SCIENCE AND TECHNOLOGY IN THE GLOBAL SOUTH

Koen Beumer and Andreas Mitzschke

Science and technology are important for the global South. Scientific insights and technologies can for instance help to solve some of the harshest problems faced by poor people in the developing countries of the global South. One common reasoning is that if technologies have proven their worth in industrialized countries, like the Netherlands, then why could they not be used to solve similar problems in countries in the global South, like India?

However, it is not always that simple. Oftentimes technologies that function perfectly well in one country unequivocally fail once brought to another country, even when the problems the technology is supposed to solve are similar.

Research in STS has been helpful in understanding why you cannot always take a technology from one place, put it in another place, and expect it to work the same way. STS has taught that technologies only function as a part of a particular context and that context may be very different from one geographical location to another. Hence if we want technologies to work in the global South, it is important to attend to the local context. We illustrate this by giving two examples of technologies that did not function the way they were expected to after bringing them to the global South: genetically modified cotton, and bicycles.

Genetically modified cotton

Genetic modification is a technology that can help to create cotton plants with new properties. The conventional method to improve cotton is called cross-breeding: For instance if you have one cotton plant that is very tall and one cotton plant that needs very little water to grow, then you can cross these plants, and some of their descendants will be both tall and require little water.

Humans have successfully managed to improve cotton plants this way for thousands of years. But the limitation with this technology is that one can only develop crops using genetic material that is already present in the plants themselves. In the 1970s, however, scientists developed the technology of genetic modification that helped them to overcome this natural barrier. With genetic modification one can take genetic material from another organism – like a bacterium, or a virus – and include it into a plant.

Using this technology, scientists have developed a cotton plant that includes genetic material from a bacterium called bacillus thuringiensis (Bt). Containing the genes from the Bt bacterium, the so-called Bt-cotton plant produces a chemical that kills a moth which feeds on cotton plants. The result is that Bt cotton needs less sprays with pesticides because the plant protects itself against the moth. This reduces costs for producing cotton and improves harvests. Farmers in the United States starting growing Bt cotton in 1995 and initially the technology worked as scientists had thought it would.

In 2002, cotton farmers in India also started to grow the Bt cotton plants. Indian cotton farming was affected by the same moth and the experience of US farmers suggested that Indian farmers would benefit equally – to fight the moth without needing to spray a lot of pesticides. However, this is not what happened. In the five years following the introduction of Bt-cotton, India's total cotton production indeed increased. The reason for this has been attributed to the introduction of Bt-cotton by some, others however disagree. They argue rising cotton production was instead due to better rainfalls and a growing acreage devoted to cotton production over the years. Also, the use of pesticides in cotton cultivation did not decrease in the long run.

Disregarding the success or failure of Bt cotton in India, the subcontinent was shaken by agrarian distress in the same period – Indian farmers committed suicide in large numbers. Certainly this phenomenon cannot be exclusively attributed to Bt cotton. The industry and some researchers for instance convincingly point out that farmers were committing suicide already before Bt cotton was introduced.

But remember that the context is important for explaining the success or failure of technologies. And the context for growing Bt cotton in India is very different from that in the United States. For one, whereas the United States has mostly a moderate climate that makes it easy to control pests other than the moth that is targeted by the Bt cotton, India has a tropical climate. In the tropics the overall number and variety of insect pests is larger and farmers therefore have to resort to spraying expensive pesticides even if they grow Bt cotton.

Moreover, the financial situation of farmers is very different in the two countries. In the United States, farmers own a lot of land and they are able to farm huge fields using computerized machinery – imagine endless fields with only cotton, maize, or soy beans. In India, by contrast, most farmers do not own more than a few acres of land and they often rely on manual labor instead of machines.

As a result, Indian farmers have extremely small margins, making them particularly vulnerable to setbacks. This is important because the seeds of the Bt cotton plant are much more expensive than conventional cotton seeds. Farmers therefore have to lend money to buy these seeds. Activists and NGOs highlight that if the harvest fails, for instance because there is not enough rain, small landholders are stuck with a debt that they cannot pay off.

In other words, even if the crop technology that American and Indian farmers use is the same, contextual differences – in climate, in farm size, financial leeway - can result in a rather different performance of the crop technology.

