SKAT

HTN

Swiss Centre for
Development Cooperation in Technology and Management

International Conference on Manual Irrigation

September 4-8, 1995

Proceedings

HTN Working Paper: WP 01/96

Swiss Centre for
Development Cooperation in Technology and Management

International Conference on Manual Irrigation

September 4-8, 1995

Proceedings

HTN Working Paper: WP 01/96

January 1996

Author: Greg Wishart

SKAT Ref: F3050-IDE/SDC CONF.-EB

Table of Contents

1 Introduction

This document reports the proceedings of the International Conference on Manual Irrigation held September 4-8, 1995. The conference took place at the Toshali Sands Hotel in Puri, India and included field visits to manual irrigation sites in the state of Orissa.

International Development Enterprises (IDE) of Denver, co-organised the conference which was sponsored by the Swiss Development Cooperation (SDC) of Bern. Participants attended from South and South East Asia, Europe, the United States of America and Central America.

Section 1.1 provides background on manual irrigation and the main participating organisations at the conference. **Section 1.2** provides background on the conference; its objectives, agenda and participants.

1.1 Background

1.1.1 The Status of Manual Irrigation

It can be argued that the Green Revolution has bypassed the world's poorest farmers. Despite wide availability of seeds, fertiliser and pesticides, many small farmers lack access to canal systems and cannot irrigate their crops. They cannot afford even the cheapest mechanised irrigation devices. Therefore, in many parts of the world they can plant only once a year, effectively halving the revenue that they can derive from their small plots of land.

Given the excess labour available in many developing countries, manual irrigation provides a suitable alternative. However, until recently, low-cost technologies for use with tube wells were not available. Against this background, research work in Bangladesh led to the production of a low-cost, foot-operated '*treadle*' pump. A treadle pump installed on a tube well costs thirty-five dollars, less than one tenth of the cost of a diesel pump.

With the development of the treadle pump, manual irrigation technology has exploded in the past ten years. The original bamboo treadle pump has sold over one million units in Bangladesh. Its price in the marketplace is unsubsidised but case studies show that farmers regularly achieve a pay-back on their investment in less than one year. The successes of manual irrigation in Bangladesh are now being repeated in India, Nepal, Vietnam and Cambodia.

1.1.2 The Role of IDE

IDE is a non-profit development organisation with a mission to improve the social, economic and environmental conditions of the world's poorest people. It does this by identifying and marketing very low-cost appropriate technologies that can be manufactured locally and sold at a fair market price. It can claim much of the credit for the success of the bamboo treadle pump, having supported its dissemination in Bangladesh over the past decade.

IDE aims to make technology affordable to small farmers and targets a net profit to them of at least one hundred per cent per year. It seeks out opportunities where it can generate multiple development impacts and expects to build global market demand of at least one million units for each technology it develops. It recognises the need for economic and environmental sustainability of its interventions.

1.1.3 The Role of SDC

SDC has played a major role in the sponsorship and consequent success of the treadle pump. It has funded the work of IDE in Bangladesh for many years, providing sufficient resources to facilitate the full commercialisation of treadle pump technology in that country. Over the past three years SDC has assisted in the establishment of IDE India, partnering IDE in its transfer of treadle pump technology to six states.

SDC's role at the conference was to observe and participate with a view to assisting IDE to plan its future strategies.

1.1.4 The Role of SKAT

The Swiss Center for Development Cooperation in Technology and Management (SKAT) is a leading international technology organisation. It specialises in the acquisition and distribution of information about technologies that support sustainable development throughout the world. One of the strengths emphasised by SKAT is the close link between information gathering and dissemination and the experience gained from consultancy and other project activities such as workshops, seminars and training programmes.

SKAT's role at the conference was to participate in, and add value to conference workshops and discussions by drawing upon its knowledge from similar fields of technology. SKAT's tasks also included the preparation of these proceedings.

1.2 Conference Overview

The International Conference on Manual Irrigation was a practical event primarily designed to assist IDE develop a clear strategy for technology research and development. However, the results of the conference will have wider appeal. IDE faces many generic issues and the solutions proposed by the conference will have application to technology development situations throughout the world.

1.2.1 Conference Objectives

The conference was designed to provide a '*breathing space*' to review and discuss the rapid development of technology in the field. The objectives were to allow designers, marketeers and users of manual irrigation to:

- **communicate** about the varieties of manual irrigation now available

- **provide** a systematic information base about each manual irrigation technology, the specific conditions for its optimal use, technologies for manufacture and installation, and field performance experience
- **provide** a baseline for systematic documentation and establishment of standards for manual irrigation
- **facilitate** communication about manual irrigation to the global small farmer community.

1.2.2 Conference Agenda

The conference agenda included a range of activities; presentations, workshops and discussions, as well as visits to manual irrigation sites:

Monday	Sept 4, 1995	Opening remarks Presentations on technologies
Tuesday	Sept 5, 1995	Field visits Prioritisation of issues
Wednesday	Sept 6, 1995	Conference workshops Conference discussions
Thursday	Sept 7, 1995	Conference workshops Conference discussions
Friday	Sept 8, 1995	Presentation of recommendations Closing remarks

1.2.3 Conference Participants

IDE staff dominated attendance at the conference, representing IDE programmes in Bangladesh, India, Nepal, Vietnam and Cambodia as well as IDE's head office in the USA. Mr Andreas Schumacher of Asian Business Consultants Pvt Ltd, a Nepal-German joint venture registered in Kathmandu, facilitated the conference.

Representatives from other organisations attended the conference in a support capacity or as guest presenters. Mr Gunnar Barnes, inventor of the treadle pump, Mr Henk Alberts, Technical Director, Rope Pumps Ltd of Nicaragua and Dr Veena Joshi, SDC Programme Officer (Energy and Environment), India were special guests at the conference. A full list of conference delegates is presented in **Appendix 1**.

2 Conference Presentations

The conference presentations are grouped under two main headings:

- presentations over-viewing manual irrigation and IDE's role in the development of low-cost technologies (**Section 2.1**)
- presentations on different types of manual irrigation technology (**Section 2.2**).

Information about other affordable technologies discussed at the conference is given in **Section 2.3**.

2.1 Putting Manual Irrigation into Perspective

2.1.1 Setting the Scene

Mr Don Schierling, IDE's Executive Vice President, opened the conference with a scene-setting presentation. He paid tribute to a number of ingenious people who created the existing manual irrigation technologies used by IDE and assisted in their dissemination. In particular he gave credit to the '*inventor*' of the treadle pump, Mr Gunnar Barnes.

Mr Schierling praised the vision of Dr Paul Polak, IDE's President and challenged participants to find ways of improving the current technologies and taking them to a wider circle of consumer throughout the world. He called for IDE to build on its strengths and challenged the organisation to:

- move away from a '*John Wayne*' to a more corporate executive style of operation
- discard '*adventurous innovation*' and embrace creative management
- develop the options it has inherited from Mr Gunnar Barnes' original innovation.

> **"Let us take Paul's (Dr Polak's) vision, look at it together, analyse it and walk out with a corporate vision. That is our dream, that is our wish. Now is the time to move on."**
>
> [Don Schierling, Executive VP IDE]

2.1.2 Why Affordable Technology?

Dr Polak provided the conference delegates with an insight to his personal views on the topic of '*affordability*'. He talked about the challenge of cost reduction and the importance of low-cost to the consumers of IDE's products.

In describing the incentives and opportunities available to IDE he singled out government-sponsored drip irrigation in India where systems cost IRps 30,000 per acre. He questioned if many small farmers would benefit from this approach.

