Micro-Irrigation and the Poor:
A Marketing Challenge in Small-holder Irrigation Development

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Abstract

Ever since they became popular in Israel and the US, drip and sprinkler irrigation technologies have appealed to large, commercial, technology-sauvy farmers. In recent years, attempts have been made—by NGOs like International Development Enterprises (IDE) and corporates like Netafim and Chapin—to adapt these technologies and promote them as livelihood-creators for the poor of Asia and Africa. IDE, which has simplified and demystified the technology has focused on cutting its cost to the minimum and on promoting it massively amongst the poor.

Does micro-irrigation offer promise as a poor-friendly technology? Based on a month's fieldwork by the authors in Gujarat, Karnataka and Madhya Pradesh in India, three hill districts in Nepal and Kenya, this paper attempts a first-cut answer to this question; it offers a preliminary, impressionistic assessment of the potential of micro-irrigation technology, its social impacts, and issues involved in 'scaling it up'. In the main, it concludes that: [a] in South Asia, IDE micro-irrigation program 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 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 amongst organic cotton farmers in Maikaal region near the site of the Maheshwar dam in Madhya Pradesh, amongst mulberry farmers of Kolar district in Karnataka and amongst 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 to coping with water scarcity offers much greater potential than promoting it to poor women vegetable growers; [f] in doing both, *prima facie*, 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.

1.Background

Micro-irrigation technologies—drip and sprinkler based systems—first perfected in Israel during the 1960's have spread to many other parts of the world, especially the USA. These seem particularly suited to conditions in water-scarce regions such as western and southern India and North China. However, introduced first in the 1970's, 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 these, 40,000 ha are in Maharashtra where it is extensively used in grape and orange orchards; the bulk of the rest are in Tamilnadu and Karnataka (Sivanappan 1994). Drip irrigation of citrus and orange orchards and grape is a big success in Maharashtra, of coconut very effective in Coimbatore in Tamilnadu and of mulberry in Kolar, Karnataka. However, despite proactive promotion by a growing private irrigation equipment industry and subsidies provided by governments, the appeal

of these technologies has remained confined to 'gentlemen farmers'. A common perception that has held sway over the popular mind is that drip and sprinkler irrigation require great deal of capital, they are difficult to manage and labour intensive, and appropriate only for commercial crops raised on scientific lines.

In recent years, there have been efforts to promote and mainstream 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, these can significantly enhance productivity of land and water, quality of the produce and the farm income of the adopter household. Pioneering efforts made in this direction are by Chapin, a US business, International Development Enteprises, Netafim, the Israeli irrigation equipment major and some other players. All these have developed and launched 'miniaturized' 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 the 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 13000 IDE bucket and drip kits were already in use by small holders 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).

Based on a month's fieldwork by the authors in Gujarat, Karnataka and Madhya Pradesh in India, three hill districts in Nepal and Kenya, this paper attempts a first-cut assessment of the potential of the technology, its social impacts, and issues in 'scaling it up'. The paper does not intend to make a definitive statement; but present the authors impressions in the manner of 'fieldnotes'. IDE's micro-irrigation program is barely five years old; and in many regions, adopters have not tried the technology long enough to realize 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 for the technology to 'sink' before it is ready for a proper,full-scale assessment.

2. Evolution of the Micro-irrigation Program in Four Locations

In all the four locations, the marketing environment—and therefore, the IDE approach—have evolved differently. In Gujarat and Nepal, the micro-irrigation program is operating in a developmental mode with IDE being the only player in small-scale MI market in selling the 'concept' of micro-irrigation to small farmers. In Maikaal and Kolar, the scene is different; here, IDE and its partners are amongst the several mainstream players in the drip irrigation business; and since they are all in marketing custom-built systems, the distinctive aspect of poverty-focused micro-irrigation is somewhat diluted.

The history of the program has also had some impact on its present state. In Gujarat, for example, IDE's micro-irrigation program is barely 2 years old; and we found it difficult to find farmers who had completed one full cropping cycle using MI technology. It is implemented in the dry region of Saurashtra and Baroda/Panchmahal districts of North-Eastern Gujarat. Some 600 bucket and drum kits were in use here. Kits have been moving at a rate of 150-200/year; but the pace has been accelerating. IDE's marketing organisation in Gujarat is simple and thin. Until recently, the IDE itself played distributor and got supplies from a Nasik-based manufacturer. A distributor has just

been appointed. He caters to some 8 'Assemblers' who are the dealers. The assembler sells ready drum and bucket kits as well as custom-built systems for each farmer's specific requirements. Within Gujarat too, 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, the target market is dominated by poor tribal women; and standardized MI kits are marketed to them for kitchen gardens.

