



## Water and Sanitation Program

An international partnership to help the poor gain sustained access to improved water supply and sanitation services

## Developing Private Sector Supply Chains to Deliver Rural Water Technology

# The Treadle Pump

## An NGO introduces a low-cost irrigation pump to Bangladesh

In the rural water supply and sanitation sector, goods and services (technology, training, repair services, financial and technical services, and facility management) are supplied to customers through a supply chain from manufacturers, importers, and service providers through a network of distributors. Payment flows in the opposite direction.

### BASIC SUPPLY CHAIN



The Supply Chains Initiative is a global initiative led by the Water and Sanitation Program. Collaborating partners include government departments, NGOs, and bilateral and multilateral agencies. The aim of this initiative is to develop practical tools that enable and encourage the private sector to provide goods and services related to rural water supply and sanitation. The initiative's first phase will focus on increasing the understanding of the dynamics of the private sector supply chains for handpumps, spare parts, and sanitation equipment.



### Summary

This case study profiles the work of International Development Enterprises (IDE), a non-governmental organization (NGO) based in the United States, in supporting the development, marketing, and distribution of a low-cost, manual irrigation pump (the treadle pump) in Bangladesh for small and marginal farmers. This included developing a supply chain and building the capacity of the manufacturers and dealers that it comprises. IDE's inputs included network development, demand creation through marketing support, and technological research and development.

The treadle pump now has sustained sales through a large number of small, independent enterprises, and 1.3 million pumps have been installed nationwide.


IDE has demonstrated that strategic intervention in a supply chain can ensure a quality product, increase demand, and foster competition and affordable prices. The challenge remains for IDE to reduce its involvement and leave behind a self-sustaining and effective supply chain. This highly interventionist approach is one example of how external support agencies can assist in developing private sector supply chains for goods and services.



INTERNATIONAL DEVELOPMENT ENTERPRISES

**SUPPLY CHAINS** Links to sustainability

## The Product: A Suction Irrigation Pump


 The treadle pump is foot-operated and has a maximum lift of 7.5 meters. It can pump up to 1.2 liters per second at a pumping head of 3 to 3.5 meters.

It extracts water from shallow aquifers (and sometimes from surface water bodies) to irrigate small plots of paddy and cash crops, of up to one acre.

The pump head consists of twin parallel sheet metal cylinders and two plungers. The plungers are attached to two foot-operated treadles mounted on a bamboo frame.

The pump is installed on a bamboo or PVC-lined tubewell.

## The Potential Market

 The potential market comprises 12.5 million small and marginal farmers densely distributed throughout Bangladesh, with an average landholding of between 0.5 to 2.5 acres of land.

The pump is appropriate for most areas of Bangladesh, except the Chittagong Hill Tracts, the coastal belt, and parts of the northwest, where the groundwater table is too low to be accessed by suction pumps.

IDE estimates that there are already almost 1.3 million treadle pumps in Bangladesh.

IDE's involvement has been predominantly in three geographical areas, which comprise 30% of the total national pump sales. However, IDE's influence on market share is not static; even in the three areas, IDE's market share has never exceeded 50% at any one time.

### THE TREADLE PUMP STORY

The treadle pump was developed in 1979 by a team working with the Rangpur Dinajpur Rural Service (RDRS), an NGO working in northwest Bangladesh. RDRS developed the new pump to meet what they perceived as a large, unsatisfied demand for manual irrigation pumps. The treadle pump offered a unique alternative to existing hand-operated pumps by enabling the extraction of larger volumes of water through the easier foot-operated method.

The RDRS Agricultural Workshop in Rangpur began manufacturing the pumps in 1980, with an initial capacity of 600 pump heads per month. To boost production, RDRS helped to finance four private workshops in northern Bangladesh, increasing the total monthly output to 3,500 pump heads. Despite early indications that the treadle pump was an attractive and affordable product, RDRS provided a 50% subsidy to farmers on the purchase price and maintained massive overheads, including some 200 extension workers promoting the pump in their working areas. By 1984, sales had reached 7,000 pumps per year, mainly in northern Bangladesh. However, further increases were limited by production capacity, the lack of a nationwide sales network, and the fact that a short supply chain from the manufacturer to the customer did not use the promotion potential of retailers. As it later transpired, the key to expansion and increased coverage lay in effective marketing.



Women also find the treadle pump easy to use.