Dr Polak informed conference participants of the reaction he receives to his presentations on the IDE '*approach*' — that of treating farmers as customers (not recipients), setting fair market prices and valuing sales. The response is roughly the same at each event - people fall asleep - until he mentions that IDE has placed one million treadle pumps in the field. At this figure, people awake. "How did you do 1m pumps?", they ask. According to Dr Polak, the movie of the work in Bangladesh makes fascinating viewing. It shows that, at the right price, technology can be disseminated and profits made throughout the distribution chain.

Reiterating his previous statement, Dr Polak opined that for small farmers and poor people, '*affordability*' is the single most important issue. In his opinion, the Green Revolution and technology - step by step - have increased efficiency and cost. Most development agencies have no concept of how critical the price is to a small farmer. According to Dr Polak, "There is a need to take the price backwards and find the trade-off between efficiency and cost."

> **"Universally, 99.14% of engineers don't understand that the right product is no guarantee of success.....It takes a ruthless, disciplined focus on price to make the product affordable."**
>
> [Paul Polak, President IDE]

In presenting a picture of IDE's future challenges, Dr Polak stated that:

- IDE needs to move towards collaboration on design. During the early days of IDE, Dr Polak conceded that he had exerted a strong influence over design. He now wants members of the IDE team to take on this responsibility.
- IDE has never systematically attacked the cost of tube wells. It has not identified ways of reducing costs, thickness and materials. There is a wide variety of recycled plastic in the world market and a range of filters that IDE might use.
- IDE faces an ongoing struggle to deliver products at an affordable price. The target for the bullock pump was $100. Dr Polak thinks that IDE may deliver it at $150. This is a major challenge to IDE.

Dr Polak invited Mr Barnes to comment on his cost targets for the original treadle pumps in Bangladesh (to make a pump that a farmer could buy with a bag of rice). By observing and working closely with farmers, Mr Barnes developed a view that the market would accept a pump if the price remained in the range of a bag of rice. He reached the target price by cutting corners in his design.

At the completion of his presentation, Dr Polak drew views on affordability from a number of delegates. According to Mr M A Sobhan, Assistant Manager Technology, IDE Bangladesh, a designer can build in affordability from the outset. Alternatively, a designer can build an affordable product by accident. Mr Amitabha Sadangi, Country Director, IDE India, cited the case of the concrete pump where research into a pump suitable for saline conditions has led to a very low-cost solution.

Mr Erich Baumann, Head of Handpump Department, SKAT argued that there is a difference between affordability and '*cheap*'. "Cheap products do not serve a purpose." Mr Baumann stated that "there is a very fine line between poor people being cheated by those who are trying to rip them off and those trying to help them". In his opinion there is also a trade-off between standards and affordability and that standardisation is important in reducing the price.

In a continuation of the debate on product quality, IDE's staff from Bangladesh felt that one should give customers a choice, but push to make customers aware of quality. If you "sell good stuff and also sell junk, increasingly people will make a choice to take the guaranteed products."

An emphasis on the replacement of high cost components with labour intensive processes can make a technology affordable. According to Mr Y Narasimhaiah, Regional Director, IDE India and Mr Bob Nanes, Country Director, IDE Nepal, this is the thinking behind the low-cost drip irrigation technology. "How can we make it more labour intensive? The biggest cost saving is achieved by making it '*shiftible*'."

In addressing a comment from Mr David Rich, Country Representative, IDE India that resellers have to be given a mark-up, Dr Polak acknowledged mistakes made in Bangladesh, particularly with regard to the non-government organisations (NGOs). "The NGO community gave such a thin margin to the pump manufacturers that the market couldn't be sustained. The treadle pump is now cheaper than when it was manufactured by the NGO community. The cut-throat commercial market has succeeded in driving down prices, but if prices are driven down too much, problems arise in the economic sustainability of manufacturers"

2.1.3 Development of the Treadle Pump

Dr Polak introduced Mr Gunnar Barnes, a Norwegian engineering consultant now resident in Tennessee, USA, who played a critical role in the development of the treadle pump. Mr Barnes has spent all his career working in village development and has acquired considerable knowledge of affordable village technologies. According to Dr Polak, "Gunnar is a rare engineer who knows a great deal about technologies and solutions".

To launch his presentation, Mr Barnes showed a number of slides that illustrated the history of the treadle pump. Downplaying his own involvement, Mr Barnes indicated why Bangladesh was "a right place, a '*gene centre*' for the treadle pump":

- there are 120 million people on 50,000 square miles and 80% of these are farmers
- at $199 a year, wages are very low
- farms are small and fragmented
- families are large and there is an excess of labour
- there are large numbers of skilled and hard working technicians
- there is almost '*wall-to-wall*' suitable aquifer
- there was sympathy and interest in low-cost methods.

At the time, however, subsidies and government efforts favoured large scale irrigation and the development of deep tube wells (DTWs). Mr Barnes was working for Rangpur Dinajpur Rural Service (RDRS), a development agency that saw manual irrigation as one of the few economic levers that most farmers could use. "For us in RDRS disbelief in DTW kept us in manual irrigation. We elevated irrigation to the highest priority."

> **"Blessed are those who expect nothing for they will not be disappointed."**
>
> [Gunnar Barnes, Inventor of the Treadle Pump]

The work of RDRS resulted in a large number of treadle pump and spin-off technologies. Products included household pumps (mild steel and cast iron), priming pumps, rope pumps, bellows pumps, concrete pumps, centrifugal mild steel pumps and channel lifters. The pumps improved with field experience.

Mr Barnes described the process of treadle pump development as one of trial and error, but pointed out that the main criterion for success was the ability to keep close to the customer. Mr Barnes highlighted the strong growth in the market once the technology became established. Early treadle pump production ran to one dozen per day. By 1993 there were four '*pretty good*' workshops in operation producing over 3000 pumps per month.

> **"The treadle operation came from the farmers themselves. Before the treadle pump there was a low level of interest at the roadside. Afterwards, interest in manual irrigation rose quickly".**
>
> [Gunnar Barnes, Inventor of the Treadle Pump]

In closing his presentation, Mr Barnes outlined some of the personal lessons learned during his career:

- Costs are important. One must implement technologies at an affordable price.
- Farmers are at times faster than engineers to understand the benefits and potentials of technologies.
- Extension plays an important role in widespread dissemination. Technology will not market itself.
- Marketing support (package deals, training tools, information on farming systems, ways of using less water) will assist technology dissemination.
- Simplicity is the key to good, low-cost design.
- Small town manufacturing is possible and creates more economic activity.
- Quality controls must be introduced at an early stage of the product life-cycle.

Questions on Mr Barnes' presentation sought to clarify issues such as the details of treadle pump design and fabrication. In a comment supported by the presenter, Mr Nanes pointed out that in the process of development the ratio of failures to successes seems to run about twenty five-to-one.

2.2 Manual Irrigation Technologies

2.2.1 Plastic Pump

Mr Mrinal Sircar, Deputy Director, Marketing, IDE Bangladesh, introduced conference participants to the plastic pump. The germ of the idea for a plastic pump came in 1991 while IDE Bangladesh was undertaking work on soft plastic foot valves for the treadle pump. IDE designed and produced a three-piece PVC pump.

Original PVC prototypes of the plastic pump were not successful, but test marketing showed that the concept has wide customer appeal - mainly because the pumps are rust-free. The manufacturer, Krishak Bandhu (KB), supported further development on the plastic pump because of its strategy to sell high margin products into the marketplace. This created the right environment for work to progress.

Design and development activities on the plastic pump commenced in earnest in January 1994. The first die was manufactured in May 1994 and has been modified three times since then to take account of lessons learned. Pumps were subjected to 4000 hours of laboratory tests. Field tests totalled 640 hours. During these tests the plastic pump has been durable and given easy and free operation.

In January 1995, IDE sent the first pumps to dealers who sold some three thousand pumps in the 1994-95 season. To date there have been some breakages and wear in installations with poor filters, but no significant problems.

