Micro-irrigation and the poor: A marketing challenge in smallholder irrigation development

La micro irrigation et les pauvres: Le défi du marketing lié au développement de la petite irrigation

Tushaar Shah and Jack Keller

Abstract

The paper presents observations made during visits to three states of India (Madhya Pradesh, Gujarat and Karnataka) and to Nepal, to review micro-irrigation programmes of the NGO International Development Enterprises (IDE). These programmes focus on introducing micro-irrigation to poor and small-scale farmers, and on developing supply chains and equipment markets so that the technology will be sustainable even at the level of very poor people, including women farmers. There were varied patterns of adoption and application of the technology in the four areas. In Nepal they found eager uptake of standardised bucket or drum kits by women vegetable farmers, whose household incomes had risen substantially; but they also found concerns that local markets for irrigated vegetables would be easily saturated, bringing risk of failure through price collapse. In Gujarat two situations are noted: poor women, economically similar to the Nepali groups, but unable to utilise the technology because of greater water scarcity; and relatively new commercial lemon-growers taking it up rapidly. In Madhya Pradesh and Karnataka users grow cotton and mulberry, on a small-medium commercial scale. In both places the commercial interest has attracted other equipment suppliers into the market, which is now developing dynamically. Some (largely negative) impacts of government subsidy policies, and of "official" approval of equipment brands offered in the market, are discussed.

Résumé

Cette communication rapporte les résultats des missions réalisées dans trois états de l'Inde (Madhya Pradesh, Gujarat et Karnataka) ainsi qu'au Népal en vue d'évaluer les programmes de micro-irrigation mis en œuvre par l'ONG International Development Enterprises (IDE). Le point focal de ces programmes est l'introduction de la micro-irrigation aux petits exploitants de moyens modestes, et la mise en place de chaînes de distribution et de fournitures pour ce matériel pour que la technologie soit à la portée des personnes à très faible revenu et des femmes. Les modèles d'adoption et d'application varient selon les régions. Au Népal on observe beaucoup d'enthousiasme chez les femmes pour les petits kits d'irrigation de goutte-à-goutte ; beaucoup d'entre elles ont vu une amélioration de leurs revenus. Mais on note aussi des inquiétudes que des marchés locaux risquent d'être saturés des produits maraîchers avec effondrement des prix et la menace de faillite. Au Gujarat il existe deux situations : des femmes pauvres, dont le niveau économique est semblable à ceux de leurs consœurs au Népal, mais qui n'arrivent pas à utiliser la nouvelle technologie en raison des difficultés d'approvisionnement en eau; d'autre part, des exploitants commerciaux ont immédiatement adopté la technologie. Au Madhya Pradesh et au Karnateka la technologie est surtout utilisée sur des petites et moyennes exploitations de coton et de mure. Le potentiel commercial a suscité l'intérêt d'autres fournisseurs de matériels et le marché de micro-irrigation se développe de manière dynamique. Les impacts (surtout négatifs) des politiques gouvernementales de subvention et de l'approbation 'officielle' de certains marques de matériels en vente aux marchés sont également abordés.

1. Background

This paper describes the observations made by the authors during visits to sites in India and Nepal. The visits were undertaken on behalf of International Development Enterprises (IDE), which is an NGO that originated in the United States and has a substantial presence in both India and Nepal, with an emphasis of putting micro-irrigation in reach of poor smallholders. The purpose of the visits was to form some ideas about the scope for development and marketing of micro-irrigation equipment, specifically targeted towards poor smallholders, and about possible strategies for increasing the uptake of these technologies by such people.

Micro-irrigation technologies (drip- and sprinkler-based systems), first perfected in Israel during the 1960s, have spread to many other parts of the world, especially the USA. These methods seem particularly suited to conditions in water-scarce regions such as western and southern India and North China. However, since it was first introduced in the 1970s, the total area under drip irrigation in India has expanded to just around 60,000 ha, against the ultimate potential of 145 M ha. Of this amount, 40,000 ha is in the state of Maharashtra, where it is extensively used in grape and orange orchards; the bulk of the rest is in the states of Tamilnadu and Karnataka (Sivanappan 1994).

Drip irrigation of citrus and orange orchards and grape in Maharashtra is a big success; of coconut in Coimbatore, Tamilnadu, and of mulberry in Kolar, Karnataka, it is very effective. However, despite active promotion by a growing private irrigation equipment industry and subsidies provided by governments, the appeal of these technologies has remained confined to "gentlemen farmers." Common perception that have held sway over the popular mind are that drip and sprinkler irrigation require a great deal of capital, that they are difficult to manage and labour-intensive, and that they are appropriate only for commercial crops raised on scientific lines.

In recent years, there have been efforts to promote a nearly opposite notion: that these technologies are particularly suited to very small, resource-poor farmers; that, for small plots, they require surprisingly little capital; they are easy to manage and, in fact, save labour; and most importantly, can significantly enhance productivity of land and water, quality of produce, and the farm income of the adopter household.

In various countries, pioneering efforts have been made in this direction by Chapin, a US business, Netafim, a major Israeli irrigation equipment company, IDE, and some others. All these have developed and launched "miniaturised" versions of drip and sprinkler systems, adapted to small vegetable gardens. Best known are bucket and drum kits, promoted by Chapin mostly in Southern Africa and by IDE in India, Nepal and several African countries. Particularly with IDE, the focus has been on cutting the cost of the technology to the minimum so that poor men and women farmers can afford it without subsidy. By one estimate, some 13,000 IDE bucket and drip kits were already in use by smallholders in Asia and Africa; and the potential seems great. A larger global initiative is already in the making for "scaling up poverty-oriented micro-irrigation by creating a global dissemination network" (Heierli and Polak 2001).

This paper attempts an initial assessment of the potential of the technology, its social impacts, and issues in "scaling it up," based on a month's fieldwork by the authors in the states of Gujarat, Karnataka and Madhya Pradesh in India, and three hill districts in Nepal. The paper is not intended to be definitive, but to present the authors' impressions in the manner of "field-notes." IDE's micro-irrigation programme is barely 5 years old; and in many regions adopters have not used the technology for long enough to realise its full benefits and constraints. There is therefore an element of speculation even in the broad qualitative assessment we offer. It will take some more years until the technology to be integrated, and ready for a proper, full-scale assessment.

2. Evolution of the micro-irrigation programme in four locations

In all the four locations, the marketing environments – and therefore, the IDE approach – have evolved differently. In Gujarat and Nepal, the micro-irrigation programme is operating in a developmental mode, with IDE being the only player in the small-scale micro-irrigation market, selling the "concept" of micro-irrigation to small farmers. In Madhya Pradesh and Karnataka, the scene is different. Here, IDE and its partners are amongst several mainstream players in the drip irrigation business; and since they are all marketing custom-built systems, the distinctive aspect of poverty-focused micro-irrigation is somewhat diluted.

2.1 Madhya Pradesh

In the late 1990s, IDE began to work with Maikaal Cotton Spinning Company, an Indo-Swiss Collaborative Company, and its development NGO BioRe, promoting bio-cotton cultivation around the Maheshwar area in the Maikaal region of Madhya Pradesh. In this dry, hilly terrain, cotton has been cultivated mostly with well irrigation. However, with rapid growth in the numbers of wells and pumps, well yields are dropping and in the dry months of summer most wells turn totally dry. Some dynamic farmers had already begun trying out the drip irrigation technology in cotton. In a short co-operation,

IDE encouraged Maikaal's member farmers to experiment with the micro-tube technology for drip irrigation on 25 acres (10 ha). For some reason, IDE was moved out of the region soon thereafter; however, the seed of drip irrigation it has sown here has blossomed and borne fruit.

Some 1,500 acres (600 ha) of Maikaal Cotton's bio-cotton area is already under drip. BioRe initiated a scheme to install drip systems on farmers' fields: the advantage to the farmer is, first, that BioRe buys tubes and laterals in bulk to get a good price; second, the farmer gets an interest-free 3-year loan. Many small farmers are taking up the BioRe offer. There are indications all around that the drip technology is being rapidly internalised by farmers and is on the verge of taking off in a big way in this region through commercial channels. The best indicator of this is that the farmers have begun to play around with the material and the design, on their own.

