



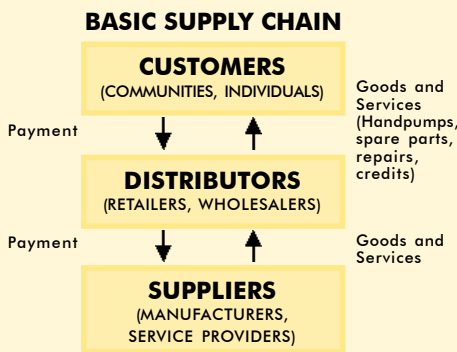
## Water and Sanitation Program

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 Rope Pump: Private Sector Technology Transfer From Nicaragua to Ghana

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.



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.



Users of Ghana with their new pump.

### Summary

The Nicaraguan rope pump has stimulated widespread interest throughout Central America due to its low cost, efficiency, durability and low maintenance needs. The pump is based on a centuries-old design that was refined during the 1980s and 1990s. Suitable for use at either a community or family level, the pump operates as well as other, more expensive pumps such as the Afridev and India Mark II at groundwater depths of up to 50 meters. The Swiss Agency for Development and Cooperation (SDC), seeing the potential for 'South-South' technology transfer of the pump, supported the principal Nicaraguan manufacturer, Bombas De Mecate S.A. (BOMESA), in setting up a Technology Transfer Center between 1996 and 1998. Working with counterparts in the West African country of Ghana, supported by the Water and Sanitation Program (WSP), BOMESA has successfully established the capacity to both produce and install the pump in that country. The experience has shown the great potential for such a transfer to bring a low-cost, reliable pump to countries where handpumps can help meet the challenge of delivering sustainable rural water supply.

## Background

In rural areas in many countries, the dispersed nature of the population has made handpumps the technology of choice for potable water supply. Handpumps require lower upfront costs and less maintenance than piped networks. Despite these natural advantages, throughout the 1960s and 1970s it became clear that 'Northern' handpump technologies were not always applicable to a developing country framework. Pump repair and maintenance often proved problematic, as did the availability of imported parts. In the early 1980s, the WSP Handpumps Project sought to address these issues by developing the concept of 'Village Level Operation and Maintenance' (VLOM) – a concept that was based on the involvement of the user community in maintenance, and technology suited to this. The donor community invested considerable resources in developing 'appropriate technology' pumps such as the India Mark II and Afridev pumps. However, these pumps still pose problems of high cost and sometimes complex supply chains for parts; in addition, there are always some types of repair that the users can-

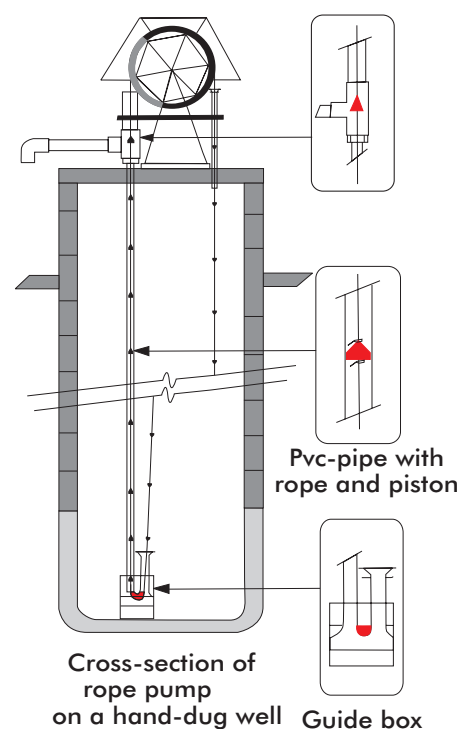
not carry out (see Supply Chains Series No. 2: Afridev Handpumps in Pakistan).

The rope pump is a centuries-old technology, with records of designs from ancient China and turn-of-the-century France. It has been used successfully for supplying both communities and individual families, but until recently was typically suitable only for groundwater depths of less than 10 meters. Whereas these older designs suffered in the long-run from their limited applicability, the rope pump – now found throughout Nicaragua and elsewhere in Central America – has overcome these initial design limitations. This achievement has made the rope pump comparable in functionality to more expensive pumps.

