Ten-year-old Solomoni Mafuta, of the village of Sentani in the Republic of Malawi, hauls his family’s maize on foot for ten miles (one way) to a diesel-powered mill to be ground. The time-consuming task has pulled him away from his studies and to the verge of flunking out of school.

Traditionally, African farmers have had two choices: haul grain to the local mill and pay to have it ground into flour, or grind it themselves by hand with a mortar and pestle. Michigan Tech alumnus Terry Woychowski, who keeps in contact with Solomoni and his family, felt something needed to be done. He asked a Michigan Tech senior design team to build a human-powered grain mill for under $100 (USD) that would work in Africa. It had to be low tech: easy to transport, clean, and maintain—and made with materials available locally.

The low cost requirement severely limited the inclusion of purchased materials such as bearings, keyed shafts, and plywood, according to mechanical engineering major Nathan Fetting. Instead, the five-person team focused on utilizing scrap metal and concrete to create a hammer mill, and utilized a belt-drive system powered by a user pedaling a bicycle. They constructed multiple prototypes and tested each one to provide viable data.

In the end, the team built a mill with Solomoni in mind. Powered by an old bicycle, a ten-year-old boy could hop on and grind his family’s maize just by pumping the pedals. It produces a fine flour, which is cooked in boiling water. The end result is nshima, a staple dish in Malawi and many sub-Saharan countries, that is similar in consistency to mashed potatoes.

“The key to the success of this project will be if local populations can replicate it using readily available materials and methods," adds Fetting.

If their effort is successful, many more human-powered grain mills will be built, in partnership with the World Hope International Foundation. “The real win will be if someone starts a micro business to manufacture these,” says Woychowski.

Low tech, high impact
Designing a human-powered grain mill for Africa