> **"Do customers like the plastic pump? We have high hopes for the next dry season. It will show the true extent of demand."**
>
> [Mrinal Sircar, Deputy Director, Marketing IDE Bangladesh]

Questions

Questions about the plastic pump sought to address issues of material properties, longevity and wear. It was pointed out that the design of the plastic pump can be improved and further testing is required. However, all conference participants agreed that IDE Bangladesh has made a promising start.

2.2.2 Drinking Water Pump

Mr Dan Salter, Project Director, IDE Vietnam, introduced the drinking water pump. IDE has identified a need for a low-cost family pump that can be used for both drinking water and plot irrigation purposes. In Vietnam, plot size, the culture of letting irrigation water flow imitate rain and very sandy soil demands a context-specific response. In Vietnam, people use watering cans with spouts. The water falling on the plants from the watering cans imitates the action of rain.

The current universal handpump in Vietnam (Cast Iron No 6) is promoted by UNICEF through the Vietnamese government. However, according to Mr Salter, the delivery system "doesn't happen", bureaucratic procedures require grouping of customers and the finished product ends up as relatively expensive product. Therefore, IDE Vietnam has investigated three main ways of reducing cost:

- Alternative pump delivery mechanisms to reach markets.
  The experience of the treadle pump shows that it is possible to deliver a much cheaper product through private sector initiatives.
- Alternative tube well sizes and technologies.
  According to IDE's research, most people would prefer to spend more time pumping and save initial capital cost.
- Alternative pump support methods.
  The pump uses a wooden support post to reduce weight and cost.

The resulting product is the cheapest handpump installed in Vietnam. The cast iron version uses the footvalve from the plastic pump and is designed as a one-piece casting for ease of machining.

> **"The drinking water pump reaches the farmer at $19 per unit. This makes it the cheapest pump in Vietnam."**
>
> [Dan Salter, Project Director, IDE Vietnam]

IDE Vietnam has faced a number of problems. The only handpump known in Vietnam for some time is the UNICEF No 6. Consequently the potential customer is very familiar with these pumps and farmers have resisted change. Not many people have wanted to use 1" pipe, because they anticipate electrification, and electric pumps would need larger diameter pipe.

Questions

In response to a question on costs, Mr Larry Egan, Country Director, IDE Vietnam, confirmed that the pump costs between $19 and $32 and that its design was a quality and cost trade-off. Further questions probed the design in more detail and included discussions on the need for a head cover. The importance of the footvalve developed in Bangladesh was highlighted. It was agreed that the drinking water pump may have applications elsewhere including parts of Africa and needs further field testing.

2.2.3 Sheet Metal Pump

Mr Amitabha Sadangi, Country Director, IDE India and Dr B L Mohanty, a consultant to IDE, provided an overview of the 5" sheet metal pedal pump and its operation. The pump can use metal pedals, rather than the bamboo treadles used in Bangladesh. IDE made this change because bamboo is not readily available in certain parts of India, and to provide automatic centring of the pump on the tubewell, making the well driller's job of installing the pump much simpler.

Dr Mohanty highlighted the fact that pedal pumps are more effective than handpumps from the point of view of easy human action. He provided an introduction to the mechanics of different pumps. He showed that, in a reciprocating pump, power is lost due to inertia of motion. He indicated that in a pedal pump the acceleration is constant. "This makes the need for centring a priority. If the play of angle is increased then the effectiveness is reduced, but if the connecting rod is close to vertical nothing is lost in the motion."

The sheet metal pump makes use of a simple O-ring seal. Dr Mohanty noted that frictional force helps the valve operation. It is almost a foolproof mechanism. The O-ring material can be cut at an angle to ensure a good fit once it is joined together.

Questions

Mr Barnes sought future details on the deflection and movement considered reasonable in treadle pumps. Mr Nanes highlighted the advantages of the sheet metal pump. According to him, "Water output is almost double, the pump can be used in any sort of water, there is no bamboo and the pump is easy to carry around the land".

Dr Polak started a debate on the superiority of pedals versus treadles and metal versus bamboo. He wondered if anyone has collected systematic data on the subject. Mr Barnes thought that the pedal pumps are superior in terms of portability and compactness. Ms Prabhu, Communications Officer, IDE India, noted that the quality of bamboo varies in India. Mr Rich said that he receives mixed opinions from farmers. He is not sure what is easier and thinks that it is "a matter of what people are used to".

Returning to his original question, Dr Polak asked whether there is any systematic data (in terms of biomechanics, output, etc.) on the pedal pump. IDE India has not undertaken these tests, but Mr Barnes summed up his experience in this area by saying, "We made some and tested them side by side, but couldn't find any difference in output as such. In the end we felt more comfortable on the bamboo. Long bamboo will deflect more."

2.2.4 Cast Iron Pump

Mr Egan introduced participants to the cast iron pump and also talked about the river pump. He indicated that these pumps are niche market pumps, designed for specific applications in Vietnam — '*the pump that saves you labour*'. IDE Vietnam have adopted standard 5" barrels and use the efficient pulley system for the river pump. The cast iron pump is exactly the same as the 3½" steel pump.

Both pumps use a dekki-style system of operation. Mr Egan stressed that there is no new technology involved and that during the design process the team opted for a common size because the parts are available. He said that cast iron helps solve the rust problems. IDE Vietnam makes the pump available, despite its price disadvantage, to give people a choice. He presented for information a number of pictures and blueprints.

In summary, Mr Egan said that one of the problems with the pump is that output is not a major consideration in Vietnam. IDE Vietnam has as its main concern the reduction of the cost of pumps to the farmer.

Questions

During the question time, Mr Nanes asked what material is used for the suction pipe. Mr Egan said, "If you don't have a flexible hose then you can use PVC or HDPE pipe".

Mr Egan outlined that IDE Vietnam had spoken with IDE India but that the pump is not yet ready for transfer. He thought that farmers like the steel pumps better. According to the farmers, "bamboo is for poor people".

Dr Polak asked about the market for river pumps in Vietnam and the possibilities for other countries. Mr Egan proposed that the river pump will remain a niche market product.

> **"We will only capture 2-3% of the manual Pump market in Vietnam (with the river pump)."**
>
> [Larry Egan, Country Director, IDE Vietnam]

Mr Jean-François Frys, Country Director, IDE Cambodia, stated that in Cambodia they have faced many technical problems and don't use the pulley. He feels that they don't need to use the pump, as they have abandoned the idea of portability. Mr Salter warned participants that suction pipe is not cheap and that 50m is about the limit of the useful range of operation.

2.2.5 Rower Pump

Mr Baumann introduced conference delegates to the '*rower*' pump. Designed and developed in Bangladesh, the rower pump is named after the rowing action of its operator. It consists of a 2" PVC pipe cylinder inclined at 30°, has a lift of 8.5m and yields 15 gallons per minute.

Direct action is used to half fill a surge chamber; the compressed air allows a smooth and continuous action. Mr Baumann pointed out that a rowing operation is ergonomically superior to the pumping action used in most handpumps, including the UNICEF No 6.

According to Mr Baumann, the rower pump initially used by Mennonite Central Committee (MCC) for field testing in 1979 had 27 parts. By incorporating design changes this was reduced to 13 components. One of the conditions adopted during the design phase was that the pump should be repairable without any special tools.

Initial marketing of the rower pump was very strongly supported by MCC in its area. In 1984 IDE commenced marketing the rower pump and expanded its dissemination to more parts of Bangladesh. Unfortunately for the rower pump, "at the same time the treadle pump took off and IDE switched to treadle. After this marketing died down."

The rower pump is manufactured in numbers of 5-10,000 for the Rower Pump per year and sells with "next to no marketing". Mr Baumann believes that the technology has big potential and pointed out that the rower pump has a 3-4' lift advantage over the treadle pump.