Nepal's Micro-irrigation program is focussed squarely on the poorest segments and on standardized drum and bucket kits. An early assumption of the program managers here was that costs of drip technology can be cut drastically by farmers shifting the pipes around. But the promotional work with farmers suggested that they did not quite like shifting the pipes around. Indeed, a Unique Selling Proposition (USP) of the drip technology is that it saves labour and on-farm water management effort. If a drip system is designed such that it has to be frequently shifted around, this USP is lost. So ultimately, IDE Nepal designed and put on the market a proper drip system in 3 sizes. IDE, Nepal has grounded some 3200 kits in around 450 villages in the Nepal hills. They have also launched the micro-sprinkler, which is probably getting more popular in Nepal hills as well as in Himachal Pradesh in the Indian side of the Himalaya's.

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 too are comparable to those of the mainstream players though they vary hugely; for horticulture, the cost of laying a drip system is Rs 7 to 8,000/acre; for mulberry, it is Rs 20-25,000 for paired row system and Rs 20,000/acre for the pit system. Costs also vary according to make; KB systems made with Jain Irrigation material cost Rs 2-3000 more per acre compared to Pioneer, Krishi, Telecom and other brands. Micro-tube technology has been popular and is now becoming increasingly so. Jain and Pioneer, two leading suppliers aggressively have promoted micro-tube systems for decades, in any case, long before IDE came in to promote them. Kolar is a major center for promoting drip irrigation. It has 70,000 acres under mulberry within 40 km radius of Kolar town. In principle, it can be a major thrust region for IDE's Micro-irrigation program. 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?

In Madhya Pradesh, the micro-irrigation program has evolved still differently. In late 1990's, IDE began to work with Mikaal Cotton Spinning Company, an Indo-Swiss Collaborative Company, and its development NGO BioRe promoting bio-cotton cultivation around the Maheshwar area (the site of one of the Narmada dams) in the Maikaal region of Madhya Pradesh. In this dry, hilly terrain, cotton has been cultivated mostly with well irrigation. However, with mushroom growth in wells

[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 for drip irrigation systems for mulberry to 80 customers and 400 acres 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 under drip irrigated mulberry.

and pumps, well yields are dropping and in 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. 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 1500 acres 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 that BioRe buys tubes and laterals in bulk to get a good price; second, 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 internalized 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 as well as the design on their own.

Overall, then, the MI program in Chhotaudepur in Gujarat and Nepal has evolved quite differently than in Saurashtra, Kolar and Maikaal. The former has been engaging primarily with very small holder, mostly women farmers; the latter has primarly reached the middle-peasantry. The former is heavily into promoting 2-3 standard configurations of bucket and drum kits; later 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, environment: Early Impressions

The beneficial impacts of drip and sprinkler irrigation in water-stressed regions has been widely studied in Israel, US and many other countries where commercial farmers have taken to it in a big way. Even in India, several researchers have highlighted the benefits of the technology. For instance, Sivanappan (1994) suggests that based on field trials conducted at various 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 of the periphery of the wetting zone without affecting crop growth. Like many other researchers have, in a survey of 160 farmers in Maharashtra Narayanmoorthy (1996b) found that drip irrigation cuts cost of cultivation especially in inputs like fertilisers, labour, tilling and weeding. The yield of drip irrigated banana and grapes was estimated to be 52 and 23 percent higher compared to flood irrigation. Benefit cost ratio of investment in micro irrigation is esitmated to be 13 without taking in to account the value of water saved and 32 with water saving accounted for in the benefit-cost calculation. Per hectare net profit of drip over conventional irrigation is Rs 1 lakh for grapes and Rs 87000 for banana crop. Unlike flood irrigation, drip irrigation works in undulating topography. Despite these advantages, the moot question is: why is MI technology spreading so slowly? 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 which holds powerful sway over the industry—that drip irrigation is appropriate only for large commercial farmers with resources and farm management skills—had led industry leaders to offer relatively expensive products designed only for large commercial farmers. IDE's Micro-irrigation program is a major breakthrough because it has down-

sized, simplified and demystified the drip and sprinkler irrigation technology for targeting it to the ultra-poor.

