TRICKLE-UP ECONOMICS

How low-tech, low-cost designs are helping the poorest farmers on Earth grow their way out of poverty | By David Armstrong with Naazneen Karmali

More crop per drop: Farmers in India and Africa use affordable, low-tech drip irrigation kits to make better use of scarce water, helping raise profits from small plots.

IDE-INTERNATIONAL STAFF (2)

THE FAMED ECONOMIST JEFFREY Sachs prescribes classic foreign aid in his recent book, *The End of Poverty*: hundreds of billions of dollars, overseen by the United Nations and the World Bank, for health clinics, schools, bridges, roads and water supplies.

Then there's Paul Polak, the 71-year-old founder of a nonprofit group that takes a minimalist approach. His Denver organization, International Development Enterprises, develops and markets low-cost, low-tech irrigation devices—essentially a rudimentary collection of foot pumps, barrels and tubes. "The idea here is the ruthless pursuit of affordability," says James Patell, a Stanford business school professor who has worked with Polak on designing inexpensive tools.

The litmus test for IDE products: The farmer can recover the cost of the device within one season. "We are firm believers in markets," Polak says.

Underlying the program is his belief that the basic problem of rural poverty in the developing world boils down to what happens on quarter-acre plots. Of the 1.1 billion people in the world who exist on $1 a day or less, he says, 75% live in rural areas and half eke out fragile livings cultivating small plots of land. Marginally boost their income, and power plants, clinics and schools will follow.

Sachs, too, thinks these small projects are worthwhile. Yet, notes Polak, "So much development work is focused on macroeconomics and increasing GDP per capita." These large-scale government aid programs are doomed to failure because of corruption, bureaucratic sloth and, ultimately, the dependency they breed among recipients, says Polak: "Until the development community realizes that the solution to poverty lies in increasing the wealth of small-plot farmers, it will continue to fail."

Manek Raut owns a 3.5-acre farm in the dusty, semi-arid region of Solapur in western India. Until recently Raut's field lay barren from lack of water, forcing his brother to leave home and Raut to labor for a pittance on a nearby farm to support his seven-member family. His employer's farm flourished using a sophisticated drip irrigation system: a motorized pump connected to long rows of tubes that snake through the crops and drip just enough water onto the roots. Widely used for decades, these commercial systems are far too expensive for poor farmers like Raut.

His fortunes changed when he saw a simpler, low-tech version promoted by IDE in India. It markets a variety, from $2 garden kits to $200 systems covering one acre. Many use a barrel of water and gravity (instead of a motorized pump) to pull the

water into tubes made of thinner, cheaper plastic than what conventional systems use. Raut paid $125, borrowed from friends, for his. He is now growing a healthy bounty of okra and beans and expects to earn $300 this season from a cotton crop. He says he can recover his $125 investment from eggplants his mother sells door-to-door.

"Without this drip, this would have remained barren land," says Raut.

Polak's IDE operates on a $10 million annual budget, raised through individual donations and grants from the likes of USAID and the Swiss Agency for Development & Cooperation. He primarily hires natives of the countries (ten throughout Asia and Africa) he's in, who recruit manufacturers to build the irrigation devices, drum up demand via grass-roots marketing and advise small-plot farmers on the most profitable crops to grow.

Paul Polak of International Development Enterprises brings a market-savvy approach to helping the poor.

This kind of market-based "sustainable" philanthropy is now fashionable, but it wasn't when Polak began IDE in 1981. "We were seen as capitalists, and capitalism was a dirty word," he says. A psychiatrist with a knack for investing, he put together, over the years, a $3 million portfolio in real estate and oil and gas. In 1981 he vowed never to take a job only for money, cashed out and started IDE. He spent the first several years living on investment income, traveling to remote corners of the world and talking to everyone he could. He had been studying the links between mental health and poverty. Now he was connecting technology and the flight from poverty.

His first big success was bringing the treadle pump to Bangladesh. Costing $25, it works like a StairMaster: Farmers pump shallow groundwater directly onto crops using the energy of their legs. Development experts were skeptical. "Human energy is the most expensive energy on Earth," says David Seckler, at the time the head of the International Water Management Institute, funded in part by the World Bank. "We always thought small diesel pumps would be the future."

The poor farmers IDE targets had energy to burn but not the $500 it cost back then to buy a diesel pump. (The price has since fallen to around $200.) IDE drummed up demand for the treadle pump by hiring troubadours to travel to rural villages singing the pump's praises and by producing a Bollywood-style movie where a family's fortunes are turned around by the pump. Made by a network of metalworkers, 1.5 million treadle pumps have been sold in Bangladesh and another 1 million in other developing countries with help from IDE. Farmers using the pump net on average an additional $100 a year from their crops, says Polak, some as much as $500.

Treadle pumps are less effective for arid or semi-arid regions. Amitabha Sadangi, the head of IDE (India), where 60% of the agricultural lands are in semi-arid regions, knew that poor cotton farmers in central India had devised makeshift drip irrigation systems from rolls of plastic tubes used to package pepsee, an Indian frozen treat. The systems usually lasted for the six-week cotton-growing season but fell apart easily. Polak put Sadangi in touch with Jack Keller, an irrigation expert and engineer from Utah State University, who, along with a group of Indian engineers, refined the idea for a mass-marketable system. "Many of these ideas come from the farmers themselves," Sadangi says.