> **"The rower pump is a viable alternative to the treadle pump and has developed more or less in parallel with its more successful rival. Despite the pump not being pushed, it finds a market."**
>
> [Erich Baumann, Head of Handpump Department, SKAT]

Questions

During the question time, Mr Nanes pointed out that for drinking water the rower pump is a big success in Nepal. Production runs to 10-12,000 pumps per year.

Mr Frys sought confirmation on the need for a surge chamber. During his reply Mr Baumann stated that the surge chamber gives no measurable increase in lift, but gives a smoother action. Commenting on local manufacturers' attention to cost cutting, Mr Baumann said that the 1½ gallon surge chamber has now '*shrunk*' to half its original capacity. He confirmed for Mr Salter that the rower pump uses a moulded plastic conical foot valve and O-ring seal.

2.2.6 Pressure Pump

Mr Salter presented a second paper, on the development of a manual pressure pump in Vietnam. IDE Vietnam has identified the possible need for a pressure pump from observations on Vietnamese irrigation practices. At present farmers tend to bucket water from existing open water sources and irrigate their crops by pouring water through a sprinkler head. Therefore, the ability to deliver ground water under pressure has some appeal, particularly in respect of reduction in labour.

Mr Salter described the aim of the development project - to produce a pump capable of delivering water over a total height of 7m, whilst overcoming head losses of a tube well, 30m flexible delivery pipe and a spray head. IDE Vietnam has produced two prototypes adapted from the treadle pump:

- a single acting pump that functions in the same way as an ordinary treadle pump, but with the top of the cylinders and the plunger rods sealed
- a double acting pump in which the bucket valves are turned back-to-back and a delivery valve is built into the bottom of the pumps.

An equaliser mechanism is used; two pulley wheels in the water with a fan belt running over them. The fan belt seems very durable under water. It costs $1 and is available throughout Vietnam. An 89mm pump is being tested which can use existing components. Manufacturing difficulties and seals are the main problems to date.

Questions

Mr Baumann highlighted the possibility of using the pressure pump for drinking water supply. Mr Salter agreed that the existing prototype can deliver at a suction of 5m and delivery pressure of 1.5m. He said that one of the problems to date is friction of the pulley wheel.

Responding to a question from Dr Polak, Mr Salter hesitated on projecting the market for the pressure pump at such an early stage. According to him, it is almost impossible to say. Whilst only two pumps have been in the market for six months, IDE Vietnam is developing the pump with a broader range of markets in mind.

Mr Nanes indicated that the pressure pump could provide an alternative and/or assist for the low-cost drip irrigation system. Mr Frys asked about the material and manufacturer of the seal. Mr Salter said that it had taken six months to find something off-the-shelf. The original seal was being cut from rubber. It is now a part from a Honda gearbox.

2.2.7 Deep-set Pump

Mr Sobhan informed conference participants about the deep-set treadle pump, a device for lifting water from more than 25-30'. Under these conditions a normal suction pump does not work. He said that for irrigation purposes, 20' is the normal limit, but there are some places in Bangladesh where the water table goes down to 40'. Although IDE has known of the need for a pump to lift from greater than 25' for some time, the deep-set treadle pump was not developed mainly because of deficiencies with the existing foot valve. According to Mr Sobhan, the new foot valve created a breakthrough.

> **"When we got this (plastic) foot valve we were able to design the deep-set treadle pump."**
>
> [M A Sobhan, Assistant Manager Technology, IDE Bangladesh]

In February 1992, IDE exhibited the first prototype at it's Dhaka offices and in May 1992 placed the first unit into the field. The deep-set pump is very similar to the normal treadle pump, but the length of cylinder varies from 5' to 30'. It requires special types of tools (to fix and replace the foot valve). The dekki system is used up to a 30' water table and a pulley system below 30'. The deep-set pump can be rigged up to a one hp electric motor or 3 hp diesel engine.

Questions

Mr Sircar outlined IDE Bangladesh's marketing approach. "We want to say yes to all customers. Now we have the deep-set pump, demand has come. We have sold 100 (say), with no focus on marketing to areas where the water table has or will recede". Mr Rich asked about the mass market. According to Mr Sobhan the deep-set pump will reach a mass market. Responding to Mr Salter's question about the deepest pump to date, Mr Sobhan said IDE Bangladesh has installed a 30' cylinder deep-set pump. This gives one litre per second sustained output. Dr Polak questioned affordability with the need for a 9" diameter borehole and whether a single cylinder could be used at depth. This is not seen as practical as a double cylinder is required to get continuous flow.

Dr Mohanty enquired about the techniques of evaluation. According to Mr Sobhan, IDE Bangladesh receives regular feedback reports from field staff. Further discussion centred on the possibility of reducing cylinder diameter so that the borehole size could be minimised. Mr Barnes thought that one could get as much water from 2" cylinders and these could be inserted into a 6" borehole. It was agreed that IDE Bangladesh should carry out further research into the matter.

2.2.8 Concrete Pump

Mr Sadangi presented information on a new concrete pump. The concrete pump project commenced in 1994 and has adopted a target unit price of IRp 300.

> **"IDE India has identified a need for a non-metal pump to help solve problems of rusting in saline conditions."**
>
> [Amitabha Sadangi, Country Director, IDE India]

Of the forty to fifty prototypes built to date many of the early models failed, but in July 1995 IDE built the first of a new series of prototypes. Mr Sadangi pointed out some of the design features of the concrete pump, including the bucket and the O-ring type seal that can be made and replaced at village level. Metal components are hot dip galvanised for protection against corrosion. The manufactured cost at the present time is IRp 350.

Questions

Mr Frys was keen to know how the cylinder is placed inside the concrete. Mr Sadangi stated that it is fixed inside during the pouring operation. Mr Salter and other participants joined into a discussion on construction techniques.

Mr Egan asked whether local villagers can manufacture the concrete pump. According to Mr Sadangi one NGO has manufactured the pump to date. Cement quality has emerged as an issue that requires close monitoring and supervision. However, the cost of the concrete pump is substantially less than the cost of an equivalent metal pump.

A number of participants, including Mr Baumann, indicated the need for improved quality control processes. Mr Sadangi said that IDE India has matters in hand but welcomes more ideas. Mr Sadangi indicated that steam can be used to reduce curing time from 21 days but that the introduction of steam brings with it additional quality control issues. Participants commented on the need for correct cement ratio.

Mr Baumann indicated his concern over the plastic seals. "These things need to be tested and assessed. The pump has considerable potential, but you need to go and test them, while you go along. It's not yet a finished product." Mr Baumann suggested that IDE India should get the "design and production right". "Don't make a bad name for yourself", he cautioned. Mr Gary Slocombe, Country Director, IDE Bangladesh warned participants that cement can be reground. "It will look the same but it won't have the strength."

2.2.9 Bullock Pump

Mr Sobhan presented a second paper on the bullock pump. He said that the idea for the bullock pump came from the motorised treadle pump but with gear up, rather than gear down mechanism. After preliminary discussions, IDE Bangladesh prepared a plan of action to:

- make a model by December 1994
- make a prototype by mid-February 1995
- conduct field tests with the prototype and develop a preliminary report by March 1995.

IDE Bangladesh implemented the action plan as per schedule. The targets for the bullock pump included low cost and the ability to pump 6l/s. It was agreed that the order of priority would be to first achieve the discharge target and secondly lower the cost.

The frame is manufactured from mild steel angle. The pump has three pistons at 120° to each other. The power unit is one or two bullocks pulling at 4.5-5.5m diameter. The prototype pump is operated through a gear mechanism of 1:2.

The results to date suggest that the bullock pump will be suitable for use on a shallow tube well. The prototype has pumped 224 litres per minute (lpm) from two cylinders and 336 lpm from three cylinders. In concluding his presentation, Mr Sobhan pointed out that the limitations of the existing prototype are given in his paper.