To the commercial mulberry farmers in Kolar and cotton farmers in Maikaal, 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 the drip-irrigating mulberry versus flood-irrigating it: water needed for ½ acre of flood irrigation will suffice for 2 acres of drip irrigation; labour requirement is drastically reduced due to low weed growth; moreover, drip irrigation itself requires far less labour and management than flood irrigation; the plant population and health are better. A major benefit perceived was larger area that can be irrigated from 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 borwell owners under flat system of electricity tariff. In Kolar, for instance, 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 MI water percolates only to 45-60 cm; so fertilizers 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, then, in Maikaal and Kolar, the gains from micro-irrigation technology seemed convincingly established; here, the ground is ready for major up-scaling; however, we could not many low-end adopters to whom the IDE program is targeted. It was only in Nepal that we could make a firm assessment of the livelihood impact of the MI program; and the evidence we gathered here validated the high expectations from the program in terms of livelihood impacts.

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. In a study of IDE's micro-irrigation program for poor women vegetable farmers in Aurangabad and Bijapur districts of Maharashra, Bilgi (circa 1999) concluded that a typical micro-irrigation kit resulted in 55% savings in water applied, 58% decline in labour-days, 16% savings in fertilizer and pesticide use, 97% increase in output and 142% increase in gross income. We wanted to explore if gains of this scale were experienced by women micro-irrigators we met in Gujarat and Nepal. Gujarat, as we mentioned earlier, offered little understanding since most of the MI kits were non-operational because of heavy out-migration of tribal families due to drought. However, our experience in Nepal suggested livelihood grains of the order Bilgi (1999) found in Maharashtra. Women we met in Nepal hills had all been growing some vegetables earlier; but they took 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 spent Rs 900-1200/year on the purchase of vegetables earlier; 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 growing 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 came, only 4 confessed to selling any vegetables; now, they all became net sellers of vegetables; while their purchase of vegetables declined sharply, their sales increased to Rs 2000-15000/year. In sum, the 30 odd adopters whom we met at Kahun have been enjoying an IRR of well over 300-500% on their original investment of Nepal of Rs 320 on the purchase of the *Saral Thopa Sinchai* , the name given by IDEN to the bucket kit system.

Elsewhere in Nepal, we found gross income from sale of vegetables to be Rs 1500-20000 per MI system with the modal value around Rs 3500-4500. In Tansen, we met farmer representatives from six Village Development Committees and NGO representatives from 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 MI program 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. [2]

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 Nepal hills, followed the same broad general pattern as several other hill communities we visited, but heightened the contextual variations. In both, we met groups of 15-20 drip users—MI communities--who were introduced to the technology by IDE; and benefited very significantly from the adoption.[3] However, the 18 women and 4 men we met in Ramadi were significantly poorer; and

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[2] Some farmer groups have already begun to work on this. The organised women of Darham Danda, for example, first agreed on a staggered harvesting program 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 stable supply of cabbage and caulif lower 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 stable market. The drip irrigator women of Darkham 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; so 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 build a 1 lakh litre capacity tank.

[3] Ramadi would probably not have qualified for IDEN's drip kit program but for the fact that it is covered under another project on development of 'Mountain Marketshed'. The village has only 16 users of which 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 25% capital cost subsidy 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. In fact, 8 non-users had showed up just out of curiosity; they had not joined the adopters so far because either 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

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 500-1000 worth vegetables. The women from Ramadi were concerned that as their vegetable enterprise reaches a serious scale, water scarcity may catch up with them. In contrast, Aaboo Khaiseni Yekle Phat consisted of none too small professional vegetable sellers 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, and slightly more land than Ramadi. Besides, 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; and 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, everyone (of the 20 odd adopters) we met doubled their vegetable area after drip, and a third of them tripled it; over half of the drip users sold Rs 10-15 thousand worth 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 everyday. Tradition of vegetable cultivation for the market, abundance of water, IDE's low cost storage tank program under which these adopters have built their private water storage ranging from 1000 to 14000 liters, proximity to markets—all these have helped booming growth in the vegetable production and incomes that the drip technology catalyzed.

What happens to the additional income from sale of drip-irrigated vegetables? In Darkham Danda, many women adopters have to 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 MI program in Nepal is attacking IDE's target segments; even so, in one of our meetings, Tulsi Neupane and DR 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 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 criticallly on a high quality, intensive technical support in drip irrigation technology as well as horticulture that IDEN have so far provided.

As of now, then, Nepal's powerful positive experience is the prime leading indicator we have of the vast potential of MI 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 the aggressive adoption by the middle peasantry—and the subsequent spurt in market development—opens up unforeseen opportunities for large-scale propagation of the technology to the poor as well.

4. Adopters and Adoption Behaviour

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were now keen to take to drip irrigated vegetables. And the adopters all wanted to increase their area under vegetables and plant numbers by shifting the pipes around a little more.

In the larger backdrop of the subject of 'scaling up through market development', one aspect of the program we explored throughout our field work was the profile of the adopters and the 'adoption behaviour' of MI customers: what triggered the first trial of the product by early pioneers? How did the by-standers process their experience with the technology? How did the word spread around? Where early experience with the technology is happy and satifactory, at what stage does the technology 'take off' and begin to spread all by itself like wild-fire?