# IDE Gets Involved

IDE's first venture in Bangladesh, under the Marketing Appropriate Technology project, identified the treadle pump as a suitable technology for large-scale marketing in order to raise small farm productivity and income. The marketing strategy had six main components:

## MARKETING STRATEGY

### Diversifying the production base:

IDE began working with affiliated manufacturers throughout the country to expand the production base and foster competition.

**Quality control:** IDE acted as a wholesaler, purchasing pumps from the manufacturer, carrying out quality inspections, stamping the pumps with a brand name, and selling them to a network of rural dealers.

**Promotion:** IDE staff, pump dealers, and locally hired promoters used posters, calendars, leaflets, and t-shirts as sales aids. They also promoted the pumps at farmers' rallies, where they showed a 90-minute promotional film to average audiences of 3,000, using local stories as the background to sell the pumps.

**Training:** IDE field staff members were trained to identify and build links with rural traders — mostly small hardware shops with localized command areas — who were interested in selling pumps. They also trained and supervised the work of installation teams.

**Creating a dealer network:** IDE set up a countrywide dealer network to purchase pumps at wholesale prices and sell them to farmers. It also set ceilings on profit margins

## THE COMPETITION

Other manual methods for water extraction are the main competition to the treadle pump. Surplus rural labor has traditionally made manual irrigation more common than the use of motorized pumps. Table 1 shows the major water extraction options available for irrigation.

Marginal and small farmers can buy water from owners of motorized pumps, who extract large volumes. However, they face high prices, perhaps a consequence of a lack of competition.

**Table 1: Water extraction options for irrigation**

Extraction Method	Price (Taka)
Swing basket	100
Dhon (scoop)	500-750
Treadle pump (installed)	1,000-1,300
Number 6 pump (no platform)	3,000-3,500
Chinese 3HP Diesel Pump (installed)	9,000-10,000

Note: 50 Taka equals US\$ 1



The traditional dhon, or scoop, is an alternative irrigation device, but one which is far less efficient.

for both producers (10% to 20%) and retailers (15%).


**Coordination:** IDE helped to coordinate the activities of other organizations involved with manual irrigation pump technology by creating the Manual Pump Group. The group discussed common issues, jointly produced promotional materials, and set up a credit program. Through this group and in its own right, IDE advocated for reduced government subsidies on agricultural pumps.

By 1988, IDE's inputs had resulted in booming treadle pump sales. Furthermore, 20 independent manufacturers had entered the market nationwide, enticed by the market success and the relatively low start-up costs to manufacture the pump (that is, the simple technology meant that manufacturers with basic metal rolling and welding equipment could start producing pumps with minimal capital costs). Competition caused prices to drop, and some of the independent manufacturers began selling poor quality products at lower prices. To

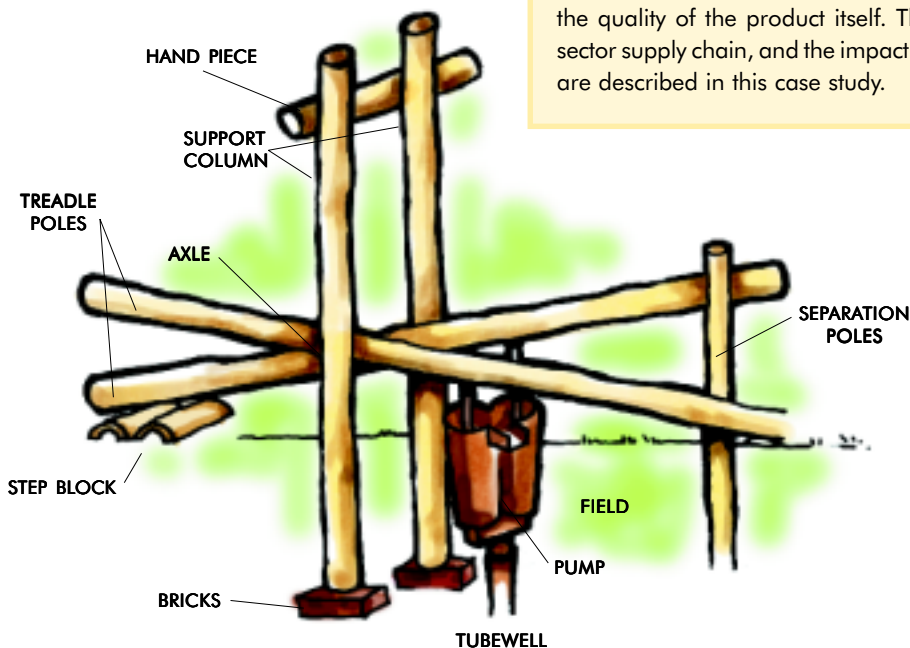
remain competitive, many of the better manufacturers were forced to offer cheaper, lower quality pumps; this resulted in reduced customer satisfaction and a drop in sales.