Questions

During the question time, Mr Egan questioned the size of the plot that can be irrigated with the bullock pump. Mr Sircar indicated that the pump is designed for a plot size of around three acres.

Mr Baumann opened a lengthy debate about the bullock pump drive ratio. He proposed that the pump should be working at 30 strokes per minute. Various participants gave their opinions about the need to increase or decrease the pump's stroke length.

Mr Rich asked Mr Sobhan what problems had emerged. Mr Sobhan said that in Bangladesh most blocks of land are very small. He also pointed out that bullock availability is another concern. Ms Prabhu asked a question about costs. Mr Sobhan said that costs are not yet available, but responding to a further question from Dr Polak confirmed that the first prototype has cost Taka 18,000 ($450). He said that he expected to reduce the cost of the leather bucket seals on future prototypes. The target cost of $150 for pump and tubewell at the manufacturing, rather than research prototype stage, should be mentioned.

2.2.10 Low-cost Drip Irrigation

Mr Nanes provided participants with an overview of low-cost drip irrigation systems. IDE conceived the idea for low-cost drip irrigation after viewing a very expensive sprinkler system operating under a programme of the Agricultural Development Bank of Nepal (ADBN).

IDE Nepal has undertaken work to reduce cost of pipes, emitters and water source. Pipe costs can be reduced by adding labour and moving pipes around. Finding a solution to the high cost of emitters has been more difficult. Mr Nanes went on to describe IDE's attempts to develop a method of putting an accurate hole into the pipe with a heated pin. The current system uses a 35W soldering machine in which the temperature can be adjusted. Therefore, IDE can control heat at the tip of the needle.

IDE has selected an ordinary 0.8mm pin. If plugging occurs, the farmer can insert a pin in the hole and clear the problem. IDE has conducted drip experiments to determine the water discharge from each hole. The first experiments gave large variations in flow. IDE has reduced this to a range to not greater than 15%.

Mr Deepak Adhikari, Project Engineer, IDE Nepal, gave participants an introduction to the components of a drip irrigation system. He said that the target area is the middle hills of Nepal.

Questions

Mr Egan enquired about the target crops for the low-cost drip irrigation system. Mr Nanes indicated that the system is suitable for vegetable row crops. The system costs $50 for a third of an acre. Dr Mohanty made some useful suggestions about designing for pressure drops in the line.

The cost of the low-cost drip irrigation system in Uttar Pradesh where IDE has used 3'x3' spacings is IRps 3000 per acre. IDE India expects the price will come down in time. Participants discussed variation of discharge. In Uttar Pradesh, the original holes (produced with a heated needle) emitted from 2.5l/h to 8l/h. By using a sewing machine, IDE has reduced the variation to around 8%. In Nepal, there were some bad variations from the norm, but these will be reduced.

Mr Nanes said that the farmer should clean the holes once in a week, the same as in conventional systems. However, the holes are much easier to clean than emitters.

It was agreed that the low-cost drip irrigation system will allow farmers with less than one acre to benefit from the technology.

2.2.11 Rope Pump

Mr Alberts introduced himself and his company, Rope Pumps Ltd of Nicaragua. He attributed the success of the rope pump to "social acceptance, a lot of marketing, participation in exhibitions, etc. and quality control". The rope pump programme has taken place in Nicaragua without external support since 1992.

Mr Alberts provided the participants with a brief comparison of basic data and artistic and technical views of the rope pump. He mentioned that the most critical part is the guide box, which is glazed ceramic to reduce wear and resist corrosion. The frame is easily made from angle iron and tube. The standard wheel is 20". The maximum depth to which the rope pump is used is 85m.

The rope pump is produced in a number of sizes (½", 1", 1½" and 2"). It comes in three versions (standard, strong for community and extra strong for heavy duty) plus one with a cover and polypropylene pipe. The cost in Nicaragua is $80 and total sales exceed 3500. In 1994, Rope Pumps Ltd started a Honduras firm and in May this year sent 200 rope pumps to Honduras.

Publications in 1993/94 (in Waterlines and other journals) caused "a lot of reaction, letters, etc.". The major conclusion of a recent study shows that the rope pump has considerable potential, can be installed by private sector, can be simply maintained, is sustainable and is accessible. Rope Pumps Ltd is preparing a technology transfer package to assist the introduction of the rope pump to other countries.

Questions

Mr Nanes expressed his interest in a pump that can take over from the deep-set at depths of greater than 40'. Mr Alberts emphasised that the rope pump fits all the criteria for a village level operation and maintenance (VLOM) pump.

Some participants expressed concern at the cost. However, Mr Alberts pointed out that costs are higher in Central America. Most participants expressed interest in the rope pump and further questions reflected their desire to compare the rope pump with the deep-set pump.

Mr Alberts reiterated that the rope pump was best suited to installation in hand dug wells. He outlined that the rope pump is cheaper than a handpump in these circumstances. There are over 20,000 hand dug wells in Nicaragua. Participants agreed that the rope pump could have some value in future IDE programmes.

2.3 Other Affordable Technologies

2.3.1 The Bike

Dr Polak described his interest in the concept of an affordable bicycle. After experience with the treadle pump in Orissa, Dr Polak believes that a market exists for affordable transport to be used most by farmers. He summarised IDE's progress to date.

The design brief is for a product half the cost of an existing bike in India ($30). The bike will work well on pavement, dirt and gravel, carry a 50kg load and have a minimum speed twice that of walking. The designer based in Denver, Rob Carter, has produced a prototype that is lighter and cheaper than existing bikes. He has simplified it and produced it without a chain or brakes. IDE plans to manufacture ten copies of the prototype in Bhubeneshwar - five with brakes, five without and field test them in India.

Questions

Dr Mohanty commented on the rigidity of the frame and proposed that the sitting position is not suitable for the height of a typical Indian. Mr Nanes asked whether the bike might not be '*toy*'. Responding, Dr Polak said that of 32 families in the test area, six or seven owned bicycles, most of which are only one grade above the cheapest. He proposed that the others don't have a bicycle because they can't afford one.

Mr Egan asked about the reproducible cost. Dr Polak indicated that the prototype will cost $60. He identified a need for capital to market the concept and design to mass manufacturers.

Answering questions about the strength of the frame, Dr Polak confirmed that IDE has tested the frame with a 250kg load. A number of participants pointed out that a second hand bike is available in India at IRps 500.

3 Conference field visits

IDE India organised visits to manual irrigation sites within the state of Orissa. The visits provided conference participants with a first-hand view of the various technologies in operation. A description of the sites is given in **Section 3.1** and a sample of photographs presented in **Section 3.2**.

3.1 Observations

3.1.1 Foot-operated Pump Site

IDE has established a working demonstration site close to Bhubeneshwar that showcases a wide range of foot-operated pump technologies. At this location IDE has erected signs to describe the various pumps and their operation.

All pumps appeared to be in good working order; some have been in operation for only a few months. Answers to questions by participants indicated that the farmers were pleased with their pumps and obtaining economic benefit from the use of the manual irrigation technology.

3.1.2 Low-cost Drip Irrigation Site

At another site close by, IDE India demonstrated the use of low-cost drip irrigation. The farmer uses a treadle pump to lift water into a tank that in turn feeds the low-cost drip pipe network.

The low-cost drip system is very simple in operation and appears well suited to irrigation of vegetables and other high value crops. Participants observed that the low-cost drip irrigation system could be readily transferred to a large number of countries with very little modification.