From the past experience and research in drip and sprinkler irrigation in India and elsewhere, there exist stylized propositions about factors that promote and 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. [4] Likewise, we also know that major barriers to adoption are high capital cost, unfamiliarity, and the high risk of failure; [5] 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 their Hawaii study of the wild-fire spread of drip irrigation for sugarcane cultivation during the 1970's, 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 stylized propositions playing themselves out in the MI scene in India and Nepal?

In Gujarat, our sense clearly was that the ongoing drought has been the principal 'trigger' for the adoption by pioneers. Most adopters we met took to MI to cut potentially big crop and capital losses from water stress. Veerjibhai Metalia of village Lalavadar installed a MI system 6 months ago at a cost of Rs 2500 to save a plantation of 90 papaya, guawa, lemon trees which is 3 years old but would surely perish due to moisture stress during the current drought. He assembled a MI system with the help of the assembler; he pumps water into a *pucca* tank from his open well some 100 meters 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 15000 litres have apparently saved his plantation. Veerjibhai appeared sold on the technology. And having adopted the technology for one reason, he has now discovered many other reasons why he should stick to it; he found moisture retention is better under MI than under the flood irrigation system; and his plants were now healthier. Panabhai in Jasdan taluka too installed a custom-built MI system at a cost of Rs 1100 to protect his small plantation of 30 sapota, lemon and other plants. His experience too 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. So one of them installed a drip system and found he could make his plants survive with very little water. He pumped his well 12 hours daily for flood-irrigating his plantation; now he uses 4 drums of 350 litres each—that is, about 1400 litres of water—to irrigate his 50 lemon trees. Following this experiment,

[4] For example, Shreshtha and Gopalakrishnan (1993) estimated that over 80% of Hawaii's sugarcane farms came under drip irrigation during the 1970's not because it saved over 20 inches (12%)in water application but because it raised cane yield/acre by 1.7 mt valued at US $ 578 at 1987 prices.

[5] In a survey of some 160 farmers in Nagpur district, Puranik et al (1996) found that all the farmers interviewed-adopters as well as non-adopters—find the high initial capital cost the major barrier to adoption of drip irrigation technology. Interestingly, nearly as many thought lack of technical knowledge and awareness and the difficulty of accessing the subsidy equally important barriers.

11 lemon farmers in the neighborhood all installed MI systems. They made a new group-managed bore well to fill up their tanks. In Saurashtra, then, the current MI 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 it if at all because they see the significant productivity impact of MI systems. 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 MI 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 MI marketing thrust we visited in Baroda 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 the MI technology; and the prime purchase motive here was irrigating vegetable gardens in the homesteads. The most popular product here was the bucket kit; the promotional message is: it can ensure 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 tribals who live here are first generation farmers. The Ashram has been popularizing modern agricultural methods here for 50 years. [6] Total drought for the second year in a row has however put the tribal agrarian economy under great stress, resulting in massive out-migration. MI kits purchased are mostly out of use since wells have no water. We could see some kits in operation in Bhekhadia village where hand pumps as well as dugwells had some water. Mostly, MI 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 good augury for the MI kit program. However, domestic water supply systems are traditionally designed to channelize domestic wastewater into the kitchen gardens. No special effort is made to irrigate the garden. So the MI kit does not offer a significant water-saving advantage over the traditional system of wastewater irrigation. Our overall sense was that poverty-focused MI as a concept is yet to be well-established in Gujarat; however, in many ways, this water-stressed state offers opportune conditions for it.

In Nepal hills, on the other hand, MI 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 IDE in adapting the product to the customer need. IDE, Nepal 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 intensive after-sales support system. An impressive aspect of the way it has gone about doing it is

[6] Its experience with promoting some technologies followed the trajectory we expect the MI technology too will follow. In the 1960's, 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 program was ultimately folded up; but its purpose of popularizing lift irrigation and irrigated farming was achieved. Fed up with the unreliability of the community lift irrigation systems, farmers took to private wells and diesel pumps in a big way as benefits of irrigation got internalized. Now groundwater markets are booming; and pump irrigation is widely used.

the adaptive design response to farmer feedback. IDE 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.[7] And the 2000 model of *Saral Thopa Sinchai* kit has fixed nearly all problems the feedback on earlier models pointed out—except, ofcourse, the propensity for clogging. But our sense was that farmers have come to terms with it: some problems have to be just lived with.