2.2 Karnataka

In Kolar, Karnataka, IDE has been promoting micro-irrigation for nearly a decade. The focus of IDE's promotional effort here is on custom-built drip systems, mostly for mulberry farmers but also for commercial orchards [1]. There is hardly any sale of bucket or drum kits; nor has horticulture emerged yet as a major customer (as probably it has in Andhra Pradesh, which we could not visit). So, in Karnataka, IDE is in a primarily promotional role for the drip irrigation industry as a whole. The costs of IDE products are comparable to those of the mainstream suppliers, though they vary hugely: for horticulture, the cost of laying a drip system is Rs 7,000 to 8,000/acre (Rs 17,250 – 19,750 per ha)[2]; for mulberry, it is Rs 20-25,000 (Rs 49,000 – 62,000 per ha) for paired row system and Rs 20,000/acre (Rs 49,000 per ha) for the pit system. Costs also vary according to manufacturer: KB brand systems made with Jain Irrigation material cost Rs 2,000 – 3,000 more per acre (Rs 4,900 – 6,200 per ha) than Pioneer, Krishi, Telecom and other brands.

Micro-tube technology has been popular and is now becoming increasingly so. Jain and Pioneer, two leading suppliers, have aggressively promoted micro-tube systems for decades, long before IDE came in to promote them. Kolar is a major centre for promoting drip irrigation. It has 70,000 acres (28,000 ha) under mulberry within 40 km radius of Kolar town. In principle, it can be a major thrust region for IDE's micro-irrigation programme. The issue is: to what end. There is some confusion about what exactly is the role of the IDE here. It does not market cheaper systems; it does not market smaller systems; it does not market primarily to the poor; and it is not the only one to promote the micro-tube system. So, "what business are we in" is the key strategy issue for IDE here.

2.3 Gujarat

In Gujarat, IDE's micro-irrigation programme is barely 2 years old; and we found it difficult to find farmers who had completed one full cropping cycle using micro-irrigation technology. It is implemented in the dry region of Saurashtra in the south-west of the state, and in Vadodara and Panchmahal districts of eastern Gujarat. Some 600 bucket and drum kits were in use here. Kits have been moving at a rate of 150–200 per year; but the pace has been accelerating.

IDE's marketing organisation in Gujarat is simple and thin. Until recently, IDE itself acted as distributor and got supplies from a manufacturer based in Nasik (Maharashtra). A distributor has just been appointed. He caters to some eight "assemblers" who are the dealers. The assembler sells ready drum and bucket kits, as well as custom-built systems for individual farmers' specific requirements. Within Gujarat, we found that in Saurashtra, the focus of IDE effort is to promote low-cost, mostly custom-built drip irrigation through the assembler who does most of the extension, promotion and custom-designing. In Chhotaudepur (Vadodara district), on the other hand, the target market is dominated by poor tribal women. Standardised micro-irrigation kits are marketed to them for kitchen gardens.

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[1] In Kolar town, for example, we met Pragathi Enterprises, a dealer who doubles up for Primere Irrigation as well as for KB (Krishak Bandhu) Micro-irrigation. He uses Primere material for building drip systems sold under the KB brand name. He sold 180 acres (73 ha) of drip irrigation systems for mulberry to 80 customers and 400 acres (160 ha) of "vegetable systems" to 50-100 farmers, essentially for mango and coconut orchards. In his 80 mulberry customers, 5-6 are large; but 75 are *relatively* small farmers with 1 to 1.5 acre (0.4– 0.6 ha) under drip-irrigated mulberry.

[2] The annual average bank exchange rate of the Indian rupee in recent years has been approximately as follows: in 1999, US$1 = Rs 43.2; in 2000, US$1 = Rs 44.9; in 2001, US$1 = Rs 47.3.

2.4 Nepal

Nepal's micro-irrigation programme is focussed squarely on the poorest segments and on standardised drum and bucket kits. An early assumption of the programme managers here was that costs of drip technology could be cut drastically by having the farmers shift the pipes around (i.e., by installing fewer pipes, so that to irrigate all parts of the plot pipes have to be moved from place to place inside the plot). But the promotional work with farmers suggested that they did not quite like shifting the pipes. Indeed, a Unique Selling Proposition (USP) of drip technology is that it saves labour and on-farm water management effort. If a drip system is designed so that it has to be frequently shifted, this USP is lost. So ultimately IDE Nepal designed and put on the market a proper drip system in three sizes. IDE Nepal has grounded some 3,200 kits in around 450 villages in the Nepal hills. They have also launched the micro-sprinkler, which is probably becoming more popular in the Nepal hills as well as in Himachal Pradesh on the Indian side of the Himalayas.

2.5 Summary

Overall, then, the micro-irrigation programmes at Chhotaudepur in Gujarat and in Nepal have evolved quite differently from those in Saurashtra, Kolar and Maikaal. The former has been engaging primarily with very small holders, mostly women farmers; the latter has primarily reached the middle-peasantry. The former is heavily into promoting 2–3 standard configurations of bucket and drum kits; the latter is primarily into custom-built systems. In the former, IDE is primarily playing a development NGO with little or no sign of other market players on the horizon trying to get a cut in the business. In the latter, the playing field is dominated by mainstream players, and the distinctive role of IDE as well as of micro-irrigation technology awaits sharper definition.

3. Impact on livelihoods, water productivity, and environment: Early impressions

The beneficial impacts of drip and sprinkler irrigation in water-stressed regions have been widely studied in Israel, US and many other countries. In India, several researchers have highlighted the benefits of the technology. Sivanappan (1994) suggests that, based on field trials at Indian agricultural universities, micro-irrigation reduces water application by 40–70 percent, and raises crop yields by 200 percent for many crops. It permits efficient saline irrigation, since salt gets accumulated only at the surface periphery of the wetting zone, without affecting crop growth.

In a survey of 160 farmers in Maharashtra, Narayanmoorthy (1996b) found that drip irrigation cuts costs of cultivation, especially in inputs like fertilisers, labour, tilling and weeding. The yields of drip-irrigated banana and grapes were estimated to be 52 percent and 23 percent higher compared to flood irrigation. The benefit-cost ratio of investment in micro irrigation was estimated to be 13, without taking into account the value of water saved, or 32 if water-saving was accounted for in the calculation. Net profit of drip over conventional irrigation is Rs 100,000 per hectare for grapes and Rs 87,000 per ha for bananas. Unlike flood irrigation, drip irrigation works in undulating topography.

The question is: why is micro-irrigation technology spreading so slowly, despite these advantages? According to Narayanamoorthy (1996b), it is because of high capital cost, absent or inadequate subsidy, poor product quality and lack of farmer awareness and knowledge. Above all, the notion that drip irrigation is appropriate only for large commercial farmers with resources and farm management skills (a belief, which holds powerful sway in the industry,) had led industry leaders to offer relatively expensive products designed only for large commercial farmers. IDE's micro-irrigation programme is a major breakthrough because it has down-sized, simplified and demystified drip and sprinkler irrigation technologies, for targeting them to the ultra-poor.

3.1 Madhya Pradesh and Karnataka

To the commercial mulberry farmers in Kolar (Karnataka) and cotton farmers in Maikaal (Madhya Pradesh), productivity impacts of micro-irrigation – in particular, producing quality crops under extreme moisture stress – were of paramount interest. In Kolar, for instance, the mulberry farmers we interviewed listed a number of advantages of drip-irrigating mulberry versus flood-irrigating it. The advantages these users perceived included:

- water needed for 0.5 acre of flood irrigation will suffice for 2 acres of drip irrigation;
- labour requirement is drastically reduced due to low weed growth;

- drip irrigation itself requires far less labour and management than flood irrigation;
- the plant population and health are better;
- a larger area that can be irrigated from the available power supply.

In many parts of India, shortage of power is the binding constraint, rather than water availability or the cost of pumping, which at the margin is zero for borewell owners under a flat (un-metered) system of electricity tariff. In Kolar, farmers get 4 hours of power during the day and 4 hours in the night; they use night power to fill up their farm ponds and tanks that are used for irrigation during the day time.

Besides these direct, private benefits to adopters, Professor Sundar of the University of Agriculture, Karnataka, enumerated several other indirect, social benefits of drip irrigation:

- it reduces soil erosion and non-point pollution because micro-irrigation water percolates only to 45-60 cm, so fertilisers and pesticide residues do not mix with the water table;
- it promotes more efficient use of nutrients;
- it ensures better and longer moisture retention in the root zone.

According to him, micro-irrigation is a powerful instrument of drought-proofing.