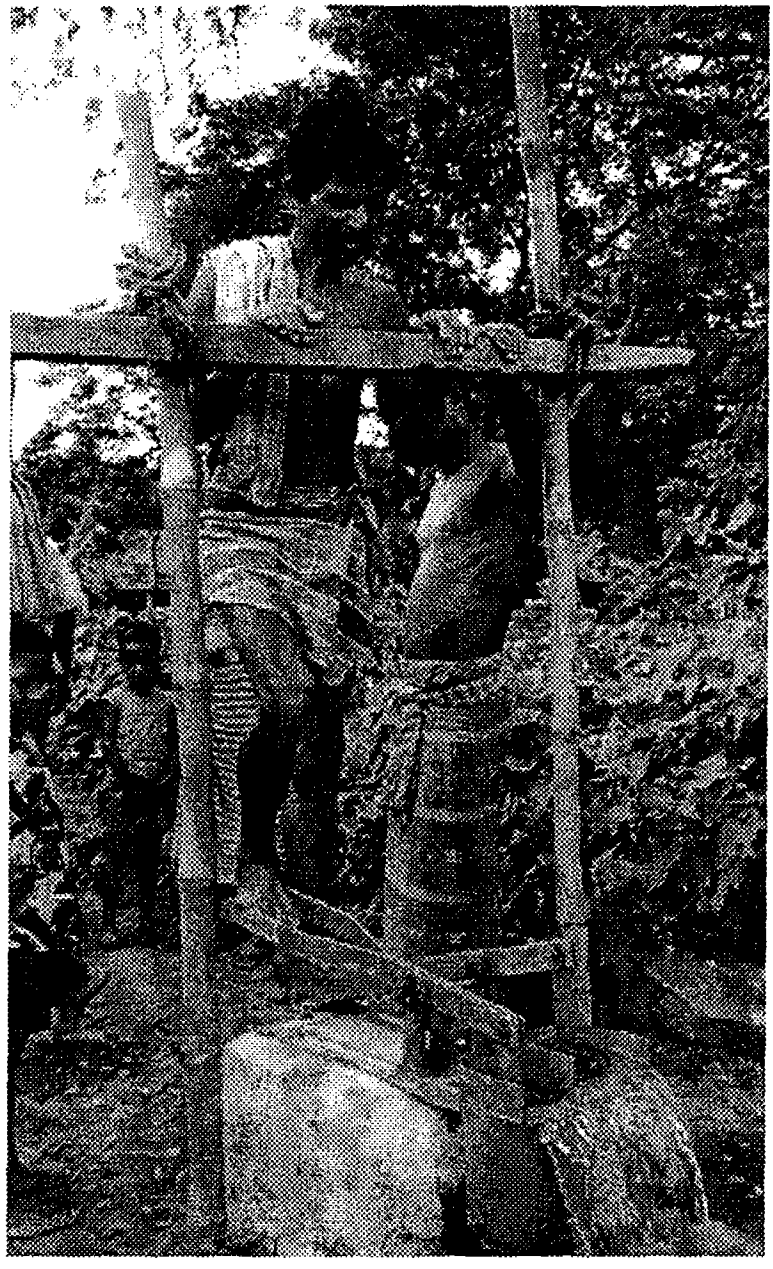
3.1.3 Bullock Pump Site

The bullock pump is installed for test purposes in the village of Uttara, Kaushalya Gang. Conference participants observed operation of the pump with one bullock hitched to the draw-bar.

The bullock was able to turn the pump without apparent effort. However, the pump appeared to '*kick*' three times during each complete cycle. Participants observed that a change in the gearing ratio would reduce this tendency. The pump appeared to draw sand up the shallow tube well. This could be a problem with the filter.

3.2 Photographs

Bamboo treadle pump



Sheet metal pump

Concrete pump

Low-cost drip irrigation

Bullock pump

4 Conference workshops

The conference workshops were designed to allow participants from different countries to share their experiences and to prepare an agenda of issues that IDE must address. The work took place in three types of fora:

- large group priority setting meetings
- small group discussion and preparation meetings
- large group presentation and review meetings.

Section 4.1 reports the priorities set by the conference. **Sections 4.2-4.5** report on IDE's Research and Development, Market Research and Global Dissemination, Quality Control, and Documentation activities respectively.

4.1 Setting Priorities

4.1.1 Priority Issues

The aim of the conference workshops was to answer the following question: "What are the most important technical issues that IDE needs to address within the next year?" Responding to Mr Schumacher's call for nominations, participants saw the following issues as those requiring IDE's attention.

Research and Development Process

- Work out a manageable product development plan.
- Co-ordinate R&D activities of country programmes.
- Articulate and structure a process for product design and development.
- Develop a 2-3 year plan for R&D and product development.
- Develop systematic product development policies and procedures.
- Produce guidelines for R&D (co-ordination, technology selection and when to market).

Prioritisation of Technologies

- Prioritise and assign responsibility for important technologies.
- Select the six most important global irrigation technologies on which to work.
- Maintain a close control on new technologies that IDE has developed especially the bullock pump, deep-set pump and drip irrigation.
- Start sorting out the pump versions and coming up with a minimum offer of models to cover farmers' needs.

By releasing new products IDE can solve real problems and regional needs. It can increase price competition and learn more about the way the market operates. However, too many products can bring about the destruction of existing relationships with manufacturers. The various parties may not be able to absorb the changes. The release of too many products can cause a breakdown in marketing disciplines.

The group recommended that IDE continues to release new products to the market. It proposed, however, that IDE should adopt a more disciplined approach to product marketing. At the moment IDE has no good idea of its product portfolio. It should release new products only when they can solve needs not yet being solved by existing products, or at a cost lower than existing products.

4.2.5 Process of Decision Making

Question 5: *What is the decision making process to continue with product development from conception to product launch?*

The existing process of decision making within IDE is highly valued for its spontaneity, flexibility and speed. IDE encourages creativity and the solution of needs. However, the group reporting on this subject identified that freedom has its downsides. IDE's process of decision making is not systematised, results in duplication and can hinder dissemination.

The group felt that IDE could adopt a more formal decision making process. This might upset some people, but the group felt that a better balance could be achieved.

Success	**Weakness**
Spontaneity, flexibility, speed Creativity is need specific	Not systematised Doubling or duplication Lack of systematised research Limited dissemination
Potentials	**Risks**
Description of the process Need (real or perceived) - R&D committee outside research Prototype - Outside research/lab and field test Test market - Need for Refinements Manufacture - To market	Too much structure might not achieve balance

4.2.6 Process of Customisation

Question 6: *What is the process of customising products to different regions?*

At the present time all products are region or country-specific (locally made and marketed). The group identified a number of weaknesses with this approach. They felt that customised products tend to be more expensive than the original. They questioned whether individual offices are customising products due to local pride and identified that present conditions have resulted from reactionary activities rather than any defined process.

The group recommended that customisations follow the same processes and are subject to the same controls as new products. Although the group recognised that this approach could affect progress, they believed that this is a risk worth facing compared to the potential benefits.

Success	**Weakness**
Locally made and marketed (region specific)	Could be customised due to local '*pride*' Customised products tend to be more expensive than the original May lead to '*re-inventing the wheel*' Support material needs to be replicated too - question of resources
Potentials	**Risks**
Same process be followed as for a new product	Over structuring can kill/slow down everything

4.3 Market Research and Global Dissemination

The conference delegates also considered the question of IDE's market research and global dissemination policies in small groups. The results of their deliberations are presented below.

4.3.1 Market Research During Expansion

Question 1: *What market research is necessary prior to expansion for IDE's programme and products? To what regions/countries does IDE want to expand its programme/products?*

The group suggested that for new countries IDE should undertake a complete feasibility study that would consist of:

- country feasibility survey addressing issues of climate, geology, rainfall, need, etc.
- market feasibility based on in-country visits

- The R&D committee has two weeks for review and comment of above.
- All drawings should be distributed to all countries (including the USA).

For current products the group suggested that IDE sets up standards and goes to the technical committee within six months.

