

Murky Water and Confused Misperceptions

James Trevelyan, Professor and Mechatronics Discipline Chair
The University of Western Australia
March 2008

Why is it, in this age of the Internet and freely accessible information, that poor countries continue to languish in poverty and ignorance? Why is water so expensive in countries where labour is so cheap? These questions prompted the author to investigate the fundamentals of engineering practice, with some surprising results....

In magazine articles about emergency relief, it is not unusual to see pictures of refugees queuing for water, standing in line with empty plastic containers, whatever they can carry water in. The message: we have provided them with water supplies, enough to keep them going. We have done our bit.

Unfortunately there are misperceptions buried deep in our subconscious that mask an alarming reality. In real cash terms, the cost of the water for those refugees can be many times the cost that you and I pay in Australia. Yet, how can that be if the water is provided free? The problem is that time costs money, even in the poorest and most destitute communities. Queuing and carrying takes lots of time.

Refugees are not the only people affected. Our research is revealing that millions, perhaps tens or even hundreds of millions of people are in similarly dire situations in many developing countries. Water, without which all life is impossible, has become unaffordable. Recent estimates suggest that a billion people or more have no regular access to clean drinking water.

The first misperception concerns the value of time. People in developing countries don't get paid very much. Even so, when they have time they do whatever work they can to help support their families. It might be only one or two dollars per day. That means that time spent waiting in queues and carrying water in plastic containers is costing them money because it is time when they cannot work. Economists call this "the shadow priced cost of labour", in effect the value of unpaid labour, usually by women and children. As a rough rule of thumb, the cost of this unpaid labour is about two thirds of the unskilled female pay rate in the region. This can be measured by carefully observing decisions that people make on whether to catch the bus or walk, whether to purchase water from vendors or carry it themselves. The astonishing uptake of mobile phones in even the poorest countries reflects this: mobile phones save time and time is worth money.

The difficulty with water is that you can't carry very much. It takes a lot of effort. Carrying two buckets will bring home around 15 litres after allowing for spillage and in hot conditions the absolute minimum is 10 litres per person per day. Even if you optimistically allow one hour to stand in line in a queue and then carry the water home, the cost turns out to be astronomical. Water carried by hand can cost anywhere from 10 times to 50 times as much as it does from the tap in Australia. In plain and simple terms, a huge proportion of the world's population cannot afford water to wash their hands. That means they lose even more time because so many people are sick and either partially or completely incapacitated by disease caused by inadequate hygiene, poor sanitation and unsafe drinking water.

What this means is that the poorest people in the world have to pay far more for their water than the richest people in countries like Australia.

Providing a water pump or well is simply not enough. Water has to be cleaned and carried by pipes into people's homes in sufficient quantity to provide for basic needs.

In the areas in which we have studied this problem in Pakistan, there are water supply systems installed with financial assistance from agencies like the World Bank. Yet the water doesn't come out of the pipes much of the time. That's why people have to queue for water and buy it from water vendors.

It has been difficult for me, as a trained engineer, to begin to understand why the engineered water supply systems don't work. As part of my research I spent an afternoon discussing this problem with senior engineers from an Indian city where the water supply is considered to be one of the best in that country. The water is usually available for between 90 minutes and two hours every second day. The way that the water system is maintained provides a high level of confidence that the water will be not be safe to drink at any time.

It is not that the engineers are lazy or incompetent. In fact, I found it hard to understand that anyone could work as hard as they do. The engineers are not only responsible for trying desperately to keep the system running but also for collecting money from individual householders. People are often unwilling to pay for a service that does not work very well at the best of times. It doesn't make the job of the engineers any easier.

Water supply is not the only area in which engineering is failing in India and many other developing countries. Electricity supply is another disaster story. Anyone who needs continuous power needs a backup supply. Small power supplies are invariably less efficient than large power stations and with low maintenance standards, operating at only part of their full load capacity, the cost of electricity from a backup supply is much higher and causes much more pollution. Low standards of maintenance for electrical appliances, poor design and insufficient thermal insulation all combine to increase the quantity of electric power needed to achieve a given result. That means that the real cost of electrical energy is many times the level in Australia and other advanced countries.

Instinctively we tend to think of countries like India, Pakistan and many other developing countries as sources of cheap labour. We are not alone in this. Indians and Pakistanis also see themselves as a source of cheap labour. Unfortunately this is an illusion. While the cost of labour per hour is low, skill levels are also low and the cost of supervision needed to obtain a reliable result can be astronomical. The result is that it is usually more expensive to achieve the same results as you would in an industrialised country. That explains why cars are still made in Japan, France, USA, Australia and Germany.

What this means for rich and poor alike in these countries is that it is more expensive for them, in real cash terms, to obtain essential services that we take for granted in Australia.

One way to understand the background to this problem is to appreciate that intense competition between industrialised countries has dramatically increased the efficiency with which engineers can supply products and services. However, engineering is much less portable than we might think. Even though the Internet has provided access to information for the most remote communities in the world, engineering relies largely on unwritten know-how that cannot be transmitted electronically. Even students in Australian engineering schools are only dimly aware that all they are learning is merely an intellectual framework in which to store that unwritten technical know-how they will accumulate later through practical experience.

The technology of water supply expressed in terms of equipment is pretty much the same in Australia and India: rivers, dams, pipes, valves and pumps. It all seems simple and straightforward. Unfortunately it is not at all easy to understand why such apparently simple technology fails to work in developing countries. However, research at the University of Western Australia is beginning to reveal some intriguing answers.

Misperceptions on labour costs lead to subtle changes in behaviour which can lead to catastrophic results. If you consider labour to be expensive, as an engineer, you take great care

to supervise workers properly and to provide them with high quality training, tools, materials and organisation. Yet in India, where labour is considered to be cheap, training is considered to be unnecessary (because workers are unskilled anyway), there is little organisation, and bosses don't trust workers with expensive tools or materials because they think that the workers will damage the tools and waste the material.

All this helps to explain why aid projects seldom seem to achieve their objectives, often because it costs so much more to achieve the same results. Yet this is contrary to that instinctive subconscious mis-perception that everything should be cheaper in poor countries. That same mis-perception leads us to think that a given amount of money will achieve more in a poor country, whereas in fact it achieves less. Then we grasp for explanations, often involving corruption, when it is our own ignorance that has led us astray.

What does this mean for us in Australia? What can we do as Red Cross supporters and volunteers?

The only long-term answer is understanding and education. That requires a huge investment but we need to understand that our future is inescapably tied up with the future of people in countries like Indonesia, China, India and Pakistan. We all share the same planet and much the same resources: air, water, energy, sunlight, though we have differences in endowment of productive agricultural land. In Australia we need to understand that we have to help others make productive use of their own resources in order for us all to survive on this one planet. We need to be prepared to spend much more of our own resources helping others and finding ways to help that work.

The author is a member of the International Humanitarian Law advisory committee of the Red Cross and Western Australia. He chairs the mechatronic engineering discipline group at the University of Western Australia. With his colleagues and students he has been researching engineering practice in Australia and developing countries. This research emerged from efforts to devise more effective landmine clearance techniques in countries like Cambodia and Afghanistan. For further information, refer to the author's website at <http://www.mech.uwa.edu.au/jpt/>.