Development engineers support sustainability through self-sufficiency

May 17 2017, by Sonia Travaglini

The finished ModRoof material is installed on a home in Gomtipur, an area in the city of Ahmedabad. Credit: ReMaterials

How do you help someone thousands of miles away in an Indian slum fix their roof, or someone in the African urban jungle access cervical cancer screening? You might think of sending some money, or perhaps supporting some charitable agencies. But in recent years a new solution has emerged—one that empowers as it helps people solve their own problems. The latest kind of engineering being explored at UC Berkeley helps those in the lowest resource areas of the world by finding ways to

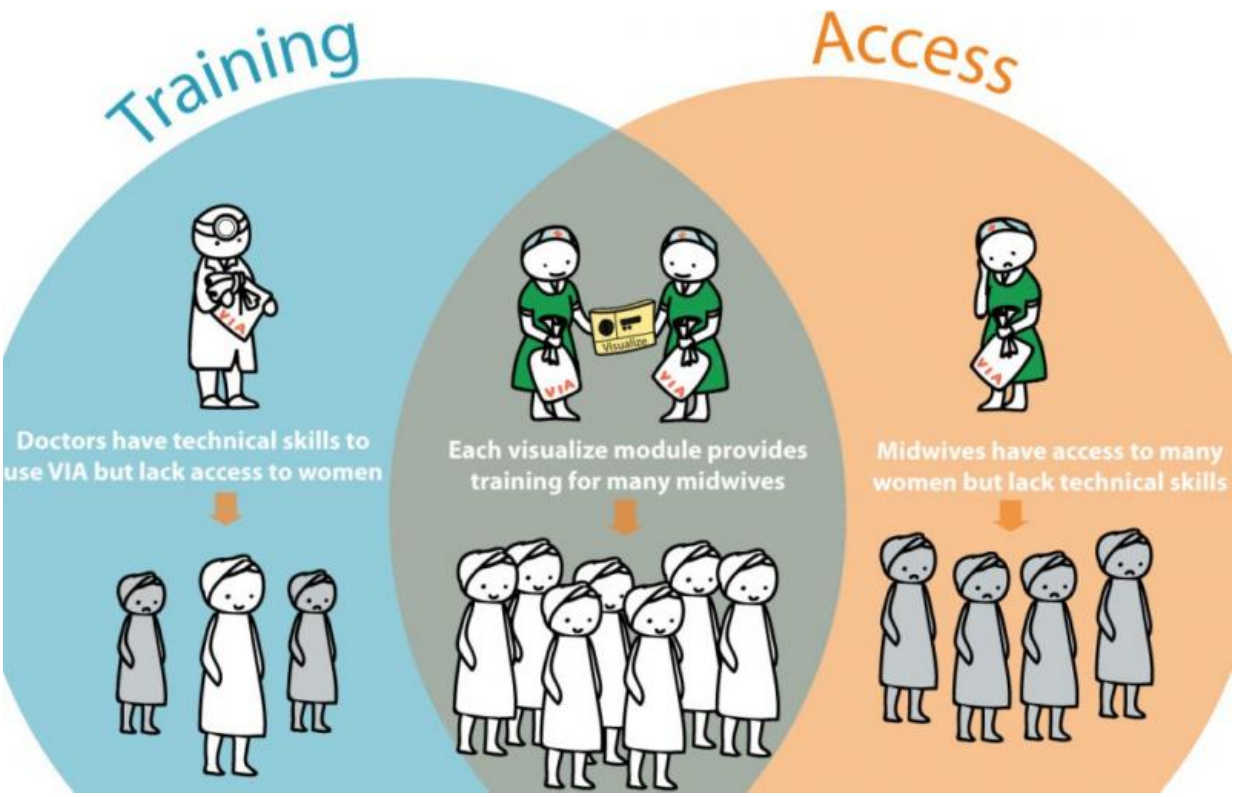
solve big problems without needing big resources. This rapidly evolving field is called development engineering, the core concept of which is helping others help themselves. While traditional aid imports finite resources that require an agency to distribute and maintain, development engineering finds new ways for a community to use their resources, knowledge, and people-power in solving their problems. After all, who is more motivated to solve a problem than those affected by it?