IDE Nepal has closely followed the development NGO model in promoting the MI technology amongst the poor. By supplying MI kits to close-knit groups of vegetable growers along with intensive after-sales support, it has created MI communities, and has actively discouraged its dealers from selling kits to isolated buyers, lest they should fail and damage the product image. Nepal hills then 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 Pokhra and Bhimad in Tanahu. Kahun VDC was a village of some 600 (including 56 drip kit user) households 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 remaining, 6 have already placed their orders. So it will not be long before this village becomes a 100% 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 emphasizing MI communities supplied with intensive technical support in both drip system use and maintenance 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 sale was less in the first year but averaged Rs 4-6000 in the second year. Once they saw they can make real money, women adopters began to learn fast. Soon, IDE found that farmers with 2 years of experience can be easily weaned away from the IDEN support system; they have enough experience to carry on on their own, and even guide new adopters. IDEN is now developing a Lead Farmer concept to multiply its technical support capability; and intelligent, dynamic farmers with 2 years of experience with drip irrigation of vegetables offer ideal candidates for such appointments. Many of these have already upgraded their systems.

The demonstration effect of MI 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

[7] 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 the water is delivered in 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.

they faced tough time laying their hands on 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 to get the kit and covered by IDEN's technical support cover. Many keen potential adopters also mobilise 15-20 others to form an MI community IDEN would work with. In Darham Danda VDC (ward 1 & 8), this organising role was performed by the dynamic chairwoman of the Jagriti Mahila Samuha, a local CBO. She visited IDE office several times but could not connect with the staff who are mostly in the field; fed up, she slid a hand-written application for support under the closed door and returned to her village. Sure enough, a marketing officer from IDE 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[8].

Constraints are showing up for wider propagation of MI kits in Nepal hills 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 it 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 10-30 minutes of fetching. [9] Water scarcity is a major constraint in the Pulpa 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.

Then, the output market is rapidly emerging as a constraint, too. Members of MI 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 down crashing. 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 downs individually is a dicey business, as some have found out after costly experiments; so now, most depend on buyers to lift vegetables ex-farm. [10] It is clear, however, that limited and shallow local vegetable markets may

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

[9] One of the women present acquired a 14000 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.

[10] Much lip service is paid to organising for marketing; but nothing concrete has happened. Even at its early stage of development, Ramadi's drip users are concerned about the limited market. IDEN helped them 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 terai. The vendors forcefully argued their position that women producers do their best to sell door-to-door, and come to them only to sell their left-overs; moreover, if they want vendors to sell their produce, growers must ensure a wide variety of vegetable crops; consumers can not be expected to buy only what they grow. Apparently, both the parties have agreed to play ball, at least for now.

nullify some of the benefits and small-farmer value the MI technology is producing except for foresightful, smart growers who anticipate the glut and prepare for it . And along with agricultural support, perhaps IDEN may also need to think of some training in vegetable marketing. [11] For, as the vegetable market becomes a buyers' market, drip users will need to innovate to keep their incomes stable or to even increase them. Alternatively, IDEN might want to reconsider its present approach of creating concentrated MI communities which glut the shallow local vegetable markets, and instead, spread the kits more thinly over a wider area by letting the dealers loose.

In Maikaal (Madhya Pradesh) and Kolar (Karnataka), the IDE program was in direct competition with mainstream players; and hence, we found here a totally different and a very interesting dynamic. It 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 were all Patidars, and had 5-15 acres of land, mostly under bio-cotton. All these were drip irrigators and good cotton farmers. And all of them 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 gray market of unbranded products offers limitless opportunities for economizing on capital investment here. Although BioRe has been collecting tube and lateral prices from several prominent market centers in MP, Maharashtra and Gujarat, the best deal it can offer to farmers is Rs 12,500/acre. But most farmers we met laid their drip systems at Rs 6000-7000/acre by assembling them with gray market material. True, BioRe offers only ISI-approved products; and farmers buy mostly gray products; but the group we met saw absolutely no quality difference. One farmer quipped: 'Big brands charge exorbitant prices and uncertain quality; gray market charges rockbotton prices and uncertain quality. So who wants big brands?" Their gray market dealers also offer them written guarantee of 5 years which they believe would be honoured if invoked. Some farmers who have been using gray products since 1996 were quite happy.