## The Rope Pump in Nicaragua

The majority of Nicaragua's 4.5 million people live on lowlands bordering the Pacific. Surface water is typically polluted and there is widespread use of groundwater sources, whether these be community or family wells. In the early 1980s, a Belgian technician developed a variation on the classical rope pump design

for use in irrigation. In 1988 the government showed interest in developing the pump for drinking water purposes. By 1990 a private firm, Bombas De Mecate S.A. (BOMESA), had started manufacturing a version of the pump. Production since that time has increased dramatically, and BOMESA now manufactures over 150 pumps per month. Another private manufacturer, Taller Lopez-Erlach (TLE), has a similar output, and there are



### BOX 1: THE ROPE PUMP

The principal elements of the rope pump are a pulley wheel, a rope with pistons attached, a pipe that enters the well, and at the base of this pipe, a guidance device for the rope. As the crankshaft is turned the rope drags the pistons up the pipe, trapping the water above them and ejecting it at the surface. The pump functions well at groundwater depths of up to 50 meters.

Due to the simple and sturdy design of the pump, maintenance needs are very limited and can easily be handled by the community or local artisan. The rope itself is the most likely part to break down, and can either be easily and cheaply replaced locally or patched up without difficulty. Makeshift repairs do not significantly detract from pump performance.

at least a dozen other small-scale participants in the market.

It is estimated that over 7,500 pumps were sold and installed in Nicaragua in 1999, and that over half of Nicaragua's rural population have heard of the pump – a result apparently due to the extensive marketing that the pump has received by the manufacturers. The marketing as well as the receptive attitude of the Nicaraguan government have been important factors in the pump's success.

In the early 1990s the Nicaraguan government added the locally produced rope pump to the list of pumps selected for use in the rural water sector, even though at that time the technology was still under development. This is an example of the government's attitude which facilitated the emergence of the market for the rope pumps despite the fact that the other pumps, all imported, received support from external agencies in all aspects of the distribution and maintenance chains.

### Supply

Both BOMESA and TLE manufacture a variety of pumps for communal and family use. TLE sells self-assembly kits that are put together and sold by local workshops. Installation can be performed on request by either firm, but tends to be prohibitively expensive. As a result, BOMESA provides an installation manual and a short training course to customers. TLE, on the other hand, maintains a network of installers throughout the country whom they recommend to pump buyers. The buyer pays the installer directly.

### Demand

Demand for the pumps comes from three sources: rural families, NGOs

## THE HISTORY OF THE ROPE PUMP IN NICARAGUA

**Early 1980s:** Belgian technician develops a variation on the classical rope pump design.

**1988:** The government develops pump for drinking water purposes and post-hurricane demand swells rapidly.

**1990:** Bombas De Mecate S.A. (BOMESA) commences manufacturing, selling to low-income rural families.

**1995:** Private sector demand has been augmented by interest from ENACAL and NGOs. IRC report on Nicaraguan Rope Pump.

**1996-98:** Technology Transfer Division created within BOMESA – produces transfer kit.

**1999:** Production surpasses 7,500 pumps a year. Ghanaian authorities and others investigate transfer possibilities.

and donors, and government organizations. During the first couple of years of production, private clients made up the majority of BOMESA's customers, while subsequently demand from donors, NGOs and government has expanded rapidly. Private clients, however, remain a significant source of revenue for both major manufacturers.

### Affordability

One of the keys to the rapid spread of the rope pump in Nicaragua has been its low cost allied to its reliability and low maintenance needs. A study performed for the WSP found that the annual maintenance cost of the rope

pump never exceeded \$10 (and in fact was less than \$5 in all but one area surveyed). By comparison, the annual maintenance cost for pumps in India – predominantly India Mark IIs – ranged between \$59 and \$107.

The upfront cost of the rope pump is also significantly less than for Afridev or India Mark II pumps. The same study found that in Nicaragua India Mark II pumps sold for \$750 (with similar prices for Afridev pumps) while the equivalent rope pump sold for \$110. The imported pumps are harder to install and maintain and rely on imported parts, whose delivery may be problematic. Therefore, in Nicaragua for wells at a depth of less than 60 m, the rope pump has been preferred to either imported pump.

In addition to its efficiency, low cost and reliability, the rope pump's simple technology means that, given a rudimentary in-country manufacturing base, it can be both produced domestically and repaired locally, features which contribute greatly to sustainability.

## The Rope Pump in Ghana

 The Government of Ghana launched the National Community Water and Sanitation Program in 1991 to accelerate access of rural communities to sustainable water and sanitation services. The agency responsible – the Community Water and Sanitation Agency (CWSA) – works with the active participation of communities, NGOs and the private sector. Communities receive government assistance in

improving their services, but are ultimately responsible for the operation and maintenance of their facilities, drawing upon the private sector for goods and services.