In response and with a view toward the long-term sustainability of the supply chain, IDE modified its strategy. Instead of competing with small, private manufacturers, it decided to pull out of wholesaling altogether and work instead with regional manufacturing partners, believing that by influencing more of the manufacturers, it could raise the quality of the majority of pumps entering the market. IDE provided technical assistance to improve product quality and business practice, helped to open up new markets, and helped to form private dealer networks. In 1988-1989, the first year that IDE implemented this strategy, treadle pump sales rose significantly.

## An Important Lesson is Learned

 In 1990, IDE decided to withdraw from two districts that had had the most significant sales, assuming that demand alone was enough

**FIGURE 1: A TREADLE PUMP**



## INTERNATIONAL DEVELOPMENT ENTERPRISES

International Development Enterprises is a US-based NGO that aims to increase rural peoples' livelihoods by working with the private sector to improve the technical development and marketing of appropriate rural technologies, such as the treadle pump. This results in improved access to appropriate technology, increased income for farmers and for the manufacturers, distributors, technicians, and financiers who comprise the supply chain required to deliver the goods effectively. IDE's specific interventions to support the supply chain are described below.

### IDE SUPPORTS AND DEVELOPS THE SUPPLY CHAIN BY:

**Building and strengthening the linkages between stakeholders in the supply chain:** IDE begins to build a network of dealers and installers to distribute the manufacturers' products.

**Demand creation and awareness-building among users:** IDE targets promotional activities at all stakeholders in the supply chain. When first marketing the treadle pump in an unserved area, IDE often subsidizes the installation costs in a few strategically located, 'showcase' sites.

**Research and development:** IDE conducts research and development on new products for the agricultural and drinking water sectors, as most small manufacturers cannot afford to do this. IDE believes that it is vital to introduce new products that enable manufacturers to maintain constant levels of production throughout the year and to attain a critical sales volume.

In the case of the treadle pump in Bangladesh, IDE is attempting to create a quality-conscious environment among the stakeholders in the supply chain. The approach promotes vigorous competition to foster higher quality products. In addition, IDE has promoted the quality approach by providing large numbers of manufacturers with services, such as dealer network development, brand name promotion, training, technical assistance, and access to new products.

IDE involvement with the treadle pump has evolved over the last 20 years, from simply marketing a technology to providing support at all stages of the supply chain, focusing on improving quality throughout the product process (that is, through the manufacturing, marketing, and sales phases) in order to improve the quality of the product itself. This evolution, the development of the private sector supply chain, and the impact on treadle pump coverage in rural Bangladesh are described in this case study.

to sustain the continued sale of the product. Unfortunately, this proved incorrect. IDE's involvement had guaranteed a certain product standard. When it withdrew, once again the number of manufacturers in the market increased and cheaper and lower quality pumps entered the market. Because of reduced customer satisfaction, sales dropped significantly in the two districts. The debate

## ROLES IN THE SUPPLY CHAIN

The supply chain comprises mainly independent and small manufacturers, dealers, and service providers, and it responds to a potential demand of 12.5 million small farmers in Bangladesh.

Hydrogeological factors limit this market, as the water table is too low in some areas of Bangladesh for suction pumps to function.

### Customers

Customers are typically small and marginal farmers who want their own irrigation devices.

### Dealers

There are approximately 1,000 stocking dealers for the treadle pump in Bangladesh, and most customers buy pumps directly from them. The dealers are normally hardware shops for which treadle pump sales are a small percentage of their overall business; some smaller shops may only sell 2 to 3 pumps per year. Many of the larger shops maintain an installation team on standby.

### Manufacturers

IDE estimates that there are 85 treadle pump producers throughout Bangladesh.

### IDE

IDE facilitates the formation of national and regional networks of suppliers, dealers, and installers. It withdraws support gradually, depending on its assessment of the network's self-sufficiency. At present, IDE is withdrawing from one region using a strategic phase-out plan. The objective is to ensure the effective transfer of function to the network partners.