As the drip technology gets internalized here, the name of the game is cutting its cost down to the minimum. And the farmer's main partner here is the private gray sector. The business has probably recognized 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 labeled 'Pepsy'—no pun intended to the soft-drink giant who just introduced disposable plastic bottles in Madhya Pradesh--which is basically a disposable drip irrigation system consisting of a lateral with holes. At Rs 1500/acre, Pepsy costs a small fraction of the more enduring systems

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[11] We met a stray MI adopter at lunch in Tanahun who has been using a drip kit for 3 years to regularly earn Rs 7500-10000 from a single crop of cucumber. He probably gets 10 kg of cucumber per plant (100 mt/ha!!) on his tiny plot; markets 2/3rd of it by weight in the retail market and the rest as snack food to travelers. He spends 2 months marketing his crop.

that Maikaal offers to its members at Rs 12500/acre; but for small farmers who are trying out the technology for the first time, it offers an important alternative. As one Patidar farmer mentioned, 'if I can buy a system at the cost of the interest amount, why should one invest capital? Why spend Rs 1200 on a filter when a piece of cloth can serve the same purpose as effectively?' The boom in the private gray 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.

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 following table. Although small by western standards, these were certainly not the smallest farmers one could find in the area. This group felt that the kind 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. Moreover, a majority of farmers are too small and poor to take to professional sericulture. The group we met represented only the upper crust. We figured that Nayatharahally has some 300 farmers of which 275 probably raise some silk worms. But 7-10 households, each having 7 acres plus, have all taken to drip and sericulture as sole or primary enterprise. At the other end of the spectrum, over 100 households with 2 acres or less all do some sericulture but only 1 has a drip system. This is because only 1-2 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. And 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 1/3rd share cropping basis; the seller provides the water and claims 1/3rd of the mulberry leaf output.

Table 1 A profile of Mulbery farmers using Drip Irrigation in Kolar

Farmer	Village	Total farm land (acres)	Area under mulberry (acres)	Area under Drip (acres)	Type of Drip system	Experience with drip irrigation
Nanjudappa Gawda	Nayatharahally	10	10	2	Integral	4 years
				2	Online	
				3	Microtube	
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	Microtube	2 months
Govinda Gawda	Nayatharahally	5	5	0	0	0

Venkatarama ppa	Nayatharahally	5	4	0	0	0
Narayana Gawda	Nayatharahally	10	8	6	Microtube	2 years
Sonappa	Gujjarahally	15	8	0	0	0
Siva Reddy	Chikapannahall y	3	1	0	0	0

The Kolar group of drip irrigators we met then were a totally different class than the poor women micro-irrigators we interviwed in Chhotaudepur in Gujarat and Nepal. These were well-off farmers; but more importantly, they had a dynamism, enterprise and awareness of technology and market conditions 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. But in sum, micro tube technology is the best and least-cost option especially for the paired row planting of mulberry: it provides greater aration and sunlight to plants; it provides greater moisture retention and better root penetration, making the plants more tolerant to dry spells. Paired row system also yields more plants—5300 per acre compared to 4600 in the pit system. As 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 small-holder market segment.

5. Market Dynamic

An extra-ordinary aspect of the MI 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 MI 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 egg this process along. Our impression is that IDEN's approach of providing intensive support to MI communities and of discouraging dealers from selling MI kits to isolated buyers may in fact hamper the market development process.

In Kolar and Maikaal 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 gray market has emerged to help them do it at much lower cost than leading suppliers of 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 agnostic—if not suspicious—of the gray market activity since it continues to sell only ISI marked branded material that more than doubles the cost of MI systems.

Karnataka has a similar market dynamic; and IDE's posture here is pretty similar to BioRe's in Maikaal.

Against the national cake of Rs 200-250 crore/year, the Karnataka drip irrigation business is estimated at Rs 40-50 crore per year. 15 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 1990's, GoI introduced subsidy in drip systems. For sericulture, subsidy was fixed at 50% for general farmers, 70% for women and 90% for SC/ST farmers; for horticulture, it was 30% for general category farmers and 50% for the Sc/ST farmers. Subsidies were available only on systems larger than 1 acre. The major industry players—like Jain irrigation-- are frustrated by the distortions caused by the subsidy. In reality, it has also increased competition for them. The subsidy has attracted a large number (40-50 companies are registered) of shady players in the drip business who peddle low quality products, and often claim subsidy without selling systems. Getting the ISI registration involves a one time bribe of Rs 6-8 lakh; 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. 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 got hooked onto the opiate of subsidies over several years. Until last year when the subsidy was as high as 90%, the marketing dynamic of the drip system was fired by the subsidy culture. Indeed, the manufacturers and dealers—including the leading brands--were after the 'unearned profit' in the form of subsidies than manufacturing and marketing margins from serving satisfied customers. Since ISI-marked product enjoyed a degree of monopoly in the form of subsidy access, their manufacturers hiked their prices pretty much to levels where they and the bureaucrats empowered to approve subsidies claimed the bulk of the subsidy. However, since claiming the subsidy involved between 1-3 years and 15-20% bribe money, there was always a market for non-subsidy drip system and products.