CWSA presently supports the installation of four types of pumps, but finds its reliance on imports for both the pumps and spare parts to be problematic. CWSA would thus like to promote the local manufacture of lower cost pumps in Ghana. With the financial support of a World Bank-supported project, CWSA staff made a short visit to Nicaragua in May of 1999 to investigate the potential for transferring the rope pump to Ghana. Representatives met with the Technology Transfer Division of BOMESA, a division that has been set up with the help of both ENACAL and SDC. They were suitably impressed by the efficiency, reliability, low cost, and availability of rope pumps in Nicaragua and saw potential for private sector development of the pump in Ghana.

CWSA wanted to nurture a local production base for the pumps within

Ghana, initially supporting several local manufacturers through guaranteed purchase schemes and by undertaking outreach work with communities in order to install a number of trial pumps. If successful, the project could be scaled up. The manufacturing of the pumps would be entirely privately financed, allowing a sustainable production, installation and repair base to develop.

Following the CWSA visit to Nicaragua, the WSP agreed to fund a three-phase transfer process. Under the first phase in 1999, BOMESA helped identify several Ghanaian workshops suitable for the production of the rope pump. The local availability of materials required for manufacturing was confirmed while some parts (such as the ceramic guide box and the pistons) were supplied from Nicaragua during the initial phases of the transfer. The capacity for producing these parts in-country was found to exist and will ensure long-term local supply. Production has now commenced in Ghana and several pumps have been success-

fully installed. Representatives of the workshops in Ghana have since visited Nicaragua to undergo further training in both technical and marketing issues.

The key to this technology transfer has been its 'South-South' nature. Many of the characteristics of the rural areas and the local private sector are similar in the two countries, and prospects for establishing a financially self-sustaining private sector base for the production, installation and repair of rope pumps in Ghana is good. The World Bank, WSP and CWSA have been deeply involved during the early stages of the transfer. It is expected, however, that both demand and supply for rope pumps will flourish independently after this initial support.

## Technology Transfer: The Potential

 Unlike many past examples of technology transfers from the 'North', the transfer for the rope pump from Nicaragua to Ghana offers great promise. It is based on the idea that the private sector of different countries can come together in mutually beneficial cooperation to manufacture and sell the rope pump. The partnership offers great potential for the private sector in both countries – with cooperation, both sides can benefit from the demand for a low-cost, reliable handpump.

With respect to the specifics of the technology transfer and capacity for companies to launch this type of product, several significant factors are outlined here.



The production of the first pump in Sindigo, Savelugu District, Northern Region of Ghana.

## THE TRANSFER PROCESS

The transfer process from Nicaragua to Ghana consisted of three phases.

### **Phase I (November 15 to November 26, 1999):**

Technical assistance provided via correspondence and a two-week visit by BOMESA to the Ghanaian authorities to help with selection of suitable manufacturers, confirm the availability of materials, supply technology transfer manuals, and help commence production.

### **Phase II (February 7 to February 10, 2000):**

BOMESA hosted two Ghanaian technicians in Nicaragua for further training, dealing with the automatization of production, marketing techniques and financial management.

### **Phase III (June 19 to June 30, 2000):**

Installation of the trial-run of 100 pumps in Ghana, further technical assistance from BOMESA covering quality control, branding and steps to develop a durable relationship between the Nicaraguan and Ghanaian manufacturers. This phase is to be followed by an evaluation of the pump's local acceptance and performance in early 2001.

### **Institutional climate**

The favorable institutional climate was a key element in the successful emergence of the pump in Nicaragua and is important in determining the

potential for a successful transfer elsewhere. Resistance from the government or other agencies makes it very difficult for sustainable private sector provision to take root.

### **Supply**

A local supply chain needs to be created with demonstrable links to the community. It should also be short enough so that rope pump manufacturing will form an important part of revenue and encourage long-term commitment by the supplier. Given the low technology nature of the pump, the appropriate pump manufacture materials should be easily available in the country. Installation and repair requirements also need consideration, with the Nicaraguan example providing a useful model.

Due to the simplicity of the pump, a specific supply chain for spare parts is not required. A majority of the parts can usually be found at the local grocer or hardware shop.

### **Quality control**

Quality control of the raw materials, manufacturing, and the installation of the pump are key elements of success. A standard of quality should be agreed to and applied by the principal producers in a country/region. The experience in Nicaragua has shown that inferior reproductions of the pump by 'artisans' that are cheaper and below standard can damage the reputation of the pump (see Supply Chains Series No.1: The Treadle Pump: An NGO Introduces a Low-cost Irrigation Pump to Bangladesh).