UC Berkeley's long history of philanthropic work has paved the way for engineering solutions in some of the world's most difficult living conditions. Founded in 2006, the Blum Center for Developing Economies is an interdisciplinary hub that supports and trains scholars across UC Berkeley to apply their skills to helping those who need it most. The development engineering program at UC Berkeley offers practical courses aimed at helping diverse teams of engineers, data scientists, entrepreneurs, and many other specialists figure out new ways of making life better with technology and ideas.

One such class is headed by the Roscoe and Elizabeth Hughes Professor of Mechanical Engineering, Alice Agogino, also the chair of the Development Engineering Graduate Group. "Development engineering is about using ideas and technology to help solve challenging problems using an interdisciplinary approach that builds on and contributes to a research foundation," says Agogino, who teaches the project-based development engineering seminar course for graduate students. "Solutions have to be self-sustaining. It's about understanding the whole situation," she explains.

To empower a community to use the resources they have on hand, development engineers must get into the nuances of the everyday lives of those they aid. Development engineering uses analysis, user research, and design methodology to come up with solutions and then test those solutions to make sure they really work. Development engineers'

solutions are created with first-hand input from people immersed in the community. Exploring the locals' knowledge and skills enable development engineers to find scalable—and sustainable—solutions.



VIA screening traditionally relies on community doctors or local medical staff to screen for cervical cancer. Development engineers created a kit, called Visualize, that teaches anyone how to use the VIA screen. This kit allows local midwives to screen for cervical cancer. Image by Ashley Truxal. Credit: University of California - Berkeley

Helping others help themselves

Self-help is not a new idea. As low-resource countries' economies and populations have grown, some have noted the danger of relying on aid.

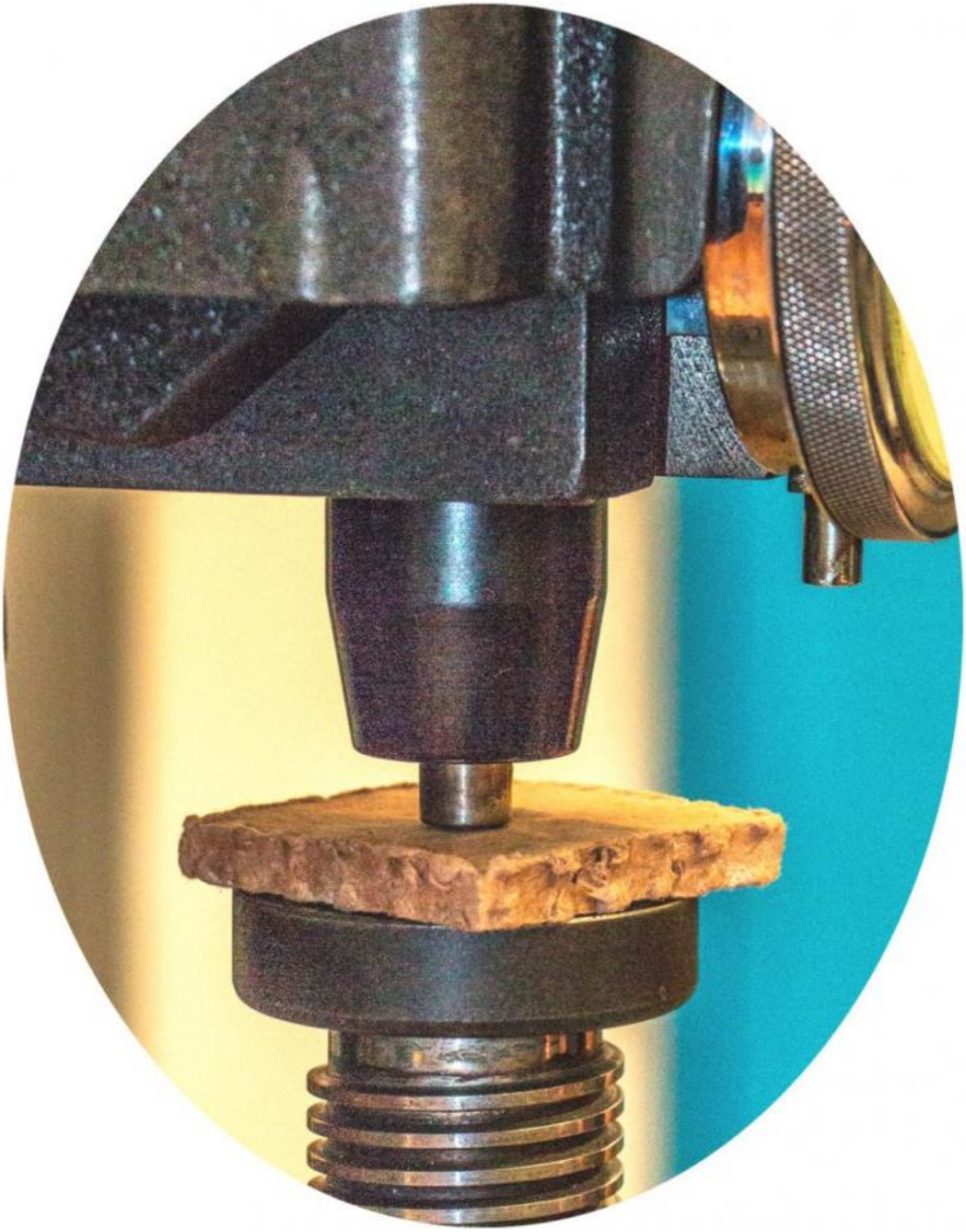
Providing aid without sufficient support for the community to be involved in solving problems poses the risk of losing rich cultural and social abilities; to avoid this, communities can be supported to invest in themselves by using their unique resources, talent, and cultural knowledge.