### Communication Infrastructure and Logistics

High population density and the relatively small size of the country mean that distances between trading centers in Bangladesh are not great. Telephone and road networks between regional towns and Dhaka are good, except during the monsoon period (June-September). However, this is not a problem for most pump manufacturers because the demand for treadle pumps peaks between October and mid-February. Most raw material suppliers are based in Dhaka or in large regional centers and most manufacturers finance the purchase of materials and transport them to their workshops at their own cost. There is also a treadle pump wholesale market in Dhaka that serves many regional dealers.

continues over whether the problems can be attributed to the change in marketing strategy (dropping IDE's wholesaling role) or to the withdrawal from the two key areas. Nevertheless, the experience provided a vital lesson: **Although increasing demand can stimulate the development of the private sector supply chain, large numbers of initial sales**

**alone do not indicate a successfully established product.**

IDE's response in 1990-1991 was to resume a direct role in the market by setting up *Krishok Bandhu* (Farmer's Friend), a brand name marketing and sales organization. It conceived of this as a flagship organization to establish a quality benchmark, and to manufacture

and sell treadle pumps and other agricultural inputs through an exclusive network of manufacturers, dealers, and installers working to set standards of quality and service. The model worked well, but IDE's main donor at the time felt it was inappropriate to support a profit-making organization. Consequently, *Krishok Bandhu* became an independent, limited company in 1995, staffed by former IDE personnel.

At the same time, IDE began the 'generic promotion' of the treadle pump, supporting all manufacturers, dealers, and installers involved with the treadle pump regardless of brand name. This strategy, however, led to severe problems, as partners in some regions provided a low quality product and poor service.

## The Quality Partner Catalyst Approach is Born



Finally, in 1998, IDE developed the Quality Partner Catalyst Approach. The approach aims to increase quality consciousness among stakeholders in the supply chain and encourage the production of higher quality products, thus achieving greater customer satisfaction, increased sales, and a higher return on investment for all stakeholders.

To foster a quality conscious environment, IDE provides its partners with incentives; those partners who get involved in the process gain access to particular IDE support. This support comes in the form of access to dealer networks developed by IDE, promotion of manufacturers' brand names, training and technical assistance, and access to new products.