Overall, in Maikaal and Kolar, the gains from micro-irrigation technology seemed convincingly established. The ground is ready for major up-scaling. However, we could not find many of the low-end adopters to whom the IDE programme is targeted. It was only in Nepal that we could make a firm assessment of the livelihood impact of the micro-irrigation programme; and the evidence we gathered here validated the high expectations from the programme in terms of livelihood impacts.

3.2 Gujarat and Nepal

In the IDE parlance, the term micro-irrigation implies drip and sprinkler irrigation technologies down-sized in scale and costs to suit very small and marginal farmers' needs and financial capacity. Studies are beginning to show that all the benefits that commercial drip and sprinkler irrigation confer on their users accrue to small and marginal farmers who take to micro-irrigation.

Bilgi (1999), in a study of IDE's micro-irrigation programme for poor women vegetable farmers in Aurangabad and Bijapur districts of Maharashtra state, concluded that a typical micro-irrigation kit resulted in the following impacts:

- 55 percent reduction in water applied.
- 58 percent decline in labour-days applied.
- 16 percent savings in fertiliser and pesticide use.
- 97 percent increase in output.
- 142 percent increase in gross income.

We wanted to explore whether gains of this scale were experienced by women micro-irrigators we met in Gujarat and Nepal. Gujarat, unfortunately, offered little understanding since most of the micro-irrigation kits were non-operational because of heavy out-migration of tribal families due to drought (see below, section 4.3).

However, our experience in Nepal suggested livelihood gains of the order Bilgi (1999) found in Maharashtra. Women we met in the Nepal hills had all been growing some vegetables earlier; but they used to take only one crop during the rainy season. Many households ate meals without vegetables for days; they grew a few plants, mostly for family consumption. They seldom or never had vegetables to sell on the market. Instead, most used to spend Rs 900–1,200 per year on the purchase of vegetables; and the quality and size of their rainfed crops were far from satisfying.

The drip kit changed all these, and in significant ways. Adopters began to grow drip-irrigated vegetables in winter and summer, while continuing to grow rainfed vegetables during the rainy season.

They all grew a variety of vegetables (Bhindi, bottle gourd, sponge gourd, snake gourd, pumpkin, tomato, chilli). They grew vegetables on a larger *net* area; their crop was better in size as well as quality. Eating vegetables daily became the habit of most families.

Before the drip irrigation came, only four said they sold any vegetables; now, they all became net sellers of vegetables. While their purchase of vegetables declined sharply, their sales increased to Rs 2,000–15,000 per year. The 30-odd adopters whom we met at Kahun have been enjoying an IRR of 300–500 percent on their original investment of Nepal Rs 320 on the purchase of the *Saral Thopa Sinchai*, the name given by IDE Nepal (IDEN) to the bucket-kit system.

Elsewhere in Nepal, we found gross income from sale of vegetables to be Rs 1,500–20,000 per micro-irrigation system, per year, with the modal value around Rs 3,500–4,500. In Tansen, we met farmer representatives from six Village Development Committees and NGO representatives from the LISP project of Halvitas, besides a dealer and the District Agricultural Development Officer. Together, the dozen or so farmer representatives present reflected the experience of over 200 drip adopters in the neighbouring areas. The overall patterns showed little variation. The technology has met with uniform success. The micro-irrigation programme is having a good run in Nepal hills. Many people believe that this run will soon be checked by water scarcity. But it is likely that marketing limitations may do this earlier than water scarcity does. IDE therefore needs to keep working on these second-generation issues which will soon begin to affect the spread of the technology.

Some farmer groups have already begun to work on this. The organised women of Darham Danda, for example, first agreed on a staggered harvesting programme amongst themselves to avoid self-inflicted glut, and then had their president enter into a smart tacit agreement with two local vegetable traders who supply to a large workforce working on a local dam project. The women agreed to offer a stable supply of cabbage and cauliflower at Rs 11 and Rs 13 per kg, respectively; they could sell initially at much higher prices, but as the glut builds up prices plummet. So, instead of taking a myopic view, they made a stable long-term arrangement, and in the process ensured a stable market.

The drip irrigator women of Darham Danda were lucky in having a farsighted president who has figured out that market bottlenecks and water scarcity may seal the fate of her members, especially in a remote location like hers. She is already planning a diversification strategy; she would like, on the one hand, to grow coffee and ginger, both of which are easier to market. To fight water scarcity, she hopes to get support for a rainwater harvesting project that can help them to build a 100,000-litre tank.

The same technology can produce significantly different livelihood impacts in two different communities. Ramadi and Aaboo Khaiseni Yekle Phat, two other villages we visited in the Nepal hills, followed the same broad general pattern as several other hill communities we visited, but heightened the contextual variations. In both villages, we met groups of 15 – 20 drip users – micro-irrigation communities – who were introduced to the technology by IDE, and benefited very significantly from its adoption. Aaboo Khaiseni Yekle Phat consisted of professional vegetable sellers, whose businesses were not very small, and who expanded their vegetable business very significantly after the adoption of the drip kits. Water is not a problem at all with Aaboo Khaiseni Yekle Phat, which has plenty of it. This village is right on the highway and ideally suited for vegetable cultivation for the market. No surprise, then, that IDEN has worked with Aaboo Khaiseni Yekle Phat farmers for nearly 4 years.

The earliest adopter of the drip kit here undertook dramatic expansion in his area under drip and sold Rs 100,000 worth of vegetables last year. Here, every one of the 20-odd adopters we met doubled their vegetable area after adopting drip, and a third of them tripled it. Over half of the drip users sold Rs 10,000–15,000 worth of vegetables. Several bought multiple kits or went for upgrades; the original pioneer installed five large drip kits; even then, he has to shift his tubes once every day.

Factors that have helped the booming growth in the vegetable production and incomes that the drip technology catalysed, include:

- tradition of vegetable cultivation for the market;
- abundance of water;
- IDE's low cost storage tank programme under which these adopters have built their private water storage ranging from 1,000 to 14,000 litres;

- proximity to markets.

However, the 18 women and 4 men we met in Ramadi (a village which has less water, and somewhat less land, than Aaboo Khaiseni Yekle Phat) were significantly poorer. Before they took to drip irrigation, none or few of them grew vegetables to sell in the market. They also experience extreme water stress; and after their first season of drip irrigated vegetables, a majority of them sold Rs 500–1,000 worth of vegetables. The women from Ramadi were concerned that, as their vegetable enterprise reaches a serious scale, water scarcity may catch up with them.

Ramadi would probably not have qualified for IDEN's drip kit programme, but for the fact that it is covered under another project on development of "Mountain Marketshed." The village has only 16 users, of whom 10 had collected to meet us. These women seemed markedly poorer; and their adoption was perhaps aided in some measure by the fact that Social Welfare Center, a local NGO, offered a subsidy of 25 percent of the capital cost to the first group of adopters. They had used the drip kit only for one season; and already there was great interest among others to adopt. Eight non-users had shown up just out of curiosity; they had not joined the adopters so far, either because they did not know or were not sure about whether it will work; and/or because they had trouble raising the cash. Some women felt, correctly, that although there are significant benefits, it takes a higher overall level of effort and engagement in the vegetable enterprise. All of these were now keen to take to drip irrigated vegetables. The adopters all wanted to increase their vegetable area and plant numbers by shifting the pipes around a little more.

What happens to the additional income from sale of drip-irrigated vegetables? In Darham Danda, many women adopters manage their households in the absence of their husbands, who are away working in India. The first charge on the earnings then is sugar, tea and other daily necessities, and school fees. Often, the remittances from husbands are delayed; so these women heads of households are always in need of cash to keep the household going.

Clearly, the micro-irrigation programme in Nepal is attacking IDE's target segments. Even so, in one of our meetings, Tulsi Neupane and D. R. Adhikari of the LISP project of Helvetas shared their major concern, that the low-cost drip technology was penetrating only the middle-poor. It is still not easily accessible to the very poor who have some land on which to grow vegetables. According to them, Rs 900 is not much for a middle-poor household but it is a good deal for a very poor household to spend on a technology they are not certain will work. Their second concern was about sustainability of an irrigation technology whose success depends so critically on the high quality, intensive technical support in drip irrigation technology as well as horticulture that IDEN have so far provided.

3.3 Summary

As of now, Nepal's powerful positive experience is the prime leading indicator we have of the vast potential of micro-irrigation technology for poverty alleviation. In Gujarat, it is still early days for even adopters to experience the full range of benefits of the technology. The experience with the technology in Maikaal and Kolar is very interesting but in a different way. In both these sites, we saw little adoption by the poor vegetable growers; but aggressive adoption by the middle peasantry, and the subsequent spurt in market development, open up unforeseen opportunities for large-scale propagation of the technology to the poor as well.