At UC Berkeley's Center for Effective Global Action, ideas about small changes in habits that could have big impacts on health are being developed. Professor David Levine, the Eugene E. and Catherine M. Trefethen Professor of the Haas School of Business, is an expert in sanitation who uses development engineering approaches to improve the health of children in low-resource countries. Levine works on a range of projects, from helping communities adopt improved cooking stoves that use widely-available wood fuel to writing children's books that promote the importance of good hygiene. One of Levine's ongoing projects is reducing the transmission of disease through handwashing at schools. His recent children's book, King Akbar Writes a Law, is a colorful and fun read and carries the serious message that handwashing is critical to staying healthy. "Things like handwashing are really important," Levine says. "We're working on how we get the entire health intervention to work for everyone when it's hard to change bad habits. Part of what I do is to help people to change their behavior every day, like handwashing." Some low-cost and low-tech solutions to promote handwashing have been found, such as reusing water bottles as soapy water dispensers. But just providing a physical item is not a complete solution—to be effective, solutions must cause lasting change in how everyday life is lived. "Providing a soapy bottle is easy," Levine says. "Changing behavior is not easy. Changing daily norms of millions of people—that's hard."

Healthcare at the heart of communities

Development engineering can also empower communities to solve

challenging health problems where outside aid and experts are in short supply. In many places around the world, a lack of affordable medical services has significant impacts on women and children. In particular, reproductive health is often difficult to address without resources. For example, cervical cancer can be identified in its early stages with a Pap test, greatly improving a patient's chance of survival. Despite this effective screen, nearly a quarter of a million women die from cervical cancer annually, and nearly 85 percent of these deaths occur in low- and lower-middle income countries without routine screening. A new, low-cost screening method known as VIA (visual inspection with acetic acid) enables cervical cancer screening with only simple medical equipment, and local medical staff can be trained to screen women in their communities. One the most beneficial aspects of the VIA screening method is that it only requires acetic acid, which is readily accessible as store-bought table vinegar, and medical staff only require basic training to visually detect precancerous cells. By detecting these precancerous cells early, women in low-resource countries can move closer to having health equality and can be more likely to get needed treatment in time to save their lives.



The ModRoof precursor material is tested for its structural integrity in a UC Berkeley engineering lab. Credit: Ryan Forster