Now that the subsidy has been reduced to 30%, the profits in ISI marked drip systems have taken a plunge. All players with major names in the ISI-sector are facing declining fortunes; they have been progressively cutting their prices to stimulate their non-subsidy sales; but here they face stiff competition from the non-ISI players who sell unbranded products at rock bottom prices. We met two dealers in Bangalore 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 sells ready made products as well as executes orders for material of required quality with a 24-hour lead time. Saiyed asserted, as did the

other dealer we met, that there is no real difference between the quality of average ISI and non-ISI products; under ISI-marked branded products, farmers often get cheated with poor quality; at the same time, many non-ISI products are of excellent quality. In general, then 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 discerning consumers, there are non-ISI marked products which are nearly as good as the best available in the market but selling at 60-70% lower price. The comparative picture of prices he gave was as follows:

	12 mm lateral	16 mm lateral	micro tubes	total system
Non-ISI Top quality	Rs 1.90/mt	Rs 2.80/mt	Rs 0.50/mt	Rs 2500
Non-ISI II quality	Rs 1.40/mt	Rs 2.30/mt		
ISI Branded	Rs 2.80-3.50/mt	Rs 4.60/mt	Rs 0.60/mt	Rs 10,000
Jain Irrigation	Rs 4.35/mt	Rs 5.50/mt	Rs 1.10/mt	Rs 12,500

For a majority of potential adopters, however, high perceived risk in drip irrigation investment is a major barrier to adoption. And this perception is not unfounded; even reputed suppliers grant that the failure rate in the drip system is as high as 50-60%. Many farmers invest in the technology but then dump it because of poor experience with it. As a result of the undertainty 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 available; 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; and the gray market has a field day.

The industry representatives we met did not seem to take IDE and its MI venture very seriously. Most thought there is a better fit between commercial farming and drip irrigation technology than between low-input subsistence farming system and the MI technology. One of them explained to us their viewpoint: “When a Nasik farmer makes Rs 2 lakh/acre from grape orchards a year, he does not mind investing Rs 2000/acre on installing a drip irrigation system. Similarly, coconut, 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 small holders. While the industry respected IDE’s marketing ethos, it betrayed its doubt about IDE’s propensity to down-scale and simplify the MI technology. The Jain dealer had 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, the business in the non-ISI brands is booming. According to Saiyad, a drip product dealer we interviewed in Bangalore, for every 100 meters of ISI-marked branded laterals, the offtake of non-Isi laterals is 1000 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 exagerated; 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-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 these had 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 stronger association with consumer's perception of quality than mere 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 in small farmer segment but 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.

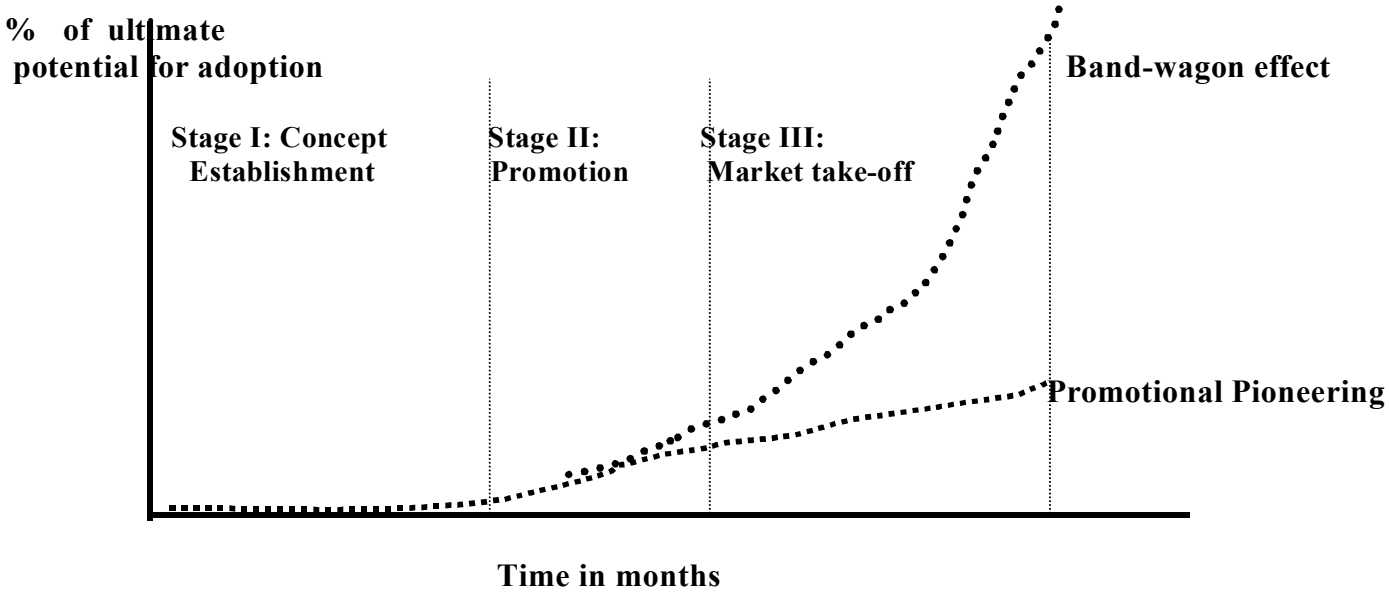
In general, then, Paul Pollak's original insight that drip kits made from recycled plastic should sell at rock bottom prices still remains valid and unfulfilled. IDE, India is once again falling into the same trap that has kept its treadle pump market from expanding to its full potential: of offering 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 maneuvering.