The challenge then was to figure out how to make the devices affordable while exploiting the profit motive. IDE (India) recruited machine shops to manufacture the drips with a simple plastic extruder. IDE (India), which in 2001 became a separate nonprofit under Indian laws, helped those manufacturers sell its KB-Drip system (for *Krishak Bandhu*, Bengali for "farmer's friend") through a network of village dealers like Ajit Bhonsle, who owns a small hardware store in Mohol, not far from Raut's farm. He had 50 customers the first year. He sells tubes for the kits for $1.30 a pound, of which 36 cents is his markup. Now, with 500 names on a customer list, he earns a profit of $2,300 a year. He plans on broadening his customer base by renting a van and demonstrating the system in villages farther afield. "Farmers need to see it to believe that KB works," Bhonsle says.

So far IDE (India) has sold some 200,000 drip kits in India, largely in the drier states. Farmers' return on their investment ranged from 40% to 64%, according to a study of the program by Amol Management Consultants, which said

RAY NG FOR FORBES

DESIGNS ON POVERTY

Village Internet kiosks, rural wireless networks and solar-powered electricity generation all have been touted as high-tech salvation for those living in poverty. But for the poorest of the poor, getting online market quotes or wireless access takes a backseat to simply increasing income from daily labor. A growing cadre of designers is creating smart, cheap, low-tech devices that can often provide a more immediate boost out of the poverty trap.

XACCESS BICYCLES

Many bicycles in the developing world are used for transporting goods. Yet most of the available bikes are the recreational type.

Solution: Ross Evans, a 30-year-old Stanford engineering grad and bicycle entrepreneur, designed the Extrabike, made of easily assembled steel rods that bolt onto the frame of a conventional bike, extending the rear tire back about 15 inches; it creates a platform that can carry 200 pounds of cargo, like containers of water or bags of grain, without sacrificing stability or ease of use. Evans figures that the extensions, now in testing, will cost around $30.

HIPPO WATER ROLLER

In many African villages women and children walk long distances to fetch water with 5-gallon buckets.

Solution: Two South African engineers came up with a 20-gallon low-density polyethylene barrel-shaped container that rides on its side and can be pushed by a handle. At $60 to $70 per barrel, it requires donor support, but some 17,000 barrels have been distributed to villages in South Africa, Angola and Mozambique.

RAT CATCHERS

Among the 3 million members of India's Irula tribe, many make their living as freelance rat catchers, using a fumigation pot—a clay pot in which they burn straw and then blow the smoke into a rat hole. The device is estimated to work only 40% of the time and is unhealthy.

Solution: The Centre for Development of Disadvantaged People engineered a $35 metal fumigation device that uses a tube and a hand-cranked fan to blow the smoke into the hole. It's 95% efficient and typically increases a rat catcher's income to $45 a month from $15.

NEPALI WIRE BRIDGES

In Nepal some 12 million people live in the foothills of the Himalayas above rivers that swell unpredictably during the monsoon season, cutting them off from the villages, markets and schools below.

Solution: EcoSystems, a for-profit company in Nepal, helps villagers build wire bridges that function like ski lifts, are operated from either side of a river and can safely carry 550 pounds. The group has built 29 bridges so far, and there have been an estimated 1.6 million trips and no accidents, a far better safety record than that of traditional rope bridges. Cost: $15,000. *—D.A.*

"there is clear evidence of their economic benefit." IDE (India) is working with venture philanthropy Acumen Fund in New York to establish a network of dealers and is toying with the idea of setting up a for-profit entity to help the program scale up more rapidly, says Acumen's Yasmina Zaidman. "It's the intervention of a solid business model that works for the poor."

To help farmers grow crops during the dry season, Polak is working on low-cost rainwater harvesting and water storage systems. Why not build a $40, 10,000-liter plastic cylinder supported by an earthen trench to collect water during the monsoon season, then pump it out when water is scarce? It's a plausible alternative to a $2,000 well.

The key is affordable design, Polak says. "Ninety percent of the people who design things work on the problems of the world's richest 5%," he says. "There is a huge need to design things that will create a market for the poorest 4 billion people."

Polak has found an ally in David Kelley, founder of the IDEO design shop in Palo Alto (famed for designing the computer mouse for Apple) and now head of Stanford University's new design institute. Polak worked with graduate business and engineering students enrolled in the school's Design for Extreme Affordability class to come up with ideas that may eventually find their way into IDE projects. A $3.50 hand pump to transfer water from a storage bag to a drip-system gravity tank looks promising, and a $4.50, 200-liter polyurethane bag might be an improvement on the $10 cost of the larger drip system's plastic barrel, particularly since IDE is shipping the drip systems out of India to its irrigation programs in Zambia and Zimbabwe.

"These customers have a high discount rate," says Stanford professor Patell, who teaches the design class. "Something cheap that will last a year is better than something twice as expensive that will last four years."

A water-storage system could help Indian farmers like Suresh Adhetrao, in the state of Maharashtra. He started with a $50 drip system and has since expanded. With a net income of $4,600 last year, he's now in the middle class, and has a new house, a 21-inch color television and a VCR. "But if there was more water," he says. "I would have earned even more." F