Bicycles

Luckily, even if technologies that successfully solve a particular problem in rich developed countries fail to do so in the global South, the effects are not always

disastrous. Sometimes people in the global South put their technologies to use in very surprising ways, for radically different purposes.

Take the bicycle that is shown in figure 1.1 and figure 1.2. The bicycle has an extra chain attached to the back wheel that connects to a round metal stone on the top of the frame. When the man on the picture pushes the pedals, the bicycle does not move forward, but instead propels the round metal stone to spin very quickly, so that the man on the bicycle can sharpen knifes.

Figures 1.1 and 1.2. A bicycle or a knife-grinder?

Koen encountered this bicycle in late 2010 in Khan Market in New Delhi, India. In the weekends Koen used to go to this old diplomat's market to have lunch in one of the numerous restaurants. And every weekend this man would come to the market, park

his customized bicycle in one of the busy alleys, and sharpen the knifes of the cooks working in those restaurants.

Certainly this is not what a bicycle is supposed to do. The bicycle was brought from rich developed countries to India to solve problems of mobility. Poor people cannot always afford to buy a car and public transport is often underdeveloped. Bicycles offer a solution to this problem. They provide cheap ways to transport people from one place to another. But that is not how the knife grinder uses the bicycle.

Similarly, the bicycles shown in figure 1.3 is also not used to solve the problem of transporting people. Koen encountered this bicycle in New Delhi as well, in late 2012. This man had found a way to attach a great number of products to his bicycle. He would go around his neighborhood, shouting 'broomsticks! shovels! broomsticks! shovels!' and people who would need a broomstick or a shovel would come out and buy one. Instead of using the bicycle to transport himself from one place to another, this man turned his bicycle into a mobile store.

Figure 1.3 - A bicycle or a mobile broom-stick store?

From an engineering perspective, in both cases the bicycle failed to solve the problems that the technology has proven to solve in rich developed countries: bicycles are not the main mode of transport people for poor people in New Delhi.

However, using insights from STS, we can come to a richer understanding of what happened when these bicycles travelled from rich to poor countries. In India, bicycles are used by people with very different needs and experiences from their counterparts in the Netherlands. These users – knife-grinders and broom-stick-salesmen – decided to take matters in their own hands. The users of the technology matter. They ignored the original script to use bicycles for the transport of people and instead interpreted the bicycle in a way that

enabled them to solve problems they encountered in their everyday life, regardless of whether people in rich developed countries envisioned this beforehand.

Conclusion

In the case of both genetically modified cotton and bicycles, technologies that functioned perfectly in the context of rich developed countries failed to do so in the context of poor people in the global South. The genetically modified organisms did not increase the profits of small Indian farmers and the bicycles in New Delhi were not used to transport people from one place to another but to sharpen knifes or sell broomsticks. Insights from STS thus help to understand why simply bringing technologies to the global South will hardly ever be enough. This is not to say that we should not try. There are plenty of examples of technologies that have successfully been used to solve problems faced by the poor. Water pumps provide clean drinking water, medication can cure tuberculosis, and mobile phones are used to stay in touch with faraway family and friends. And as we saw in the case of the bicycle, people in the global South can also use technologies to solve problems that the technology was never intended to solve. In the best case technologies hence contribute to development.

However, as we have shown in the case of genetically modified cotton and bicycles, one can never entirely predict what will happen once technologies are brought to the global South. But when we try to bring technologies to the global South, STS has taught that we should at the very least try to understand the local context in which the technology is supposed to solve particular problems.

Suggestions for further reading

Bijker, W. E. (1995). *Of bicycles, bakelites, and bulbs: toward a theory of sociotechnical change*. Cambridge, MA: MIT Press.

Gaurav, S., & Mishra, S. (2012). To Bt or Not to Bt? Risk and Uncertainty Considerations in Technology Assessment. Indira Gandhi Institute of Development Research (IGIDR) working paper, 2012 - 001(001), 32.

Stone, G. D. (2012). Constructing Facts. Bt Cotton Narratives in India. *Economic and Political Weekly, XLVII*(38), 62-70.