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 no big deal. So if the technology had some special benefits to offer to small holders, 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 thet can not easily access is the micro-tube (is this true?) The drip systems are 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 growing lucrative market in drumstick in Padra taluka; and drum stick is specially amenable to drip irrigation. So in Saurashtra, they are marketing 'drum-stick' micro-irrigation as a concept. In Karnataka, micro-irrigation of mulberry has been a big hit, and can be counted as a significant IDE breakrthrough.

The exciting aspect of the IDE's Micro-irrigation program—as, indeed its organisational philosophy—then is the implicit vision about how market development takes place for new products and technologies with potential for livelihoods creation. Simply put, this vision is set out 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

Figure 1



new technology-concept, adapting it to the local conditions and demonstrating its potential benefits to its target customers.

The best example of 'concept establishment' work is to be found in IDE Nepal's micro-irrigation program. IDE Nepal has by far the clearest strategic position: it is in the business of marketing low cost mirco-irrigation technologies to 'selected' small holder 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 neither be 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 MI kits. [12]

[12] 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 assmbler said they service the demand; the dealer said he does not.

IDEN follows an elaborate process[13] –and has invested significant organisational resources—in achieving its strategic goal. This intensive support and backstopping make IDEN's drip program virtually failure-proof. We could see this in course of our visits; in five 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.

One issue which might 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 3200 adopters so far—or even to the 1200 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.

This first stage entails laborious, patient and often frustrating work of pioneering a new concept, support and 'hand-holding' for early adopters, developing manufacturers, setting up supply chains. The adoption is slow and restricted to a small number of risk-loving customers. Many potential customers—the by-standers—closely watch the trials with the new concept by early adopters, gathering their evidence and drawing their own inferences. It takes time for this 'edvidence gathering and analytical process' to mature since each 'by-stander' sets up and works with his own mental model. If the technology delivers against the expectations of early adopters and by-standers, the market development process enters the second phase when IDE's promotional efforts begin to deliver results in rapid growth in 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/technology is capable of sustaining on its own- without subsidy and other external support—then we begin to see inkling of interest in it from other players in the market who basically want to jump onto the bandwagon and build profitable line of business on the groundwork of pioneering and promotion done by the 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 throught stage I and II. The role IDE might ideally play becomes extremely complex

[13] The process of introducing the MI technology in a new community involves several steps as follows:

Step 1: The Marketing Supervisor makes an exploratory visit to the village to undetake 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'—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 operationa and repairs. Further some agronomic training is given too on planting and spacing.
Step 5: After this, the Marketing Supervisor and Agriculture Technician keep visiting the community alternatively 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.

at this stage; as the pioneer and the oldest player, it could set standards for others, become a rallying point, actively assist its competitors to take on its own brand; for its ultimate aim in stage III is not the gains from promotional pioneering it did laboriously but to also capitalize on the 'bandwagon effect' produced by the entry of other players—which, in the ultimate analysis, is the market development role it claims to be playing.

Against this model, we found that Gujarat and Nepal are still pretty much in stage I 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 I labour by IDE as well as BioRe, some 1500 acres of Maikaal Cotton's bio-cotton area is now under drip. BioRe initiated a scheme to install drip system on farmers' fields: the advantage to the farmer is that BioRe buys tubes and laterals in bulk to get a good price; second, farmers gets an interest-free 3-year loan. Many small farmers are taking up the BioRe offer. There are indications all around that drip technology is being rapidly internalized by farmers and is on the verge of taking off in a big way in this region. The best indicator of this is that the farmers have begun to play around with the material as well as the design on their own. 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 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.

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