4. Adopters and adoption behaviour

In the larger backdrop of the subject of "scaling up through market development," one aspect of the programme we explored throughout our field-work was the profile of the adopters and the "adoption behaviour" of micro-irrigation customers. What triggered the first trial of the product by early pioneers? How did the bystanders process their experience with the technology? How did the word spread around? Where early experience with the technology is happy and satisfactory, at what stage does the technology "take off" and begin to spread by itself rapidly?

From past experience and research in drip and sprinkler irrigation in India and elsewhere, there exist propositions about factors that promote or inhibit the adoption of this technology by farmers. In general, it is considered to be the technology for well-off, commercial farmers; farmers take to these not so much to save water but to increase output and incomes and save labour and inputs. For example, Shreshtha and Gopalakrishnan (1993) estimated that over 80 percent of Hawaii's sugarcane

farms came under drip irrigation during the 1970s not because it saved over 500 mm (12%) in water application, but because it raised cane yield by 4.2 tonnes per hectare, valued at US$578 at 1987 prices.

Likewise, we know that major barriers to adoption are high capital cost, unfamiliarity, and the high risk of failure; and that adoption tends to build up as early adopters' successful experience gets confirmed and widely known, and as technology becomes simpler and cheaper. In a survey of some 160 farmers in Nagpur district of Maharashtra state, Puranik et al. (1992) found that all the farmers interviewed – adopters as well as non-adopters – found the high initial capital cost to be the major barrier to adoption of drip irrigation technology. Interestingly, nearly as many thought that lack of technical knowledge and awareness and the difficulty of accessing the subsidy were equally important barriers.

In their study of the rapid spread of drip irrigation for sugarcane cultivation in Hawaii during the 1970s, Shreshtha and Gopalakrishnan (1993) concluded that "continued improvements in the technology have made it more applicable and affordable, thus reducing the risk involved with new technology, as well as reducing the cost of information over time." To what extent are these propositions playing themselves out in the micro-irrigation scene in India and Nepal?

4.1 Madhya Pradesh

In Maikaal (Madhya Pradesh) and Kolar (Karnataka), the IDE programme was in direct competition with mainstream players; and hence, we found here a very interesting dynamic. IDE played a pioneering role in introducing drip irrigation among cotton growers in Maikaal and mulberry growers in Kolar; but the adoption is confined largely to middle peasantry; and it is an open question whether IDE does not need to redefine its role, now that the concept is established.

In Maikaal, we met a group of 15–20 cotton growers from 2–3 villages who had gathered in Mohna village. They each had 5–15 acres (2–6 ha) of land, mostly under bio-cotton. All of these were drip irrigators and good cotton farmers. All were using the micro-tube system, although the government subsidy scheme allows only drippers. Only a few large, influential farmers got access to subsidies; most others purchased the material from the open market, and built their own micro-tube based system. One farmer had built a micro-tube drip system with micro-tubes only for one row of plants; this required more lateral, but offered the advantage that he can weed and inter-cultivate without having to shift the pipes around.

The grey market[3] of unbranded products offers limitless opportunities for economising on capital investment here. BioRe (IDE's partner NGO in this state : see section 2.1 above) has been collecting tube and lateral prices from several prominent market centres in Madhya Pradesh, Maharashtra and Gujarat, and the best deal it can offer to farmers is Rs 12,500/acre (Rs 31,000 per ha). But most farmers we met laid their drip systems at Rs 6,000–7,000 per acre (Rs 15,000–17,250 per ha), by assembling them with material bought in the grey market.

BioRe offers only products that have been approved by the Indian Standards Institute (ISI); and farmers buy mostly grey products; but the group we met saw absolutely no quality difference. One farmer quipped: "Big brands charge exorbitant prices and provide uncertain quality; the grey market charges rock-bottom prices and uncertain quality. So who wants big brands?" Their grey-market dealers also offer them written guarantees of 5 years, which they believe would be honoured if invoked. Some farmers who have been using grey products since 1996 were quite happy.

As the drip technology becomes internalised here, the major objective of suppliers is to cut its cost down to the minimum. The farmer's main partner in Madhya Pradesh is the private grey sector. The business has probably recognised that many first-time users will try out drip technology only in a drought to save their crops with little water. They also recognise that their demand is highly price-elastic.

To encourage such small farmers to try out drip irrigation, one innovative manufacturer has just introduced a new product labelled "Pepsy," which is basically a disposable drip irrigation system

[3] "Grey products" are goods that may be copied from mainstream manufacturers, but are sold more cheaply and are usually of more dubious or less reliable quality.

consisting of a lateral with holes. At Rs 1,500 per acre (Rs 3,700 per ha), Pepsy costs a small fraction of the more enduring systems that Maikaal offers to its members at Rs 12,500 per acre (Rs 31,000 per ha); but for small farmers who are trying out the technology for the first time, it offers an important alternative. As one farmer mentioned, "If I can buy a system at the cost of the interest amount, why should I invest capital? Why spend Rs 1,200 on a filter, when a piece of cloth can serve the same purpose as effectively?"

The boom in the private grey trade in laterals and micro-tubes – and the falling prices of parts – suggests that IDE's ultimate goal of market development is likely to be achieved in this region rather effortlessly.

4.2 Karnataka

In Kolar district, the mulberry heartland of India, we met a similarly dynamic and resourceful group of 20–25 mulberry farmers of all classes and social groupings in Nayatharahally village. We took a quick inventory of our sample which yielded the data of Table 1. These were certainly not the smallest farmers one could find in the area. This group felt that the kinds of drip irrigation systems they use are beyond the resources of small and marginal farmers. The farmers face several barriers to adoption: capital requirement is one; lack of education and awareness is another; but the most important is that small and marginal farmers do not have borewells.[4]

A majority of farmers are too small and poor to take to professional sericulture (production of silk, which is the purpose of mulberry cultivation). The group we met represented only the upper crust. We estimated that Nayatharahally has some 300 farmers, of whom 275 probably raise some silk worms. But 7–10 households, each having at least 7 acres (2.8 ha) plus, have taken to drip and sericulture as their sole or primary enterprise. At the other end of the spectrum, over 100 households with 2 acres (0.8 ha) or less all do some sericulture, but only one has a drip system. This is because only one or two of the marginal farmer households have their own borewells; indeed all the 60–70 borewells in the village were owned by large and medium farmers.

The ownership of a borewell seems a precondition to adoption of micro-irrigation for mulberry. Most poor sericulturists without their own borewell depend upon larger farmers for the supply of mulberry leaves, which has catalysed a vibrant exchange institution in mulberry leaves. Small silk farmers buy leaves on a regular basis at Rs 100 – 150/bag; some also buy water from big farmers on one-third share cropping basis, in which the seller provides water and claims one-third of the mulberry leaf output.

Table 1. A profile of mulberry farmers using drip irrigation in Kolar.

Farmer	Village	Total farm land (acres)	Area under mul-berry (acres)	Area under drip (acres)	Type of drip system	Experience with drip irrigation
Nanjudappa Gawda	Nayatharahally	10	10	2 2 3	Integral Online Micro-tube	4 years
Narayanappa	Thondala	7	2	2	Micro-tube	2 months
Ravakrishnappa	Thondala	20	9	9	Micro-tube	4 years
Muniappa	Thondala	5	5	3	Micro-tube	4 years
Ramappa	Thondala	10	7	7	Micro-tube	4 years
Ramappa	Thondala	1	0	0	0	0
Srirama Reddy	Pumbarahally	12	2	1.5	Micro-tube	3 years
Ranganath	Nayatharahally	5	5	1	Micro-tube	2 months
Govinda Gawda	Nayatharahally	5	5	0	0	0
Venkataramappa	Nayatharahally	5	4	0	0	0
Narayana Gawda	Nayatharahally	10	8	6	Micro-tube	2 years
Sonappa	Gujjarahally	15	8	0	0	0
Siva Reddy	Chikapannahally	3	1	0	0	0

Note : 1 acre = 0.4 ha.

[4] Borewell = shallow tubewell.

