Soy dairy technology may not be profitable in developing countries, study shows

February 18 2022, by Marianne Stein

Soybean is a promising crop for developing countries, because of its high protein and oil content. Over the past decades, humanitarian aid organizations and policymakers have promoted soybean processing technologies such as the "soy cow," which extracts milk from soybeans. But a new study from the University of Illinois shows that soy cows in many cases are not economically viable and do not provide the expected benefits.

"The soy cow was promoted as a way to increase soybean utilization and address poverty and malnutrition. However, no research had been published to address whether this is a sustainable business concept for the developing world," says Peter Goldsmith, professor and director of the Soybean Innovation Lab (SIL) at the U of I.

In 2016, SIL partnered with the U.S. Agency for International Development (USAID) in undertaking a large-scale study that would help determine whether the soy cow is an appropriate technology for small-scale, rural enterprises.

The consulting firm Palladium had established six soy dairy operations in Malawi with funding through USAID's Agricultural Diversification Activity. SIL researchers collaborated with the Palladium team to introduce financial and production recordkeeping to the six companies.

The USAID project donated the soy cow equipment, including a grinder that can run on electricity or pedal power, a steam boiler, a pressure

cooker, and a stainless steel press. Operators also received the first batch of soybeans and supplies, and bicycles to distribute their products. Going forward, they would pay their own operating costs, including rent, electricity, labor, transportation, and supplies such as soybean and sugar.

The soy cow converts beans and water into milk, which can be further processed into yogurt, cheese, and ice cream to be sold at local markets and roadside stands. The process also yields okara, a high-protein byproduct used for animal feed or as an ingredient in baking.

Goldsmith estimates the soy cow technology appears sustainable when simply looking at operating margins. But proper bookkeeping methods reveal a more complete financial picture and a different result.

"You can convert soybeans into milk, sell it, and pay for your costs, but that's not a sustainable business. You also have an amortization cost of the $10,000 equipment with some sort of loan even if it's a non-cash donation. And then you have depreciation costs—the equipment is getting older and you eventually need to replace it," he explains.

"The soy cow has the capacity to produce almost 1,700 liters of soymilk per month. But these operators were producing about 147 liters on average, and some of them were producing as little as 75 liters. You've got a big piece of equipment that's idle about 81% of the time, based on a single operating shift benchmark."

The soy cow enterprises are located in rural areas, where wages are low and soy milk is not part of the regular diet, so there's not a large market for the products.

The soy cows also operate in makeshift spaces that aren't food safety compliant, so the products cannot be sold in retail stores. Becoming food safety compliant involves significant additional capital investments to

upgrade the physical infrastructure. Similarly, quality packaging and labeling, which would help sales, are expensive, so entrepreneurs resort to poor quality but cheap single-use plastic sachets. They transport the highly perishable soymilk products in a cooler box attached to a bicycle, so the sales radius is small.

"The soy milk is a great product but it's competing with other beverages that are a lot cheaper. The demand does not match how much the soy cows can produce. The application to address poverty and malnutrition is lost because the enterprises can't sustain themselves," Goldsmith states.

The study's first author, Julia Krause, worked on the project as an undergraduate student intern at SIL. She traveled to Malawi to meet with collaborators, and she organized and analyzed the bookkeeping data. Krause graduated from the Department of Agricultural and Consumer Economics at U of I in 2021 and now works in research and development at PepsiCo in Plano, Texas.

To learn more about undergraduate student research opportunities, visit the College of Agricultural, Consumer and Environmental Sciences website.

"From the skills I learned with SIL in data analysis, scientific writing, and real-world engineering application, I was able to unlock my passion for research and development in food engineering as a career. SIL was truly a foot in the door to the inspiring world of data-driven problem-solving with global collaborators," Krause says

The authors conclude soy cow technology would be better suited to urban settings, where the capital investment would be larger, but capacity would be matched to the demand.

An alternative technology, consisting of a household soy kit, appears

more appropriate for rural enterprises. This kit is designed for use in home kitchens and produces smaller amounts more aligned with local market demand. SIL researchers tested the feasibility of the soy kit in previous research and found it had potential to improve the economic conditions of rural women in Malawi.

The article, "Soy Dairy Performance Metrics" is published in *African Journal of Food, Agriculture, Nutrition and Development*. Authors are Julia Krause, Peter Goldsmith, Margaret Cornelius, Maggie Mzungu, Charity Kambani-Banda and Courtney Tamimie.

More information: Soy dairy performance metrics, *African Journal of Food, Agriculture, Nutrition and Development* (2021). DOI: 10.18697/ajfand.105.21245

Provided by University of Illinois at Urbana-Champaign