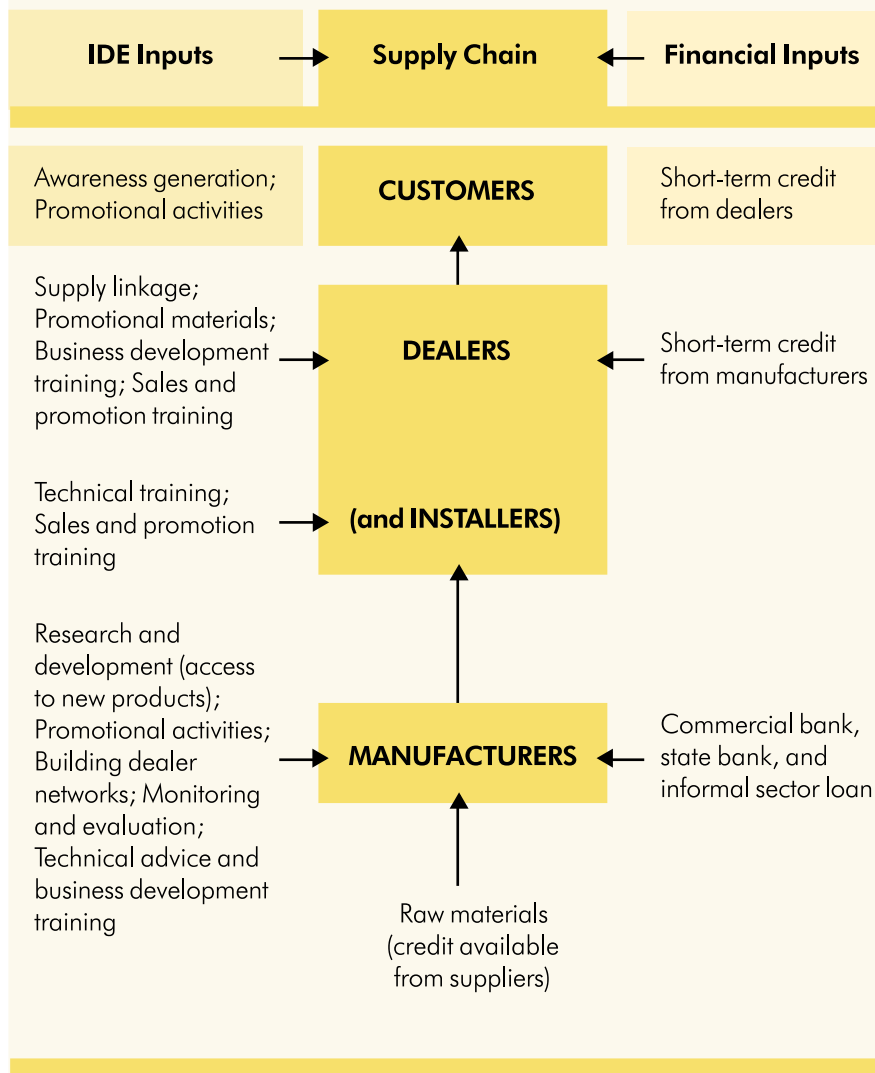
IDE evaluations suggest that this

approach has encouraged a significant improvement in the quality of most treadle pumps entering the market. For example, there are more 16- and 18-gauge treadle pump heads with high quality welds. This contrasts with the pre-1998 situation when the majority of treadle pump sales from the 85 manufacturers in Bangladesh were of low price and low quality. An impact study by Shah et al. (1999) found that the market for treadle pumps is far more responsive to price than to quality, and IDE's experience has been that their involvement has led to sustained sales of the higher quality pumps, suggesting that the improved quality is still being provided at an acceptable price, and that customers are making a conscious decision to invest in a higher quality, higher priced pump.

Given that IDE's influence has never extended to more than 50% of the market in the three regions that they are working, (which equates to 15% of the national market), it is possible to conclude that the market offers a range of options on price and quality, and that there is a customer profile that matches each stage in this range. Each customer profile has a minimum level of acceptable quality and maximum level of acceptable price. IDE's experience suggests that their direct influence has predominantly been at the higher end of the market, but that they may have had an indirect influence on the pump quality in other sectors.

IDE's experience has also shown that within the market, there are informed customers who choose the lower quality pump with its shorter average lifetime and reduced capital costs. IDE suggest that farmers who evaluate the return on their investment, weighing the returns from the annual or seasonal sale of their produce with the increased cash availability from purchasing a lower cost pump, conclude that more frequent repair or replacement of the pump is more

**FIGURE 2: TREADLE PUMP SUPPLY CHAIN MAP**



**THE TREADLE PUMP SUPPLY CHAIN**

Figure 2 shows the treadle pump supply chain from the manufacturers, through the dealers, to the customers. Surrounding the main supply chain are the external inputs that contribute to it, including raw material supply financing, technical and marketing support, and business development services.

## SUPPLY CHAIN EFFECTIVENESS

The effectiveness of a supply chain can be assessed by considering whether the pumps are (a) available (b) affordable and (c) reliable.

### Availability

All treadle pump components are readily available 'off the shelf' from rural dealers. Most dealers maintain teams of installers who can sink a tubewell and install a pump within 1 to 2 working days.

### Affordability

The cost of an installed pump equates to 5.5% to 7.7% of average per capita gross domestic product in Bangladesh<sup>1</sup>, and continuing pump sales suggest that the treadle pump is affordable.

The price of the pump (see Table 2) depends on the cylinder wall thickness (gauge<sup>2</sup>), the standard of welding, and the types of valves supplied. The cost of the below-ground components depends on the length of PVC pipe needed to access the water table.

**Table 2: Price of treadle pumps**

Treadle Pump Specification	Wholesale Price (Taka)	Retail Price (Taka)
16-gauge	220-280	230-300
18-gauge	200-240	220-260
20-gauge	160	180-200
Average cost of below-ground components (including boring)		800-1,000
Total average cost of treadle pump (installed)		1,000-1,300 (\$20-\$26)

<sup>1</sup> The World Bank Development Report (1999/2000) estimates the annual gross domestic product per capita in Bangladesh at Taka 18,000 (US\$360).

<sup>2</sup> Standard wire gauge is a measure of the thickness of the sheet metal; 16-gauge is thicker than 20-gauge.

### Reliability

Reliability, which is dependent on quality, is influenced by the gauge, the standard of welding, and craftsmanship. Table 3 shows IDE's field observations of average pump lifetimes<sup>3</sup>.