The Kolar group of drip irrigators we met were a totally different class from the poor women micro-irrigators we interviewed in Chhotaudepur (Gujarat) and Nepal. These were well-off farmers; more important, they had a dynamism, enterprise and awareness of technology and market conditions that we did not expect to find in the poor women vegetable farmers. For instance, the Kolar group's assessment of the pros and cons of alternative drip technologies reflected their knowledge and experience with drip irrigation. We were told that integral systems have higher chance of clogging; micro-tubes clog less easily but they make inter-cultivation difficult; they are also more prone to damage; women weeders pull out micro-tubes to tie their bundles of forage.

Micro-tube technology is the best and least-cost option, especially for the paired-row planting of mulberry. It provides greater aeration and sunlight to plants; it provides greater moisture retention and better root penetration, making the plants more tolerant to dry spells. The paired-row system also yields more plants: 5,300 per acre, compared to 4,600 per acre in the pit system. As the paired-row system becomes popular, so does the micro-tube technology that the IDE is promoting. All in all, IDE's Kolar story so far has been the affluent-farmer story. But it seems poised at a point where the small mulberry farmer too may take to drip irrigation if he had the right options. Overall, too, the drip sales are set to take off in a big way; and a challenge for IDE, it seems, is to increase its penetration in the smallholder market segment.

4.3 Gujarat

In Gujarat, our sense clearly was that the ongoing drought has been the principal "trigger" for the adoption of micro-irrigation by pioneers. Most adopters we met took to micro-irrigation to cut potentially big crop and capital losses induced by water stress. However the experience and the consequences of the drought were different in the two parts of the state that we visited. The differences seem to be due to the different socio-economic status of the farmers. We record first our observation in the Saurashtra region of the state.

Veerjibhai Metalia of village Lalavadar installed a micro-irrigation system 6 months ago at a cost of Rs 2,500 to save a plantation of 90 papaya, guava, and lemon trees, which is 3 years old but would surely perish due to moisture stress during the current drought. He assembled a micro-irrigation system with the help of the assembler; he pumps water into a tank from his open well some 100 metres away. The tank is connected to the well through a buried pipe, and the drip system is hooked on to the tank. The well can be pumped only once in 2 weeks, and yields just enough water to fill the tank. But these 15,000 litres have apparently saved his plantation. Veerjibhai appeared enthusiastic about the technology. Having adopted it for one reason, he has now discovered many other reasons why he should stick to it. He found moisture retention is better under micro-irrigation than under the flood irrigation system; and his plants are now healthier.

Panabhai in Jasdan taluka installed a custom-built micro-irrigation system at a cost of Rs 1,100 to protect his small plantation of 30 sapota, lemon and other plants. His experience was similar.

In Vinchhia village, we met a community of professional small-scale horticulturists who raised lemon gardens. These were under tremendous moisture stress during the current (2001) summer drought spell as their wells dried up. One of them installed a drip system and found that he could make his plants survive with very little water. Formerly, he pumped his well for 12 hours daily to flood-irrigate his plantation; now he uses 4 drums of 350 litres each (that is, about 1,400 litres of water) to irrigate his 50 lemon trees. Following this experiment, 11 lemon farmers in the neighbourhood all installed micro-irrigation systems. They made a new group-managed borewell to fill up their tanks.

In Saurashtra, then, the current micro-irrigation buying spree is triggered by the drought. The experience has been good; but it will be interesting to see what these adopters do if there is a good monsoon in 2001. Many will probably keep using ithe technology because they see its significant productivity impact. There is much that is common amongst Saurashtra adopters; they are early in their learning curve about what the technology can deliver, besides saving their plantations during the current drought.

If drought triggered micro-irrigation adoption in one part of Gujarat, it induced adopters to fold up their kits and shelve it in another part. In Chhotaudepur area, another pocket of micro-irrigation marketing thrust we visited in Vadodara district, the IDE assembler is Anand Niketan Ashram, Rangpur, a local NGO with high credibility with the tribal communities here. Rangpur Ashram has been

aggressively promoting micro-irrigation technology; and the prime purchase motive here was irrigating vegetable gardens in the homesteads. The most popular product was the bucket kit. The promotional message is: it can ensure a steady supply of 500 grams daily of vegetables per household for 3 months a year. Some 450 bucket kits are grounded in 4 *talukas*; in the Rangpur area itself, some 200 have been sold through the NGO.

This is a predominantly tribal area. Bhil tribal people who live here are first generation farmers. The Ashram has been popularising modern agricultural methods here for 50 years. Its experience with promoting some technologies followed the trajectory we expect the micro-irrigation technology will follow. In the 1960s, it installed scores of lift irrigation schemes to promote irrigated farming. It took 8–10 years for the new technology to sink among these communities, used to rainfed, slash-and-burn farming. The Ashram's lift irrigation schemes faced endemic problems of economic viability; and the programme was ultimately folded up; but its purpose of popularising lift irrigation and irrigated farming was achieved. Fed up with the unreliability of community lift irrigation systems, farmers took to private wells and diesel pumps in a big way as the benefits of irrigation were internalised. Now groundwater markets are booming, and pump irrigation is widely used.

Total drought for the second year in a row has however put the tribal agrarian economy under great stress, resulting in massive out-migration. Micro-irrigation kits purchased are mostly out of use, because wells have no water. We could see some kits in operation in Bhekhadia village where hand pumps as well as dug wells had some water. Mostly, micro-irrigation kits are used to sustain small kitchen gardens; however, one farmer also raised a somewhat larger garden with a custom-built kit. There is a tradition of vegetable gardens besides the homesteads in the Bhil households; this is a good augury for the micro-irrigation kit programme. However, domestic water supply systems are traditionally designed to canalise domestic wastewater into the kitchen gardens. No special effort is made to irrigate the garden. So the micro-irrigation kit does not offer a significant water-saving advantage over the traditional system of wastewater irrigation. Our overall sense was that poverty-focused micro-irrigation as a concept is not yet well established in Gujarat; however, in many ways, this water-stressed state offers opportune conditions for it.

4.4 Nepal

In the Nepal hills, on the other hand, the micro-irrigation concept is already firmly established amongst poor women vegetable growers. The trigger for new purchase decisions is not so much water stress but generating significant household income. Some very interesting work has been done here by IDEN in adapting the product to the customer need. IDEN has been steadfast in pursuing the original mission of introducing the micro-irrigation intervention: of designing a product appropriate to the needs of the small farmer household, and promoting it aggressively to that target group with an intensive after-sales support system.

An impressive aspect of the way it has gone about doing it is the adaptive design response to farmer feedback. IDEN began with a set of assumptions about what might cut costs best and yet find favour with the target households; as it went ahead testing out those assumptions, it cast aside those that were not supported, and developed new ones based on feedback from users. This resulted in much ingenious experimentation in design; and all of it seemed driven by user feedback and functionality. A new, improved product has been launched almost every year since inception.

Thus, for example, the 1998 *Saral Thopa Sinchai* (drip irrigation) kit they introduced had a very simple common household filter on the neck of the tank. The 1998 kit was also made available in "very small" size for 40 plants. These were both changed in the 1999 model, which incorporated several new design features. Similarly, in the early models, IDEN used black recycled rubber laterals; but these were found too hard and non-durable; so they used 8 mm green PVC lateral which is better in quality and image. Finally, IDEN has avoided the use of micro-tubes; instead, they have punched fine holes in the lateral itself and fitted it with raffles which, when fitted over the holes, ensure that the water is delivered in a trickle rather than in a sprinkle. This has made frequent shifting around of pipes a major requirement; it has also imposed a tough planting discipline on users; if they do not maintain the same distance as between the holes, the system will mis-deliver water.

The 2000 model of *Saral Thopa Sinchai* kit has fixed nearly all problems the feedback on earlier models pointed out, except the propensity for clogging. But our sense was that farmers have come to terms with this: some problems have to be just lived with.

IDE Nepal has closely followed the development NGO model in promoting the micro-irrigation technology amongst the poor. By supplying micro-irrigation kits to close-knit groups of vegetable growers, along with intensive after-sales support, it has created micro-irrigation communities. It has actively discouraged its dealers from selling kits to isolated buyers, lest they should fail and damage the product image. The Nepal hills have some major clusters of drip kit users, and we saw and interacted with several of these.

On our first day of field visit, we went to Kahun near Pokhara and Bhimad in Tanahu. Kahun is a village of some 600 households (including 56 drip-kit users) with 9 wards; Bhimad is a trifle larger. In Bhimad, we met a sizeable group of some 35 women and 8 men adopters of drip kits. In Kahun, we interacted with a group of women in ward 1; this had 70 households; 40 of these have adopted drip kits; of the remainder, 6 have already placed orders. So it will not be long before this village becomes a 100 percent drip-user village. But such examples must be few; for, if 50 drip kits are grounded per village, IDE Nepal's total kits should be in 60 villages instead of 450–500. So there must be many villages which have isolated adopters of drip kits.

