

Treadle pumps — the Cambodian experience

by Simon Batchelor

In Bangladesh, over 500 000 treadle pumps are in operation. Cleverly designed and cheap to make, this technology has proved a marketing triumph; but would the Khmer farmers of the southern Cambodian district of Prey Veng respond as enthusiastically to the introduction, by Northern NGOs, of a pump which was new to them?

IN MAY 1993, the first treadle pump¹ to be imported into Cambodia was installed at the home of Mrs Svay Gruu. It worked, there were no problems during its first 10 months, and so the village requested a further 10 pumps from the British NGO, Christian Outreach (CO), which introduced the technology as part of its community development work.

Prey Veng has an extremely hot climate; there is one rainy season, and, like their compatriots, the people are still trying to pull themselves out of 30 years of chaotic, civil war. Everyone is a rice farmer in Prey Veng and, until the CO programme was established, relied on the inadequate water supplies provided by one open well per village.

The impact of the treadle pump was immediate. Neighbouring villages requested pumps, which they initially purchased through their own, revolving village development fund. By March 1994, 74 pumps had been installed within the programme, facilitated by a funding partnership between Christian Outreach and the American NGO, World Concern (WC).

Two workshops — each employing a welder, and equipped with basic tools — accepted the challenge of producing the pumps. Throughout early 1994, the manufacturers established their production by selling pumps to the programme, and began to sell to private buyers: by July, 100 privately owned treadle pumps were operating.

Demand outstrips supply

CO distributed 50 treadle pumps throughout areas of Prey Veng beyond the 'programme', on a soft-loan basis: if they failed to work en masse, CO would replace them with Soks — pumps made from a piece of PVC piping with welded supports and a home-made piston using an old tyre washing. In November, sales increased dramatically as the rains failed and farmers tried to save their rice crop. Between November and January 1995, the Svay Antor manufacturer alone sold 450 pumps. Demand outstripped supply, and the prices of both pump and drilling rose. The CO/WC partnership helped two new Prey Veng

manufacturers to start production, while another manufacturer set up independently, with some technical support.

By March 1996, an estimated 2000 treadle pumps had been installed in Prey Veng; 475 of them were bought using the CO-established credit facilities.

Growth — key factors

Table 1 shows the relative costs and suitability of the pumps available to the farmers of Prey Veng.

Of the three, the treadle is the cheapest. But, although very cost-effective, to say the treadle is half the cost of a Sok suction pump, and a third less expensive than a No. 6 suction pump, would not be completely accurate. A groundwater hole would have to be drilled to install any of the three pumps in Prey Cla commune. Local drillers can drill and line the hole with plastic pipe for \$50 (1 chi of gold)²; for this amount they will also install the pump. With both the Sok and the No. 6 this means no input from the villager; the treadle-pump user, however, must supply wood to make the frame, and assist the driller in installing the pump.

Taking all these factors into account, the villagers compared the costs of an installed unit, illustrated in Table 2. Although the villagers know that the treadle is only \$10 cheaper than the Sok's total cost of approximately \$70, they still perceive the treadle pump to be 'cheaper'. This factor alone would not ensure the popularity of the pump which, because it does not compete overall, has not been replicated in other parts of the country.

Local maintenance and repair

The cheaper the pump, the more vulnerable it is to breakages from extensive use. The villagers recognized that easy repair is important. While the No. 6 pump may need repairing only once every two years, repairs have to be carried out by a hand-pump technician. The 'downtime' (when the pump is idle, between breakage and repair)

Table 1. Pumps available in Prey Veng in the early 1990s

<i>Pump name</i>	<i>Type</i>	<i>Cost</i>	<i>Comment</i>
No. 6 handpump	imported suction	\$32	Made from cast iron, a strong pump but hard to repair. Pump washers have to be purchased in Phnom Penh.
Sok handpump	Prey Veng-made suction handpump	\$25	Made from plastic pipe and welded metal pieces, more likely to break than the No 6, but easier to repair locally. Pump washer made from old tyres.
Treadle footpump	Svay Antor-made suction foot-driven	\$12	Made from folded and welded metal. Likelihood of breakdown similar to Sok, but even easier to repair locally. Washers have to be brought from Phnom Penh (same washers as No. 6, but the manufacturers arrange purchase).