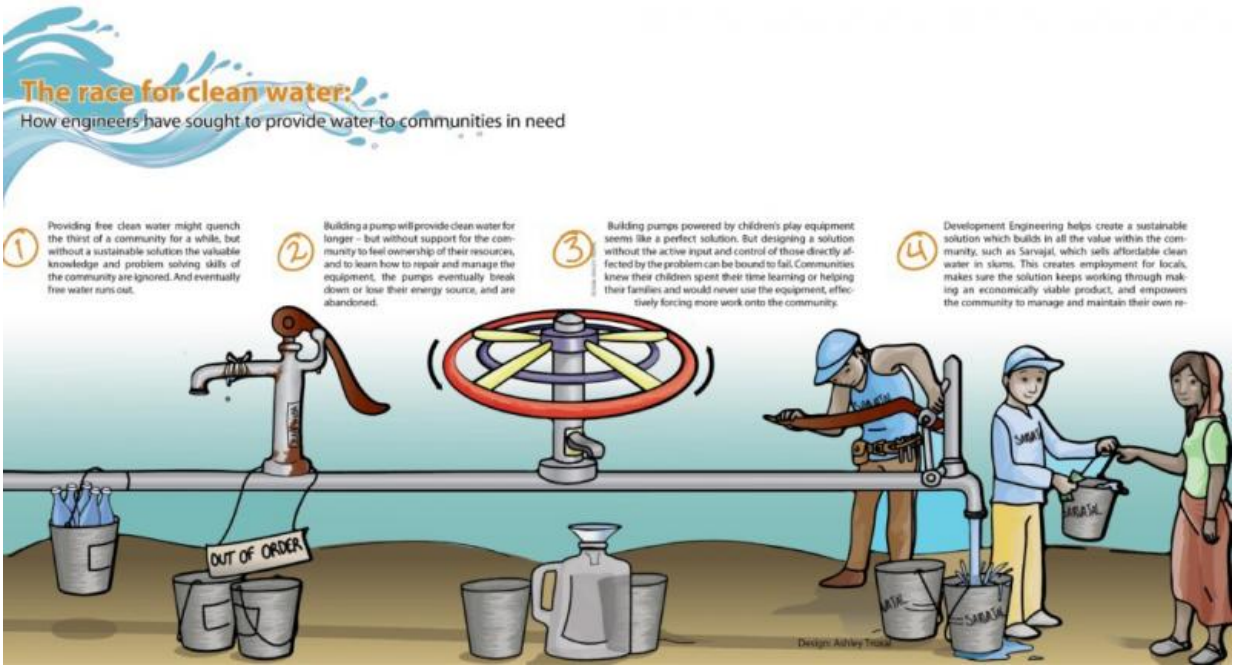
Recently, a team of development engineers has been working to enable women to monitor their cervical health even without trained medical staff. The UC Berkeley team is led by Julia Kramer, a graduate student in the UC Berkeley Haas School of Business, who co-founded Visualize, a project to design and implement training for VIA cervical cancer screening in Africa. What began as immersive research project in Ghana led to an idea to empower local women by training midwives to screen for cervical cancer. While several organizations have worked to bring VIA cervical cancer screening to rural communities, none have taken the novel approach of empowering midwives. Midwives are traditional providers of reproductive healthcare in these communities, and by developing a technology to train them in the VIA screening methods, women can effectively help other women prevent cancer.

Making a lot from a little

Development engineering goes beyond technology for health and sanitation—it can also solve problems such as acquiring housing materials for slums where money and resources are tight. A recent example of this is a project to help improve the low-cost housing materials widely used within the slums of India. Ahmedabad, in India's Gujarat state, has miles of dense, urban shanty housing built by families from limited local resources. Using sheet metal, bricks, plastic tarps, and any other available materials, families work together to build their own homes. Due to the lack of proper building materials, space and infrastructure, these homes often have no power, running water, or adequate roofing to keep out monsoon rains. While corrugated iron sheets are the go-to material to roof homes, they make it breathlessly hot during the 50°C (122°F) days, don't retain heat through the night, and constantly rust. With plenty of rainfall and no materials to weatherproof houses, rust quickly creates holes in the sheet metal roofs, which is replaced by yet more rusting sheet metal.

Despite limited resources, Ahmedabad's residents are highly skilled at making the most of the materials at hand and are actively empowering themselves to make their communities better. The narrow, winding miles of slums are a vibrant community full of energy, and residents work to support their families and have a rich cultural life of festivals, family life, and the everyday business of living. The powerhouse of these communities are the hardworking women who not only care for their families, but often use their local knowledge and resources to fix their homes themselves. Despite their ingenuity and support from their families, once they have paid for food, cooking fuel, and other necessities, few can afford expensive housing materials. Residents often are forced to buy cheap corrugated iron for their roofs, getting trapped in a cycle of need and lack of resources.