The discussions on this topic revealed a wide range of opinions. Some participants thought that the process was excessively bureaucratic. Others thought that the process was too simplified and suggested that it would prove impossible to resolve design issues in two weeks.

There was some confusion with the wording '*design specifications*'. Dr Veena Joshi suggested that a better word might be '*product definitions*'. Mr Baumann pointed out that in India '*standards*' mean that a product has been approved by a standards authority. In the end the term '*product data*' was proposed as the best description of the information package surrounding the product.

4.4.2 Manufacturing and Distribution Channel Quality Control

Question 2: *How does IDE manage quality control for manufacturers?*

Question 3: *How does IDE manage quality control for the distribution channel?*

The group reporting on these topics presented its answers in the matrix that follows.

Success	**Weakness**
KB has set up a system of QC During the start up phase quality conscience is promoted Awareness of farmers raised Mistri training	IDE system in mature market has no formal control, market takes over Insufficient documents, specifications
Potentials	**Risks**
Training of producers Setting up manufacturing capacity Pre qualifications of producers	Customer may reject technology More complicated products make quality control more difficult

IDE is normally operating directly in the market when it introduces the product. Once the product has matured, IDE gets out of direct intervention into quality control.

Mr Rich called for feedback from other regions. Mr Slocombe indicated that IDE Bangladesh plays the role of a wholesaler. Therefore, "We have control, we are the authorised KB dealer in Bangla-

desh". Mr Frys said that in Cambodia, "The market does this by itself. If the customer is not happy, he goes to the manufacturer."

Mr Baumann pointed out that the "farmer is giving you good money, and expects good products. You need to ensure that pumps work to specification; 95% is cheating. You may need to ask five rupees more, but it's worth it". Mr Egan stated that, "We're starting to deal with this one, with guarantees, replacements." Mr Rich indicated that IDE India carried out spot checks on products. Mr Salter proposed that IDE India is "heading for a much bigger problem with the concrete pump". Participants agreed that IDE faces a major issue in maintaining quality control over pump manufacturers.

4.4.3 Installation and After Sales Quality Control

Question 4: *How does IDE manage quality control for installation?*

Question 5: *How does IDE manage quality control for after sales service?*

The group proposed that quality control for installation can be controlled through:

- training at different levels (misti, dealer, user, etc.)
- establishing guidelines, checks and tests
- overseeing by IDE staff or by training individual inspectors
- *accreditation (e.g. mistri card)*
- promoting good dealer-mistri relationships
- documentation and reporting.

According to the group, after sales service can be quality controlled through:

- training at mistri and dealer level
- setting minimum standards
- knowledge and use of standards
- spares and tools
- IDE addressed cards (postcards for complaints)
- '*do's*' and '*don'ts*' at community level.

The group thought that IDE needs to get the following message across to all involved in the manual irrigation market: "Good quality = good business".

At the end of this presentation, Mr Baumann gave some pointers. "My reaction is that you have a big task ahead of you in order to keep a check on the quality. I hope that you will be able to implement these proposals. On the issue of the '*post card*', I think that you will need a big post box and an office to sort out the complaints."

> **"It's my personal opinion that you implement some of what we discussed today rather than invent new products."**
>
> [Erich Baumann, Head of Handpump Department, SKAT]

Answering a question from Ms Prabhu, Mr Baumann reiterated his previous comments by saying, "Its a big task. Concentrate resources on bringing good quality of product to farmers."

> **"90-95% of our products are pumps. Well less than 5% of our time is (spent) in new products. In Vietnam, our work is mostly on the 'old standby' (the treadle pump)."**
>
> [Larry Egan, Country Director, IDE Vietnam]

Dr Polak believes that there is no simple answer. Mr Sircar agreed. According to him, "IDE takes direct control where volumes are low, but as the market grows you can't control it. We can't do a lot. KB takes control. We have strict quality control on 39,000 pumps but let the market take care of the rest. We are building knowledge at the farmer level, we are contributing. We find that when farmers buy a second pump they buy good quality."

> **"Right now we don't have much quality control but we build up awareness on a broad scale to make them (the manufacturers) aware of customer needs."**
>
> [Mrinal Sircar, Deputy Director, Marketing, IDE Bangladesh]

Dr Polak suggested that IDE places considerable emphasis on educating the farmer to know about quality. However, Mr Rich thought that in IDE India's case about 20% of its revenue is spent on R&D and only 2% or less on quality control. Mr Baumann summed up the discussions by pointing out to the participants that external quality control costs on the India Mk 2 handpump run at approximately 3%.

4.5 Documentation

The workshop session on documentation addressed the five questions presented below.

Question 1: *Why is it important to document?*

Question 2: *What do we need to document and in what form?*

Question 3: *Who should gather information and document?*

Question 4: *Who are the users of this documentation?*

Question 5: *Should each country come up with their own documents or do we set up an international system?*

The groups commented on these questions for the functional headings identified below.

4.5.1 Research and Development and Quality Control

In the area of R&D it is important to document in order to provide:

- a record of history
- a record of product development (prototype)
- a record of laboratory tests
- a record of field tests
- guidance for design and fabrication
- quality controls.

Historical Records

The team thought it was obvious what information should be gathered to create a record of history.

Product Development

The team proposed that IDE should produce idea generation papers, results of systematic literature research, performance specifications and TOR for design (if necessary), prototype drawings and specifications, and documents for promotion of the idea (for marketing and fund raising).

They proposed that information should be gathered by the lead organisation and IDE's R&D committee. Information should be held in the form of written plans.

Laboratory Tests

IDE should maintain records of laboratory tests for objective verification of results, to check against TOR and for funders. The information will come from IDE and outside laboratories and the government. It will include written reports from outside organisations.

The results of laboratory tests will be used by IDE, funders, international and national standards boards and manufacturers.

Field Tests

IDE must document the results of field tests to ensure that it records the feedback from its customers and field workers. This information will allow IDE to change its TOR if necessary. Field tests can be carried out by NGOs, universities and private organisations. The information will be held in the form of written reports and in videos.

Field test information will be used by lead organisations, funders, IDE, its partners and manufacturers.

Design and Fabrication

Design and fabrication information is held to allow standardisation, control the manufacturing process and ensure quality control. The information will be collected by the lead organisation and the R&D committee.

Information will consist of fabrication diagrams production manuals, blueprints, models and videos. Users will include manufacturers, IDE and its partners.

Quality Control

Quality controls must be documented for marketing, customer satisfaction, sustainability and standardisation. This information is collected by the lead organisation, third parties and manufacturers.

The documents will consist of reports, videos and seals/stamps for use by IDE, its partners and customers.

4.5.2 Market Research, Training and Channels/Pricing/Promotion

Market Research

The group proposed that IDE should use an effective combination of formal and informal market research. It should document informal in-house research and introduce a strategy to disseminate its research findings. It should use the results of market research as inputs (country-wise and globally).

IDE needs to develop a historical base of information to share creativity, information, knowledge and skills. It should document successful strategies and also the unsuccessful ones. Everyone should gather this information, but the marketing staff in particular. They should present the information in a structured, written form and maintain an archive.

Training

The training documentation needs of IDE include development of training needs assessment reports, training curriculum, elements within curricula, post training evaluation reports and all media materials.

The reasons for undertaking this work include the strengthening of IDE and its partner organisations. The training staff should undertake this work and maintain the records.

Channels/Pricing/Promotion

The information for channels/pricing/promotion should be decided by the marketing and sales team. The documents should consist of all promotion materials and tools in the form of literature, audio visuals, albums, etc. All information should be properly archived.

4.5.3 Monitoring and Evaluation

The group proposed that monitoring is like taking a snapshot and includes the systematic collection of data and that evaluation asks questions about whether and why targets have or have not been met.