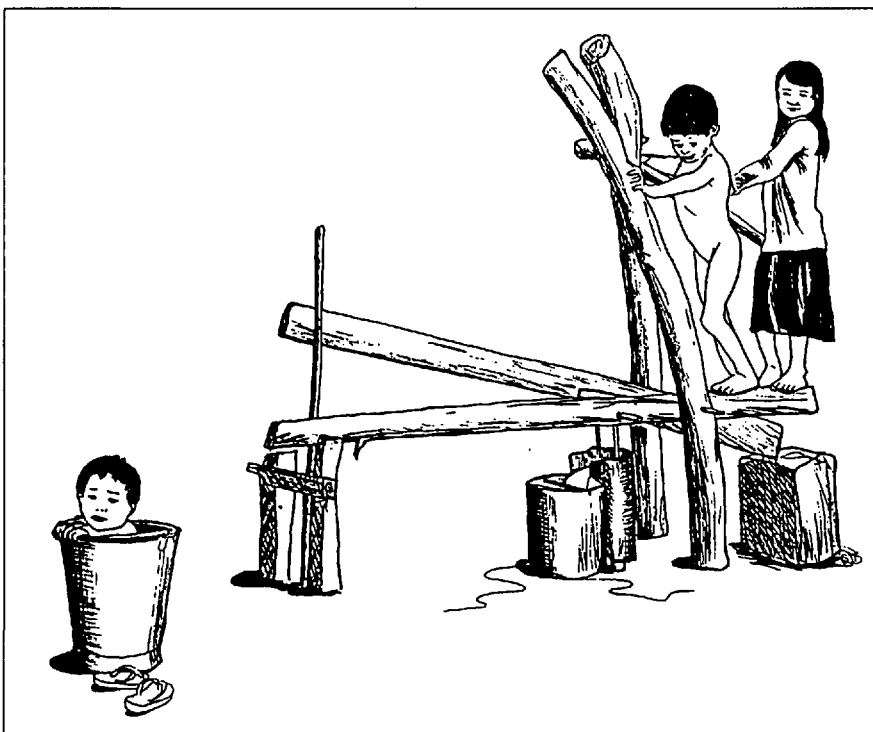


Figure 1. The locally made treadle pump — an immediate success story.

may be several days, even weeks; whereas a local artisan, with simple welding skills, can fix a Sok or a treadle pump. The treadle pump has a further selling point: as Mrs Svay Gruu demonstrates so clearly on page 22 — and unlike the Sok — the washer on the piston can be taken out and replaced without tools.

Suitable, accessible water supply

One cannot discuss water output without looking at supply. Even though the Sok pump had been available for eight years, there were few drilled holes in Prey Veng. A 1993 estimate for the whole province (12 districts) was 1500 holes. Approximately four people were making the Sok, although the original designer and manufacturer retained about 70 per cent of the market.

The main manufacturer — Mr Sok — sells his pump as a turnkey activity. The two drilling teams who install the pumps had already established that there was an abundant supply of fresh groundwater. The driller had to drill between 20 and 30m deep, through a number of sand and soft-clay layers. Once a hole is punched through a clay layer to the given depth, an artesian water supply would fill up the borehole up to approximately 4m below the surface.

As part of the CO programme, some village committees and individuals decided to exploit the income-generating opportunities of drilling. They found that a simple, locally made drilling rig could be used effectively. Consisting of a number of metal pipes

with a pump to circulate the water, the total investment was about \$300. Initially, the villagers used a handpump to circulate the water but, as the profits from the first 20 holes rolled in, most of the drillers invested in a petrol-driven pump (\$300).

A study carried out by Sina Than in 1992³ found that the artesian supply under Prey Cla is an abundant, replenishing supply with the potential to be used extensively. The indicators are that treadle pumps can be operated, without seriously depleting the supply.

The ease with which water can be obtained, together with the formation of new, local drilling enterprises must also have influenced the growth in popularity of the treadle pump. The village drilling teams then formed an informal connection with the

length of time, to water a vegetable garden for example, can result in backache — it is hard work. The villagers immediately commented that a foot-driven pump is easier to use in this context. They estimated that a person could use a treadle for three or four times longer than a handpump. At the same time, the treadle pump has two pistons; so, for every minute a person is pumping, the treadle's output is nearly twice as great as a handpump's.