**Table 3: Average life of treadle pumps**

Pump Specification	Average Life
16-gauge	5-7 years
18-gauge	3-5 years
20-gauge	1-2 years

Despite the apparent economic advantage of the 16-gauge pump over the lowest quality pump (that is, a purchase price that is on average 50% higher in return for a 250% longer life), half of all sales are for the cheapest pump.

<sup>3</sup> The Afridev and India MKII handpumps have an average life of 7 years (HTN Conference 2000).

viable than the gains achieved from higher initial financial outlay for a higher quality, longer lasting pump.

## Access to Financing



Access to financing is a key issue for all stakeholders in the supply chain; this is particularly true for pump manufacturers, who have three main sources of financing, including (a) commercial banks; (b) state banks; and (c) the informal sector (for example, friends, family, and moneylenders).

A manufacturer's profit per treadle pump can be 8% to 10% and working capital can revolve many times in one year. Smaller manufacturers are more likely to obtain loans from the informal sector, as they are often unable to meet the collateral requirements of commercial and state banks, and consider the typical commercial loan interest rates, 16% to 18% per year, to be prohibitive. In addition, acquiring a loan is quite bureaucratic, and often requires unofficial 'service payments' to move the process along. Raw material suppliers also extend short-term credit to pump manufacturers in return for a 2% surcharge. Manufacturers usually give short-term credit to dealers, depending on their credit worthiness; they often extend the same service to customers.


## Next Steps



The treadle pump is not a drinking water pump, but its success has encouraged IDE to enter the drinking water sector with the development of the *Jibon* pump for low water table areas. It is using the same approach with this product, including phases for research and development, establishing a dealer network, and

marketing and promotion, to be followed by eventual withdrawal.

## Lessons

 The implementation of an effective marketing strategy during the pump introduction was critical to the development of a treadle pump market.

- IDE successfully fostered improvements in quality standards by providing business support and incentives to a large number of treadle pump manufacturers who were prepared to adopt a quality-focused approach. The competition created also ensured that the pumps were available at affordable prices.

- Although increasing demand stimulated the development of the supply chain, large numbers of initial sales **alone** did not indicate a successfully established product.

- Supporting a large number of small, independent stakeholders contributed to the sustainability of the supply chain; the increased number of competent suppliers has ensured that if one supplier leaves the market, others will replace it.

- A focus on quality was important to ensure sustained demand within the higher price range in the market and this may have helped to raise standards



Small local dealers sell treadle pump cylinders.



Manufacturing of treadle pump cylinders.

in areas not directly influenced by IDE's interventions.

## Contacts

If you would like more information, please contact:

**Anthony Oyo**, [aoyo@worldbank.org](mailto:aoyo@worldbank.org)  
**Water Help Desk**, [whelpdesk@worldbank.org](mailto:whelpdesk@worldbank.org)

[@worldbank.org](mailto:whelpdesk@worldbank.org)

Or visit our Web site at: [www.wsp.org](http://www.wsp.org)

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## Water and Sanitation Program

1818 H Street NW  
Room F4K-172  
Washington DC 20433 USA

Phone: +1 (202) 4739785  
Fax: +1 (202) 5223313, 5223228  
E-mail: [info@wsp.org](mailto:info@wsp.org)

Web site: <http://www.wsp.org>

## Water and Sanitation Program - South Asia

Flat #03-04, Building 'A'  
Priya Prangan, 2 Paribagh, Dhaka 1000  
Bangladesh  
Phone: (880-2) 8611056-68  
Telefax: (880-2) 8615351, 8613220  
E-mail: [wsp@worldbank.org](mailto:wsp@worldbank.org)  
Web site: <http://www.wsp.org>

A Supply Chains Initiative Study produced by the Water and Sanitation Program and International Development Enterprises.

Case studies on existing Supply Chains will shortly be available in a global synthesis paper, with additional reports on Pakistan and Bangladesh. The initiative is also developing supply chain strategies in Mozambique and Southern Africa in collaboration with governments, the private sector, and external support agencies.

Other publications in the Supply Chains Initiatives series: Afridev Pump (Pakistan) Global Synthesis Report

## August 2000

The Water and Sanitation Program is an international partnership to help the poor gain sustained access to improved water supply and sanitation services.

The Program's main funding partners are the Governments of Australia, Belgium, Canada, Denmark, Germany, Italy, Japan, Luxembourg, the Netherlands, Norway, Sweden, Switzerland, and the United Kingdom; the United Nations Development Programme, and The World Bank.