Stanford SOCIAL INNOVATION Review

What's Next

Irrigation Innovation

By Noël Duan

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green, light pink, orange and lavender. With their beaks nudging each other playfully, the trio exudes energy and mutual affection.

"For us, this art is our God, and we worship it daily by practicing it," Pushyam says. "We just want an equal respect for our traditional art and for the artists." ■

WATER & SANITATION

Irrigation Innovation

BY NOËL DUAN

Irrigated agriculture represents the largest proportion of consumptive freshwater use in the world. For that reason, the challenge of sustainable food production in many communities begins with obtaining freshwater.

Most water pumps rely heavily on electricity, gas, or solar energy, and yet many rural areas in the developing world do not have access to power sources. "In absence of a cost-effective alternative, farmers manually carry water for many hours a day or depend only on rainfall," says Pratap Thapa, a cofounder of the irrigation innovation startup aQysta. They may cultivate only one season per year (as opposed to four), limiting their income significantly.

The Netherlands-based aQysta attempts to provide a more sustainable solution with its Barsha pump, which delivers water for agricultural irrigation without fuel, electricity, operating expenses, or greenhouse gas emissions. Its three cofounders —Lennart Budelmann, Fred Henny, and Thapa—are engineers who met at the Delft University of Technology.

The Barsha is a spiral pump, in which two vertical discs composed of coiled tubes are partially submerged in a flowing river. Blades sit between these two discs, facing the flow. The river's movement causes the disks to spin, gradually scooping water into the spiraled tubes, where it is eventually flushed into irrigation pipes and onto farmers' fields.

Pumps powered by the kinetic force of water are nothing new. The spiral pump was reportedly invented in 1746 to provide water for a dye works outside of Zurich. At that time, the spiral pump wasn't very efficient due to a lack of lightweight materials, says Yash Shah, a former aQysta engineer now pursuing a PhD in fluid dynamics. aQysta "developed such a pump from materials that allow it to float on a flowing river," he says. The latest model is both durable and efficient, with a maximum flow of 43,000 liters per day, capable of irrigating about five acres of land.

Nepal offers one of the Barsha pump's most successful case studies. Though 92 percent of its rural population had access to potable water as of 2015, the country struggles to produce enough food for its 29 million people. Currently, 68 percent of Nepal's population works in agriculture, producing 34 percent of the country's GDP—but it's not enough. Thirty-six percent of children under age 5 suffer from chronic malnutrition. Increasing the country's agricultural productivity is a prime concern, and innovations in irrigation efficiency offer one solution.

NOËL DUAN is a San Francisco- and New York City-based writer, editor, and researcher.

Mechanical engineers Sujan Dulal and Dipesh Budathoki help install a Barsha pump in the Tamakoshi river in Dolakha, Nepal.

Nepal's glacier-fed rivers, which run at high speeds down mountainous slopes to flood-prone valleys, are ideal for water flow. Their momentum helped the pump get started, Shah says. After the first trials, aQysta reworked the designs using lighter materials to make the pump work at slower flow speeds and in flatter terrains.

For farmers like Arjun Kumar Khatri, in the Nepali village of Ratmate, the Barsha pump has been a godsend. Its 24/7 flow "saved my paddy nursery from dying last year during the drought," he says. He uses the water for his cattle and has started growing vegetables for himself.

Individual farmers as well as the organizations or government agencies that support them purchase the pumps for an up-front investment between $1,000 and $2,000, depending on the model. "Making the product accessible to rural areas in developing markets is a challenge," says Thapa, who claims that customers can break even in two years. Smallholder farmer markets, which constitute a majority of aQysta's current customers, are highly price sensitive, so the company is moving to low-cost suppliers in India and China, aiming to reduce the product's cost by 50 percent by 2019.

aQysta is scaling by partnering with local distributors to meet its goal of having 1,000 pumps in use around the world by 2020. For now, there are 221 pumps, including 170 in Nepal, running in 13 countries, including Panama, Spain, Turkey, and Zambia.

The simple pump has its limits: If the coils capture too much air, it won't work well with an irrigation system. aQysta is working to remedy this bug with adaptations for different communities. At a pump installation in Spain, for example, Shah and his team added vents and valves to eliminate trapped air. As aQysta scales in different regions, such customization remains critical. ■

PHOTOGRAPH COURTESY OF AQYSTA