The treadle pump arrived at a significant time. For the previous 15 years, Prey Veng villagers had felt fortunate to have one reliable, open well. The idea of *surplus* water, for even micro irrigation, remained a dream for many families. The treadle pump proved ideal; the families began to grow key vegetables such as dragoons (swamp cabbages), and onions, to consume and sell.

The value of the different vegetables varies as the gardeners explore what is and is not possible with the treadle pump. The programme provided the opportunity for them to share ideas, and soon people learned which vegetables to grow.

Many chose onions. In the dry season, one *aa* (10m by 10m) can provide onions for the family, with enough left over to be sold at market for 4 *chi* (\$200). When circumstances are favourable, therefore, the treadle pump can pay for itself in less than three months. The majority of gardens yield produce with a market value of around 1 *chi* (\$50); even at this rate, the investment is justified in a little over one season.⁴

Appropriate and traditional

Perhaps the most attractive aspect of the treadle pump and, probably, the

Table 2. Installed pumps in Prey Veng — comparing the costs

Pump name	Cost	Drilling and installation	Total cost	Comment
No 6 pump	\$32	\$50	\$82	
Sok pump	\$25	\$50	\$75	
Treadle pump	\$12	\$50	\$62	Villager must provide some wood — a hidden cost of \$3 to 4.

new treadle manufacturers, offering a turnkey service of drilling and installation.

Output

Both the No. 6 and the Sok pumps are hand-driven, so using them for any

secret of its popularity, is its similarity to traditional technology. For centuries, the Khmer people have used a rice pounder whose wooden framework bears a close resemblance to the framework of the treadle pump. Cuts of bigger, thicker wood are used but, essentially, the leverage is the same.



Tina Gue/Panos Pictures

Backs to the land — Cambodian farmers were attracted by a technology that made some of their work easier.

When the villagers saw the first treadle pump, they immediately understood the mechanism of the framework, and have been able to duplicate it easily.

Similarly, using one's feet to pump water is a common idea. The Khmer villagers shift water from one surface area to another using various types of 'paddle' pump. This concept of 'walking' to pump water is traditional and, therefore, extremely acceptable.

Local marketing

The drillers' turnkey service was important. Globally, turnkey operations tend to be more successful than partitioned ones but, in Khmer society, relationships are a key factor. The drillers were often local people who serviced their own village and the surrounding area. They were often related to their clients, or their clients could be classed as neighbours — even those living relatively far away. News of the treadle pump's efficiency spread entirely by word of mouth, and its availability from a number of different sources contributed to this market process. If the manufacturers had attempted to promote their pump solely from their workshop, it is doubtful that the impact would have been so great. The drillers formed a roving and trusted sales team.

The relationships between drillers and manufacturers have also provided an economic bridge for people. The

manufacturers often gave the pumps to the drillers on credit (based on the collateral of relationship) who, in turn, might offer the pump to the user on a three-month credit basis (again, because they know the client and trust him to pay back the money after an agreed period — usually post-harvest). This informal credit system has helped the spread of pumps.

Summing up

Bielenberg and Allen⁵ suggest that a number of factors influence the market for treadle pumps. As well as these physical, economic, and technical factors, the Prey Veng experience — in which the pump became enormously popular very quickly — suggests that we should also add the social environment. Overall, therefore, the treadle pump has

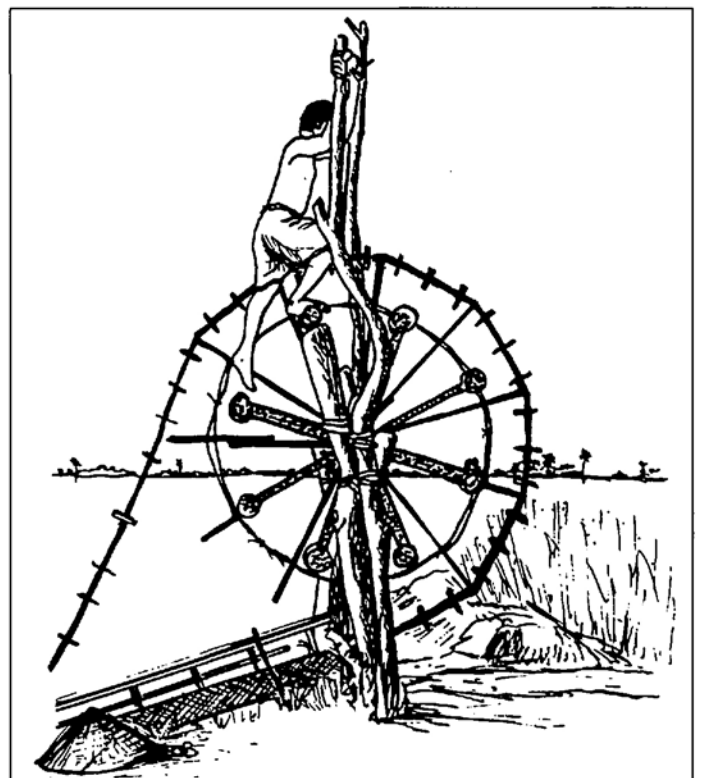
proven so popular in this area of Cambodia because:

Physical environment

- *Water supply* - an artesian supply at 20m that rises to 4m, giving a plentiful supply with a suction pump.

Economic environment

- *Cost competitiveness* The treadle pump compares favourably with alternative products on the market



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(No.6 and Sok suction handpumps).

- **Cost effectiveness** The bottom line for users has to be the income potential in relation to the investment. In one dry season, several

trust of several drilling businesses. This enabled the drillers to buy pumps on credit, and prevented problems in modifying or replacing them.

- **Community development** The CO programme incorporated a forum for the rapid exchange of ideas, and a risk-taking environment in which innovators could explore new uses of the pump.

Technical environment

- **Local production** Easy manufacture by a welder encouraged several manufacturers to produce the units locally; enabling local supply and local technical support. A poorly made pump could be replaced without any great difficulty.

The CO/WC partnership has made an exciting start, and the production of pumps has gained a momentum that is out-running the NGOs — the sign of a truly appropriate technology!

We hope to see

the treadle pump being used throughout Cambodia to help Khmer farmers increase their food security for many years to come.

References

1. See Technical Brief no. 35, 'Low-lift irrigation pumps', *Waterlines* Vol. 11, No. 3, for technical details.
2. 1 chi of gold = US\$47 plus or minus approximately \$1. It is used in normal market transactions in Cambodia because, until recently, the riel was very unstable.
3. Sina Than, 'Alternative Strategies of Irrigation Development in Cambodia', Cornell University, USA, August 1982.
4. Comparable with results in Bangladesh. See Orr, and Islam, 'The socio-economic impact of the treadle pump', BRRI, Bangladesh, 1988.
5. Bielenberg, Carl, and Allen, Hugh, *How to Make and Use the Treadle Irrigation Pump*, IT Publications, London, 1995.

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A master meets his match

Mrs Svay Gruu is a widow living alone in Prey Veng. Her pump worked well for several months. One day, CO staff talking near the pump were approached by the local teacher, who was rather inebriated.

'This needs new washers. The washers are finished' he shouted. Mrs Svay Gruu came to see what the noise was about. When she heard the teacher's complaints, she exclaimed: 'No, it doesn't!', and pushed him to one side. She bent down, lifted the main beam, removed the pin, dropped the piston down, brought it back up the other side, and handed him the piston of the pump. 'Look, the washers are fine!'

He took the piston, and fumbled with it, trying to take off the washer. Mrs Svay Gruu snatched the piston, mumbling under her breath, and extracted the washer. 'See, it's fine,' she said impatiently, handing him the washer. When he had looked at it, and the CO staff had checked it (there was no significant wear), she reversed the process and reassembled the pump; Mrs Svay Gruu had received no training.



Mark Edwards/Still Pictures

A Bangladeshi pump-seller. The relationship-based culture in Cambodia enables drillers to buy on credit.

farmers grew spring onions and sold the crop (after household deductions) for \$200; at current prices, the pump and borehole have paid for themselves within three months.

- **Turnkey service** The local drillers' turnkey service meant that, for a fixed fee, they would drill both the hole and install the pump.

Social environment

- **Cultural appropriateness** Early on, observers of the first demonstration models commented on the pump's resemblance to a rice pounder, and that they could easily do the woodwork. Secondly, the Khmer people are used to foot-driven pumps.
- **Local marketing** Khmer culture is based on relationships. The local artisans gained the approval and

The Editor would like to hear from other readers with experience of attempting to replicate the success of the treadle pump in Bangladesh in other parts of the world.



Tina Gue/Panos Pictures

If farmers throughout Cambodia use the treadle pump, food insecurity could be greatly reduced.