IDEN's distinctive approach, emphasising micro-irrigation communities supplied with intensive technical support in both use and maintenance of drip systems as well as in horticulture, has produced major impacts. Vegetable production increased manifold, and generally surpassed the wildest expectations of the adopters. Average gross income from sales was less in the first year but averaged Rs 4,000–6,000 in the second year. Once they saw they could make real money, women adopters began to learn fast. Soon, IDEN found that farmers with two years of experience could be easily weaned away from the IDEN support system; they have enough experience to carry on their own, and even to guide new adopters. IDEN is now developing a Lead Farmer concept to multiply its technical support capability; and intelligent, dynamic farmers with two years of experience in drip irrigation of vegetables offer ideal candidates for such appointments. Many of these have already upgraded their systems.

The demonstration effect of micro-irrigation communities is already strong. Some of the women we met came to know first about the drip system not from IDE, but from the gardens of some early adopters. But they faced a tough time obtaining the kit, because of IDEN's policy of not selling to isolated buyers. Many intent farmers have to beg existing groups to accept them as members, in order to get the kit and IDEN's technical support cover. Many keen potential adopters also mobilise 15–20 others to form a micro-irrigation community that IDEN would work with. In Darham Danda (wards 1 and 8), this organising role was performed by the dynamic chairwoman of the Jagriti Mahila Samuha, a local CBO. She visited the IDEN office several times but could not connect with the staff, who was mostly in the field. Fed up, she slid a hand-written application for support under the closed door and returned to her village. A marketing officer from IDEN turned up a week later to "process" the application of the women of Darham Danda. This opened a new chapter in the lives of these women.

One consequence of this success is that it has attracted attention of subsidy-providers. Subsidies to the tune of 25–33 percent are already available from local NGOs and even the Agriculture Development Officer's (ADO) office. One representative of a federation of women's groups was in our meeting, canvassing for a regular subsidy programme. The ADO, who has already been offering 25 percent subsidy to 30–40 women, has offered to expand the programme to cover 300 women. He has been asking potential adopters, who are ready to buy the kits, to wait for next year so that he can oblige them. If this subsidy menace grows, it must hit the programme in ominous ways.

Constraints for wider propagation of micro-irrigation kits in the Nepal hills are showing up from two directions: water scarcity and output market glut. Using drip irrigation is not easy for many of these women farmers, since their only source of water in the dry season is the public drinking-water taps. One such tap is available for 15–20 households, and they share the water equally. Most fill buckets and fetch them to fill the drip tank manually; a few lucky ones are close enough to the tap to be able use a hose to connect it to their tank. For many, however, filling the drum may involve from 10 to 30 minutes of fetching.[5]

[5] One of the women present acquired a 14,000 litre tank under trial by IDE; that is her water insurance; her plan is to fill it up with rain water and seal it; it is to be used to save her vegetable crop during the summer days of acute water scarcity.

Water scarcity is a major constraint in the Palpa district, which is mostly dry. Some of the users in our meeting collected surplus overflow from the drinking water system during the night and used it for drip irrigation. In Darham Danda, the remote village in Palpa's mountains, women have to make 14 turns to fetch water for domestic, livestock and drip irrigation requirements. If 3–4 people help in fetching water, they can do the household's water-fetching in 4–5 turns; but even that takes half a day since each turn takes 1 hour for a slow walker and 30–40 minutes for a fast walker.

The output market is rapidly emerging as another constraint. Members of micro-irrigation communities tend to grow the same vegetables, and their products end up in the same limited local market at around the same time. This results in a glut, and prices go crashing down. In Aaboo Khaiseni Yekle Phat, some women vegetable farmers sold their cauliflower and cabbages at rock-bottom prices; and even then, had to dump some in the drain. Trucking vegetables to distant towns individually is an uncertain business, as some have found out after costly experiments; so now, most depend on buyers to lift vegetables ex-farm.

Even at its early stage of development, drip users in Ramadi village are concerned about the limited market. IDEN helped them to meet local vendors from Bhesisahar and Bhotowodar in a workshop to create better understanding between the two. The growers urged vendors to stop buying vegetables from the *terai* (lowlands). The vendors forcefully argued their position, that women producers do their best to sell directly, door-to-door, and come to the traders only to sell their left-overs. Moreover, if they want vendors to sell their produce, growers must ensure a wide variety of vegetable crops, as consumers cannot be expected to buy only what they grow.

It is clear that limited and shallow local vegetable markets may nullify some of the benefits and small-farmer value that the micro-irrigation technology is producing, except for smart growers who anticipate the glut and prepare for it. Along with agricultural support, perhaps IDEN may also need to think of some training in vegetable marketing.[6] For, as the vegetable market becomes a buyers' market, drip users will need to innovate in order to keep their incomes stable or even to increase them.

Alternatively, IDEN may want to reconsider its present approach of creating concentrated micro-irrigation communities which glut the shallow local vegetable markets, and, instead, spread the kits more thinly over a wider area by letting the dealers loose.

5. Market dynamic

An extraordinary aspect of the micro-irrigation intervention in the four sites was the emergence and nature of the market dynamic. In Gujarat and Nepal, we found little evidence of competition to IDE in the micro-irrigation market. In Gujarat, the intervention itself is very young; the benefits of the technology are yet to be discovered by the adopters; and a potential for profitable business is yet to emerge. In Nepal, there are signs of such potential emerging; but it is not clear to us if IDEN is doing much to assist this process. Our impression is that IDEN's approach of providing intensive support to micro-irrigation communities, and of discouraging dealers from selling micro-irrigation kits to isolated buyers, may in fact hamper the market development process.

In Karnataka and Madhya Pradesh, however, we witnessed highly charged market dynamic in micro-irrigation material. We saw earlier that in Maikaal, farmers have begun to experiment with the technology, and the grey market has emerged to help them do it at much lower cost than by using branded drip products. Products like "Pepsy" are likely to be welcome by first-time adopters – especially, the poor farmers – who want to avoid undue risk of technology failure. However, BioRe's approach is somewhat doubtful about grey market activity, since it continues to sell only ISI-marked branded material that more than doubles the cost of micro-irrigation systems. Karnataka has a similar market dynamic; and IDE's posture here is similar to BioRe's in Maikaal.

[6] We met a micro-irrigation adopter at lunch in Tanahun who has been using a drip kit for 3 years to earn regularly Rs 7,500–10,000 from a single crop of cucumber. He probably gets 10 kg of cucumber per plant (100 tonnes/ha) on his tiny plot; marketing two-thirds of it in the retail market and the rest as snack-food to travellers. He spends 2 months marketing his crop.

Within the national drip and sprinkler irrigation equipment market of Rs 2,000–2,500 million per year, the Karnataka drip irrigation business is estimated at Rs 400–500 million per year. Fifteen years ago, when drip irrigation came to be commercially marketed for the first time, some of the leading players, especially Jain Irrigation, invested heavily in market development and were beginning to reap the benefits. But in the 1990s, the Government of India introduced subsidy in drip systems. For sericulture, subsidy was fixed at 50 percent for general farmers, 70 percent for women and 90 percent for farmers of scheduled tribes or scheduled castes;[7] for horticulture, it was 30 percent for general category farmers and 50 percent for the ST/SC farmers. Subsidies were available only on systems larger than 1 acre (0.4 ha).

The major industry players, like Jain Irrigation, are frustrated by the distortions caused by the subsidy. It has increased competition for them. The subsidy has attracted a large number (40–50 companies are registered) of shady players in the drip business who sell low-quality products, and often claim subsidy without selling systems. Getting the ISI registration is said to involve a one-time bribe of Rs 600,000–800,000; but then the manufacturer becomes entitled to market his products under the subsidy scheme. This has made big players uncompetitive; it has also created quality problems and impeded market growth due to diminishing farmer faith in the technology.

Even today, the drip irrigation industry does not see much promise in the small-farmer segment of the market. According to the Jain Irrigation dealer, a successful adopter is typically a large commercial farmer with some education. But since such farmers are few in number, the potential in a district gets exhausted fairly soon. Moreover, with such farmers, who maintain their systems well, there is little replacement demand; so the market gets easily saturated. These farmers integrate drip technology into their farming enterprise very well; so they buy it for its long-term productivity and economic benefits, not for the expedient goal of tiding over a drought season.