So how did development engineering help build better homes? In this case, working with the Blum Center for Development at UC Berkeley, a team of engineers, scientists, epidemiologists, and graduate students from many disciplines came together to work on a project with real potential: ModRoofs. The project was created by ReMaterials, founded by Hasit Ganatra, an engineer who decided the unfit cement and corrugated and metal sheets widely used for roofing materials had to go. Working with fellow engineer Lisa von Rabenau, ReMaterials has invested time in talking to the real experts—the residents of the Ahmedabad slums. Together with the locals, ReMaterials found a widely available resource that could be used to solve the roofing materials problem: cardboard. Once the paper-based packaging has been used, it's often discarded, ending up being disposed of as solid waste. Ahmedabad is one of the engines of industrial and financial growth of India's Gujarat state; while making significant progress toward their aim of achieving zero-waste, the state is actively seeking to improve its ability to recycle solid waste, like cardboard. With this information, ReMaterials developed a new roofing material made from recycled cardboard.



Credit: University of California - Berkeley

With support from United States aid agencies and UC Berkeley, the project has figured out how to turn waste into building resources, and most importantly, hand over ownership and production of the roofing material to the residents of Ahmedabad. This novel roofing material recycles readily available cardboard to create tough, waterproof, and long-lasting roofing tiles, which are manufactured by local residents using technology and equipment available at the location. The large, brightly colored tiles are a desirable and stylish option in a world of rusty metal, and they are designed to be modular so they can be purchased one-by-one as a home is expanded over time. This is a key part of ensuring the solution is actually accessible to local residents: as families expand their homes over time and within their means, they can improve the roof tile-by-tile. Families can update their housing the way they want, when

they want, and without breaking the bank.

Using development engineering concepts, ReMaterials has created a sustainable model of value, employment, and self-help, with local women entrepreneurs trained in how to manufacture the tiles from waste cardboard so they have control of their own working space and decisions. By using the development engineering approach, the solution to rusty roofs recycles waste and is both realistic and sustainable.

Creating sustainable businesses that solve problems as they serve the community are some of the most innovative ways of improving life in low-resource countries. Clean water for all is one of the most important health goals for all nations, and new approaches to this age-old problem can result in improvements, even in challenging locations. Sarvajal, a company founded in 2008 by Anad Shah, is widely acknowledged as providing a breakthrough in ensuring clean water access in slums. Sarvajal's success is in creating a business model that fit with the economic, social, and political needs of the slums they serve. Sarvajal created attractive and stylish locations where water is sold at very low cost (2.6 gallons of clean water for six cents). This strategy created local jobs and provided low-cost access to clean water, an inventive solution to a longstanding problem.

Development engineering also works on a larger scale, with philanthropic foundations finding new ways to use technology to solve short-term problems that have long-term humanitarian impacts. "Even in the software industry, the potential for impact is huge," says Zoe Bezpalko, the design and impact lead at the San Francisco-based Autodesk foundation. The foundation supports the design and creation of innovative solutions to the world's most pressing social and environmental challenges. "We are all involved in providing the tools people need to use their resources," Bezpalko says. The foundation's software is used in millions of applications around the world. Some help

humanitarian efforts in locations with little infrastructure. "Working with drone technology and reality capture, we can donate our software and training to the UN Refugee Agency engineers, who use it for super-fast mapping of refugee camps," Bezpalko explains. This project, the goal of which is to find new ways to get necessary information to agencies faster than ever before, is one of her favorites.

Berkeley and building lasting change

Engineering change that positively impacts people and empowers the user is a multifaceted and sensitive task. While great strides have been made in sanitation, clean water, and health, difficult problems still need to be solved and require the coordination of many communities to make a lasting impact. All of us want a future in which we enjoy equality in life, resources, and health, but for so many in resource-limited parts of the world, access to basic healthcare, clean water, and safe housing is still a challenge. Development engineering helps communities find sustainable, realistic, and self-generated solutions to the problems they best understand. With so many engineers, business students, and researchers throwing their thoughts and time into finding new ways to solve old problems, the future is beginning to look just a little bit brighter.

Provided by University of California - Berkeley

Citation: Development engineers support sustainability through self-sufficiency (2017, May 17) retrieved 26 April 2024 from https://phys.org/news/2017-05-sustainability-self-sufficiency.html