Information is required to record and allow IDE to learn. This information should be collected at a country level and should include any data that might be required for the evaluation.

IDE's management should decide who collects the information which will be used by internal staff, funders, country organisations and international organisations.

5 Recommendations

The conference participants discussed and agreed on a wide range of recommendations. ***Section 5.1*** details the conference's recommendations for IDE's R&D activities. ***Section 5.2*** provides suggestions for marketing. ***Sections 5.3 and 5.4*** propose changes in documentation and global relations respectively. Finally, ***Section 5.5*** outlines the structures of three cross-country committees.

5.1 Research and Development

Mr Nanes presented the recommendations of the group charged with improving research and development activities within IDE.

5.1.1 Focus of R&D

The conference agreed that IDE should focus its R&D activities on four new technologies in the next year. The technologies chosen by the conference for focus were:

- animal driven pump
- drip irrigation
- concrete pump
- low-cost tube well.

The term '*focus*' was clarified by the conference as indicating '*concentration*' or '*serious effort*'. It was not the intention of the conference to stop all work on other technologies. The individual countries would be free to undertake small scale R&D if they perceived a market demand.

5.1.2 Responsibility for R&D

It was agreed by the conference that a '*lead*' country should take the primary responsibility for R&D on each technology. This should be agreed by IDE.

5.1.3 Documentation of R&D

It was agreed by the conference that research should be properly documented at all stages and circulated to appropriate parties which will include other IDE offices, Denver, partner organisations and funders.

5.1.4 Controls on R&D

It was agreed by the conference that R&D should proceed only according to positive results of market research.

5.1.5 Justification of R&D

It was agreed by the conference that the cost of R&D should be justified by the potential benefits of the project.

5.1.6 New Product Procedure

It was agreed by the conference that IDE shall proceed with new product developments according to the process proposed during the conference.

5.2 Marketing

Mr Rich presented the recommendations of the group charged with suggesting improvements to IDE's marketing.

5.2.1 *Marketing within IDE*

It was agreed by the conference that marketing is IDE's strength. In order to improve the marketing function, the conference recommends that IDE introduces systematic and well-documented market research (formal and informal) for product development and geographic expansion. IDE must build up in-house and independent market research capability.

5.2.2 Management of Marketing

It was agreed by the conference that that IDE should develop a detailed TOR before initiating market research (clear goals and objectives) and adopt disciplined and systematic customer driven marketing strategies. There is a need for marketing to be reinforced as IDE's corporate culture.

5.2.3 Internal Marketing

It was agreed by the conference that IDE should place higher priority on internal marketing and make greater use of documentation to disseminate the results of IDE's successes and failures. It was agreed that IDE should undertake more in-house cross-country training and make better use of creative internal training modules.

5.2.4 External Marketing

It was agreed by the conference that IDE should be disseminating IDE's marketing approach to a wide range of organisations (funders, governments, partners, etc.).

5.2.5 Co-ordination of Marketing

It was agreed by the conference that IDE should retain its cross-country marketing committee and ensure that marketing is carried out in accordance with laid down principles via a programme of continuous monitoring and evaluation.

5.3 Documentation

Mr Baumann presented the recommendations of the group charged with improving documentation activities within IDE.

5.3.1 Internal Documentation

It was agreed by the conference that IDE should recognise its need for a systematic and structured form of documentation. The conference recommended that IDE's administration committee should, within the next two months:

- list all the essential and optional reports
- formulate guidelines on the format of these reports
- identify a unified package for accounting and financial reporting
- set up a distribution list for reports. All major reports must be sent to all country programmes.

It was agreed that Mr Egan would be appointed as chair of the administration committee.

5.3.2 External Documentation

It was agreed by the conference that IDE should develop a strategy to communicate the IDE '*message*', experience on technologies, etc. to governments, donors, decision makers, NGOs and the public.

The conference made recommendations that IDE Denver should:

- Co-ordinate and drive the level of profile
- Develop presentation packages for decision makers
- Prepare an implementation strategy to ensure that all published materials are disseminated to the global AT networks.

It was agreed that IDE should plan to produce three articles/videos annually and that all published documents should be sent to International network organisations.

5.4 Global Relations

Mr Alberts presented the recommendations of the group charged with improving IDE's global relations.

5.4.1 Global Objectives

It was agreed by the conference that IDE should develop further links with external parties in order to:

- retain a sense of perspective
- provide ways of disseminating its results and methodology
- gain strategic inputs (technical, financial, R&D support, etc.).

5.4.2 Global Message

It was agreed by the conference that it was crucial for IDE to explain how, after having the right technology at the right place and right time, it has built the right structures and methodology and recognised the critical factors of its success. The message should be disseminated to key policy makers, funders, NGOs and private firms and supported with similar cases of success.

5.5 IDE Structures

It was agreed by the conference that IDE should maintain the operation of all three cross-country committees.

5.5.1 Research and Development Committee

The R&D committee will consist of:

- Mr Nanes - Chairperson
- Mr Salter
- Dr Polak
- Mr Barnes
- Mr Sobhan
- Mr Sadangi.

5.5.2 Marketing Committee

The marketing committee will consist of:

- Mr Sircar - Chairperson
- Mr Rich
- Mr Chat
- Ms Lan
- Mr Schierling
- Ms Prabhu.

5.5.3 Administration Committee

The administration committee will consist of:

- Mr Egan - Chairperson
- Mr Slocombe
- Mr Frys
- Mr Sadangi.

Abbreviations

ADBN	Agricultural Development Bank (Nepal)
AT	Appropriate Technology
DTW	Deep tube well
IDE	International Development Enterprises, Denver
KB	Krishak Bandhu
MCC	Mennonite Central Committee
NGO	Non-government Organisation
R&D	Research and Development
RDRS	Rangpur Dinajpur Rural Service
SDC	Swiss Development Cooperation, Bern
SKAT	Swiss Center for Development Cooperation in Technology and Management, St Gallen
VLOM	Village Level Operation and Maintenance

Appendix 1

List of Participants

Name	Designation	Organisation/Country
Dr Paul Polak	President	IDE/USA
Mr Don Schierling	Vice President	IDE/USA
Mr Bob Nanes	Country Rep.	IDE/Nepal
Mr Deepak Adhikari	R&D Officer	IDE/Nepal
Mr Larry Egan	Country Rep.	IDE/Vietnam
Mr Dan Salter	Project Director	IDE/Vietnam
Mr Nguyen Van Chat	Dy. Country Director	IDE/Vietnam
Ms Lan	Communication Officer	IDE/Vietnam
Mr Jean Francois Frys	Country Rep.	IDE/Cambodia
Mr David B Rich	Country Rep.	IDE/India
Mr Amitabha Sadangi	Country Dir.	IDE/India
Ms Maya Prabhu	Communication Officer	IDE/India
Mr Y Narasimhaiah	Regional Dir. AP	IDE/India
Mr Suresh Bisoyi	Regional Dir. Orissa	IDE/India
Mr Gunnar Barnes	TP Specialist	Consultant/USA
Dr Veena Joshi	Programme Officer	SDC/India
Mr Gary Slocombe	Country Rep.	IDE/Bangladesh
Mr Mrinal Sircar	Dy. Director (Marketing)	IDE/Bangladesh
Mr A M Sobhan	R&D Officer	IDE/Bangladesh
Mr Greg Wishart	Consultant	SKAT/Switzerland
Mr Karl Erpf	Handpump Engineer	SKAT/Switzerland
Mr Eirch Baumann	Head, Handpump Dept.	SKAT/Switzerland
Dr B C Mohanty	R&D Adviser	IDE/India
Mr Henk Alberts	Technical Director	Rope Pumps Ltd/Nicaragua
Mr Andreas Schumacher	Moderator	Asian Bus. Consultants/Nepal