### **Demand**

A WSP study *Rural Water Supply in Nicaragua: The Rope Pump* indicates

that demand should be high wherever there are a large number of low-income rural households with no access to piped distribution water. A tradition of using family wells for drinking water is helpful, as this will facilitate rope pump adoption and lower the capital cost where existing wells can be used. Evidence also indicates that in the beginning the role of state extension agencies, NGOs, and donors will be extremely important in mobilizing demand for the pump. BOMESA stresses that a successful trial installation, with product quality assured and followed by marketing and information campaigns, is of great importance. Demand must prove sustainable once initial support is withdrawn.

### **Financing**

Financing and willingness to pay for producers is critical to the success of the transfer. If manufacturers require seed capital, governments or donors could provide this. This should take place preferably in the initial phases only. In Ghana a guaranteed initial purchase provided the incentive to develop initial production capacity.


The need for independent cost recovery by the private operators cannot be overstated. If this is only achieved through distortions in the market, due to government or donor intervention, then production will remain dependent upon such distortions.

### **Support to marketing**

Marketing and promotion are extremely important in establishing the demand for the pump. To promote sustainability, the manufacturer should incorporate costs of marketing into the price of the pump. Careful branding is also important. However, a large

promotion campaign is a heavy cost for the manufacturer and the industry to assume alone. A recent study by SDC, *Poverty Alleviation as a Business*, recommends the launching of a significant promotion and marketing campaign for the pump. The study suggests that this could be done as a public investment and that such a campaign could be a good investment for donor water and sanitation programs.

## Conclusion

 The Nicaraguan rope pump has significant potential. Its low cost, efficiency and reliability

### WILLINGNESS TO PAY

Willingness to pay by users is also important, and this has been found to exist where financing for them is available. The national public utility (ENACAL) in Nicaragua has implemented a pilot project with CARE and SDC in which micro-credit is made available for the purchase of family rope pumps. This pilot, carried out in a poorer area of the country, has shown that the population exhibits both a willingness and a capacity to repay the loan for the pump in one year. Demand for the pump for both domestic and small-scale gardening purposes exists, provided that suitable credit is available. It is also notable that the pump is not regarded as an inferior good – a “product for the poor”. Many middle-class families also use it, and ownership comes with no social stigma.

have given it high social acceptance in Nicaragua and elsewhere, while its low-technology nature permits local manufacturing. Experience has shown that it exhibits significant potential for ‘direct’ technology transfer from company-to-company and should be of great interest to policy-makers and the private sector alike. Several key issues remain regarding the dissemination and transfer of this technology:

- the role of external agencies, the government, and the private sector in supporting the process
- the types of arrangement between private companies from Nicaragua and other companies in the world to facilitate dissemination and assure a sustainable high quality production
- the extent of demand and potential for similar transfers in other countries.

These and others issues will be discussed in two upcoming events:

**1) May 2001: Workshop in Nicaragua**, organized by the Handpump Technologies Network (HTN), SDC, and BOMESA in partnership with the International Resource Center (IRC) and the WSP. The workshop is designed to inform national rural water supply policy-makers and international decision-makers of the rope pump technology. Structured actions to support the rope pump technology transfer process will be also defined. The workshop should increase the visibility of the rope pump across the international rural water supply sector.

**2) End of 2001: Workshop in Ghana**, led by CWSA, private sector investors and others with the support of the WSP. Opportunities for stimulating market demand throughout West Africa will be discussed.

## Water and Sanitation Program

1818 H Street NW  
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>

### Community Water and Sanitation Agency (CWSA)

Fidelity HSE. RING ROAD CENTRAL  
PMB, KIA, ACCRA, GHANA  
Tel: 233 21 779102  
Fax: 233 21 24 58 46  
E-mail: [cwsd@ghana.com](mailto:cwsd@ghana.com)

### Bombas de Mecate S.A.

Technology Transfer Division  
P.O. Box 3352 Managua, Nicaragua  
Fax: 00-505-278 4045  
E-mail: [ropepump@ibw.com.ni](mailto:ropepump@ibw.com.ni)

### Water and Sanitation Program

François Mûnger  
E-mail: [fmunger@worldbank.org](mailto:fmunger@worldbank.org)

### Other publications in this series:

1. The Treadle Pump: An NGO Introduces a Low-cost Irrigation Pump to Bangladesh
2. Afridev Handpumps in Pakistan
3. Arsenic Mitigation in West Bengal and Bangladesh
4. The Growth of Private Sector Participation in Rural Water Supply and Sanitation in Bangladesh

### February 2001

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 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.