Governments are now cutting subsidies on drip irrigation; and this is creating a new generation of problems for the industry mainstream, which has become addicted to subsidies over several years. Until last year, when the subsidy was as high as 90 percent, the marketing dynamic of the drip system was fired by the subsidy culture. The manufacturers and dealers, including the leading brands, were seeking “unearned profit” in the form of subsidies, rather than manufacturing and marketing margins from serving satisfied customers. Since ISI-marked products enjoyed a degree of monopoly in the form of subsidy access, their manufacturers raised their prices to levels where they and the bureaucrats empowered to approve subsidies claimed the bulk of the subsidy. However, since claiming the subsidy involved between 1 and 3 years and 15–20 percent bribe money, there was always a market for non-subsidy drip systems and products.

Now that the subsidy has been reduced to 30 percent, the profits in ISI-marked drip systems have plunged. All suppliers with major names in the ISI-sector are facing declining fortunes; they have been progressively cutting their prices to stimulate non-subsidy sales; but they face stiff competition from non-ISI suppliers, who sell unbranded products at rock bottom prices.

We met two dealers in Bangalore (Karnataka) who deal in the cash-and-carry market for ISI as well as non-ISI products. Jai Kisan Irrigation and SN Pipe Products were two such. SN Pipe’s Saiyad was of the view that “ISI mark + subsidy = fraud.” He stocked best as well as second-quality material from ISI as well as non-ISI sectors; he himself was a manufacturer and sold ready-made products, as well as executing orders for material of required quality with a 24-hour lead time. Saiyad asserted, as did the other dealer we met, that there is no real difference between the average quality of ISI and non-ISI products. Under ISI-marked branded products, farmers are often cheated with poor quality. At the same time, many non-ISI products are of excellent quality.

In general, then, the ISI-mark is at best a poor indicator and guarantee of quality. The company brand name is a much better indicator; for example, the brand name Jain Irrigation conveys assured quality; but companies with such respected brands exact a commensurately high price. But for

[7] In India, the scheduled tribes and scheduled castes are groups of low social status, and generally rather poor. Various types of legal and financial assistance are used by government, for the general objective of reducing the differentials between these groups and the rest of society.

discerning consumers, there are non-ISI marked products which are nearly as good as the best available in the market, but sell at 60–70 percent lower price. The comparative prices he gave are shown in Table 2.

Table 2. Comparison of prices (Rupees/metre) of different grades of products.

	12 mm lateral	16 mm lateral	Micro-tubes	Total system
Non-ISI II quality	1.40	2.30		
Non-ISI top quality	1.90	2.80	0.50	2,500
ISI Branded	2.80 – 3.50	4.60	0.60	10,000
Jain Irrigation	4.35	5.50	1.10	12,500

For a majority of potential adopters, high perceived risk in drip irrigation investment is a major barrier to adoption. This perception is not unfounded. Even reputed suppliers agree that the failure rate in the drip system is as high as 50–60 percent. Many farmers invest in the technology, but then abandon it because of poor experience with it. As a result of uncertainty about how well it will work, many first-time buyers of drip products view their purchase decision more as an expenditure decision (like buying a bag of fertiliser) than as a long-term capital investment decision. In turn, this means that most first-time buyers are highly price-sensitive, and search for lowest-priced products; this tendency is also strengthened by the lack of faith in the quality assurance of ISI-marked products. As a result of all these, very little non-subsidy demand goes to ISI-marked branded products.

The industry representatives we met did not seem to take IDE and its micro-irrigation venture very seriously. Most thought that there is a better fit between commercial farming and drip irrigation technology than between low-input subsistence farming system and micro-irrigation technology. One of them explained to us their viewpoint: “When a farmer in Nasik makes Rs 200,000/acre/year from grape orchards, he does not mind investing Rs 2,000/acre on installing a drip irrigation system. Similarly, coconut or areca nut farmers internalise the drip technology easily; but vegetable growers, especially small-scale, find it more difficult to do so. Vegetable prices fluctuate heavily, and growers need to deal with output as well as price risks; so they are lukewarm to capital intensive farming.”

The industry had thought similarly about mulberry growers too; but IDE’s breakthrough has begun to change their thinking somewhat. Problems with the availability of spare parts, insufficient and erratic power supply are other factors that impede wide acceptance of drip irrigation among smallholders. While the industry respected IDE’s marketing ethos, it betrayed its doubt about IDE’s propensity to down-scale and simplify the micro-irrigation technology. The Jain dealer quipped: “…drip irrigation technology involves more than just joining tubes with laterals… micro-tubes are an obsolete technology... besides the kits overlook the importance of custom design…”

Arguably, IDE in Karnataka could have carved out a more strategic role for itself in Karnataka’s fluid market environment. Now that the subsidy is cut down, business in the non-ISI brands is booming. According to Saiyad (the dealer in Bangalore), for every 100 metres of ISI-marked branded laterals, the sale of non-ISI laterals is 1,000 meters. When we tried to cross-check this figure, Sundar, one of IDE’s friendly ISI-marked manufacturers, suggested this ratio of 1:10 is hugely exaggerated; according to him, the actual ratio is probably 1:5 or 1:6 but not as high as 1:10.

By tying up with top brands in the ISI-approved sector, IDE has ensured that it promotes drip systems in the highest price range without commensurate quality assurance, and by doing that, it has virtually excluded from its ambit the low-end customers who are its target segment. Even if they have an intent to purchase, the poorer farmers are likely to be far more readily drawn to the non-ISI market than to Jain Irrigation and Primere or IDE’s KB, which is, and is perceived to be, in the same league.

Since the company brand name has a stronger association with consumer’s perception of quality than the ISI mark, IDE could use the KB brand name to develop and market a range of low-cost, high-quality drip products in the non-ISI sector, that can not only achieve quick penetration among small farmers, but also make KB a leading non-ISI brand. Indeed, IDE can develop the bucket and drum kit market by introducing trial kits at rock-bottom prices: bucket kit at Rs 100 and drum kit at

Rs 250. These can be made using recycled but good quality material under a minimalist IDE quality control mechanism.

In general, then, Paul Polak's original insight that drip kits made from recycled plastic should sell at rock-bottom prices still remains valid and unfulfilled. IDE, India, is once again falling into the same trap that has kept its treadle pump market from expanding to its full potential: of offering a high-quality product at a high price to a target market that is extremely price sensitive. If micro-irrigation is to take off in a big way, it seems to us that this will need to change, and marketing elitism will need to make way for some street-smart market manoeuvring.

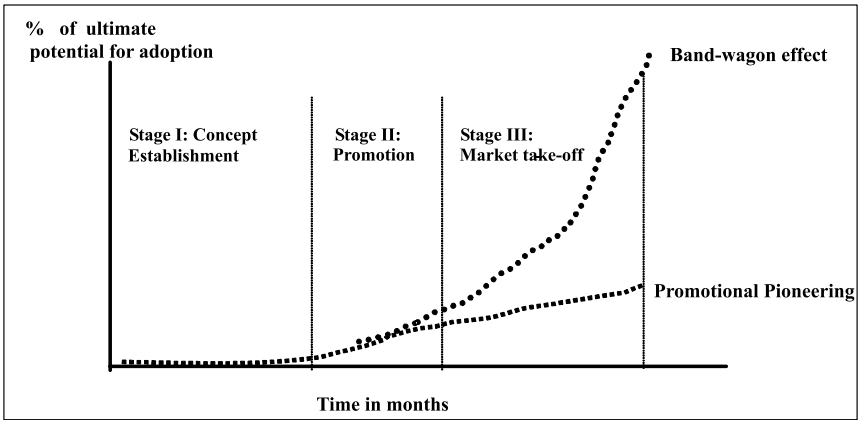
6. Assessment and future challenges

A critical strategic issue for IDE is: what exactly is it marketing, or indeed, what business is it in, in the field of micro irrigation? As a product, bucket and drum kits hardly offer a USP since all parts are available in the grey market and assembling a kit is not difficult. So if the technology had some special benefits to offer to smallholders, the more dynamic would have surely taken to it since, besides upper-end brands like Jain, they also have access to a whole range of tubes. The only part they can not easily access is the micro-tube. The drip systems have been marketed in the country for over 15 years now; and the micro-tube is considered by the industry an obsolete technology when compared to dripper.

One concept that the IDE is trying to market is a whole new farming system. In Gujarat, they found a growing lucrative market in drumstick in Padra *taluka*; and drumstick is especially amenable to drip irrigation. So in Saurashtra, they are marketing drumstick micro-irrigation as a concept. In Karnataka, micro-irrigation of mulberry has been a big hit, and can be counted as a significant IDE breakthrough.

The exciting aspect of IDE's micro-irrigation programme, and its organisational philosophy, is the implicit vision about how market development takes place for new products and technologies with potential for livelihoods creation. This vision is set out simply in Figure 1, which sets out the roadmap outlining IDE's entry into a new domain with a new technology concept. Typically, it spends a good deal of time and energy initially in establishing a new technology concept, adapting it to the local conditions and demonstrating its potential benefits to its target customers.

Figure 1. Stages in the adoption of a new techonlogy.



The best example of "concept establishment" work is to be found in IDE Nepal's micro-irrigation programme. IDE Nepal has by far the clearest strategic position. It is in the business of marketing low-cost micro-irrigation technologies to "selected" smallholder communities, along with an intensive pre- and after-sales support system. IDEN actively discourages direct sale of drip kits by its dealers without its recommendation, because it believes that without adequate technical support, adoption may be neither beneficial nor sustainable. Since IDE Nepal believes that such support can be best provided to groups of adopters organised by IDE, potential adopters outside the IDE groups may find it very difficult to get the IDE micro-irrigation kits.[8]

IDEN follows an elaborate process, and has invested significant organisational resources in achieving its strategic goal. This intensive support and backstopping make IDEN's drip programme virtually failure-proof. We could see this in course of our visits; in 5 days, we met over 200 adopters, mostly women, a few men; and we did not find anyone who was disappointed with the system. Everyone was happy, some more, some less so; clogging bothered everyone; but in no case can one say that the adoption failed.

The process of introducing the micro-irrigation technology in a new community involves several steps, as follows:

- Step 1: The Marketing Supervisor makes an exploratory visit to the village to undertake a rough feasibility analysis. He explores a range of questions: does the village have a tradition of vegetable cultivation? Is there some water available? Is there access to a market nearby? Are farmers open to new ideas?
- Step 2: If the village passes this test, a meeting is planned and organised, if possible with the entire community. In this the technology is demonstrated, a sales speech delivered with the idea of generating interest in it. Invariably, 10–15 farmers show readiness to try it out.
- Step 3: A training workshop is conducted for the "pioneers" (those who showed interest in the trial) in two aspects: [a] agronomic: seed preparation, common nursery, spacing, etc.; and [b] drip kit purchase, installation, operation and maintenance. After this, a common nursery is raised in 4–6 weeks; as it gets ready, pioneers are asked to approach the dealers and obtain their kits.
- Step 4: Marketing Supervisor, Agricultural Technician and Installer visit the community again to train in proper installation of the system, its uses, its operations and repairs. Some agronomic training is given too on planting and spacing.
- Step 5: After this, the Marketing Supervisor and Agriculture Technician keep visiting the community alternately at an interval of one week; this interval grows longer as the community becomes at ease with the system; but IDE support is available virtually on demand.

An issue which may become important as drip sales grow is IDEN's capacity to sustain such a support system. We probably saw some of IDEN's best-performing drip-irrigation communities. One wonders if it is easy to provide such a cover to all 3,200 adopters so far, or even to the 1,200-odd who will buy the kits this year. IDEN's challenge then is to find innovative ways to extend its technical support cover in a cost-effective manner – through collaboration with NGOs, or through enlisting successful and enterprising adopters in the task of supporting new ones.

In the market-development process that is illustrated in Figure 1, the first stage entails the laborious, patient and often frustrating work of pioneering a new concept: support for early adopters, developing manufacturers, setting up supply chains. Adoption is slow, and restricted to a small number of risk-loving customers. Many potential customers, the bystanders, closely watch the trials with by early adopters, gathering their evidence and drawing their own inferences. It takes time for this

[8] We met the Pokhra assembler and a dealer; both of them suggested that there is a direct demand for drip kits without IDEN recommendation. It is not clear how dealers respond. The assembler said they service the demand; the dealer said he does not.

evidence-gathering and analytical process to mature, since each bystander sets up and works with his own mental model.

If the technology delivers, the market development process enters the second phase when IDE's promotional efforts begin to deliver results in rapid growth of technology adoption and sales volumes. In this phase, promotion and marketing acquire a critical role; sales begin to build up; awareness about the technology spreads.

If the product or technology is capable of sustaining itself, without subsidy and other external support, then we begin to see interest in it from other players in the market who basically want to build a profitable line of business on the groundwork of pioneering and promotion done by IDE. It is here that IDE differs from other NGOs. Whereas most NGOs would view this growing interest of private players in their product with a sense of concern and insecurity, IDE views it as the sign of its success, the fruit of its arduous labour throughout stages I and II.

The role IDE might ideally play becomes complex at this stage. As the pioneer and the oldest player, it could set standards for others, become a rallying point, and actively assist its competitors to take on its own brand; for its ultimate aim in stage III is not the gains from its promotional pioneering but to capitalise on the "bandwagon effect" produced by the entry of other players, which is the market development role it claims to be playing.

Against this model, we found that Gujarat and Nepal are still mostly in stage 1 of the market development process for micro-irrigation; however, Kolar and Maikaal are somewhere in stage II or even III. In that sense, the market dynamic we found here is different from Gujarat and Nepal, and offers interesting insights. After five years of stage 1 labour by IDE as well as BioRe, some 1,500 acres (600 ha) of Maikaal Cotton's bio-cotton area is now under drip.

There are indications all around that drip technology is being rapidly internalised by farmers and is on the verge of taking off in this region. In Maikaal, the micro-irrigation market is already in stage III of Figure 1; and there are strong indications that private business is doing far more to cut the costs and reach the technology to poor farmers than IDE and BioRe are, probably because the former understand the mindset and the behaviour of the poor.

7. Conclusions

Following this preliminary assessment, we conclude that:

(a) In South Asia, IDE's micro-irrigation programme has responded to two critical but distinct needs: of the poor women to create a new means of income and livelihood; and of farmers in water-scarce areas to cope with extremes of water scarcity.

(b) The best example of the first is to be found in the Nepal hills, where Micro-Irrigation Communities, mostly of poor women vegetable growers, created by IDE, Nepal, have experienced major improvements in cash income and household food and nutrition security.

(c) The best examples of the second are to be found among organic cotton farmers in Maikaal region of Madhya Pradesh, near the site of the Maheshwar dam, among mulberry farmers of Kolar district in Karnataka and among lemon growers in Saurashtra in Gujarat.

(d) The strategic issues in marketing micro-irrigation bucket and drum kits to the poor women vegetable growers are totally different from promoting micro-irrigation to farmers coping with extreme water scarcity.

(e) In terms of sheer scale of outreach, promoting micro-irrigation as a means of coping with water scarcity offers much greater potential than promoting it to poor women vegetable growers.

(f) In doing both, it seems that the IDE operating philosophy of paring the cost of the technology down to the minimum and of using normal market processes to mainstream it holds great promise.

Bibliography

Bilgi, M. 1999. Socio-economic study of the IDE-promoted micro irrigation systems in Aurangabad and Bijapur. *International Development Enterprises, New Delhi.*

Heierli, U.; and P. Polak. 2001. "Making a Difference for the Poor? Market Creation for Low-cost Micro Irrigation Can Do It", *Paper for the Workshop on "Initiating a Global Micro-irrigation Network"' held in Berne, Switzerland, May 28-30.*

Narayanamoorthy, A. 1996a. Evaluation of drip irrigation system in Maharashtra. *Gokhale Institute of Politics and Economics, Pune, India.*

Narayanamoorthy, A. 1996b. Micro-irrigation. *Kisan World, v. 23, no. 1, January, pp. 51-53.*

Puranik, R. P.; S. R. Khonde; and P. L. Ganorkar. 1992. Constraints and problems as perceived by non-adopters and adopters of drip irrigation systems. *Agricultural Situation in India, vol. XLVII, No. 1, April, pp. 33-34.*

Shreshtha, R. B.; and C. Gopalakrishnan. 1993. Adoption and diffusion of drip irrigation technology: an econometric analysis. *Economic Development and Cultural Change, v. 41(2), January, pp. 407-418.*

Sivanappan, R.K. 1994. "Prospects of Micro-irrigation in India." *Irrigation and Drainage Systems, 8(1), pp. 49-58.*