



A brief history of hand-drilled wells in Niger

Kerstin Danert

Over 30 years, water supplies in parts of Niger have been transformed by private businesses hand augering and installing improved lifting devices. Can the more expensive technologies of percussion drilling and rope pumps also be adopted by the private sector?

The successful adoption of hand-augered wells and treadle pumps in Niger (now used in their thousands) for both irrigation and drinking water builds upon the traditions of hand-dug wells and small-scale irrigation, as well as local private enterprises serving local needs. Hand-dug wells have been used as water sources in much of Niger for generations. Traditionally, these were unlined, or supported with wood, although government agencies and others now promote cement-lined wells.

The majority of Niger's population depends on rain-fed agriculture, and small-scale irrigation is only undertaken on a limited scale, primarily in southern Niger. The numerous market gardeners there, who traditionally use calabashes and leather bailers to water their crops, have created a market for the introduction of hand-drilled wells with improved lifting devices.

Over the last 30 years, more than 5000 hand-augered wells have been drilled in several parts of Niger by private drillers, and a similar number of treadle pumps have been supplied by local manufacturers. The numbers continue to grow. Today there are over 70 hand drillers (often with more than one team each) in different parts of the country. The information provided here is based on a three-week field visit to the southern part of the country in late 2005 by the author, covering 3500 km and undertaking interviews with over 60 stakeholders.

Development to uptake

Hand augering results in a small diameter borehole and involves using a soil auger to penetrate the soil, lifting it

to remove the material. The technique can penetrate certain sands, silts and some clays, but cannot deal with collapsing sands, gravels or hard formations.

Hand augering was introduced to Niger in the 1960s by Richard Koegel of the ILO, and was developed in the 1970s by the American Peace Corps and in the late 1980s by Lutheran World Relief (LWR). In collaboration with local well diggers and manufacturers, Jon Naugle of LWR championed the work, improving and promoting the technology. Starting from a few hand-drilled wells, it is estimated that about 3,500 had been drilled by June 1996; since then more than 1,500 have been drilled additionally.

The Projet Pilot de l'Irrigation Privée (PIPI I), funded by the World Bank (1997 to 2001) and enabled by Enterprise Works/VITA (EWV), still with Jon Naugle, further promoted hand drilling and introduced treadle pumps. A second phase, PIP II (no longer a 'pilot') is on-going. EWV is no longer involved and there is no more technology development. PIP II now subsidizes farmers to improve their small-scale irrigation practices.

Multiple uses of water

In many cases, farmers use their hand-drilled irrigation wells for drinking water, while some drillers have started to drill with the primary purpose of providing drinking water in people's backyards. Tunfanfi village, near Madaoua, is a particular case where every household now has a hand-augered well in their backyard. It should be noted that these examples, exciting as they may be, are not very widespread.

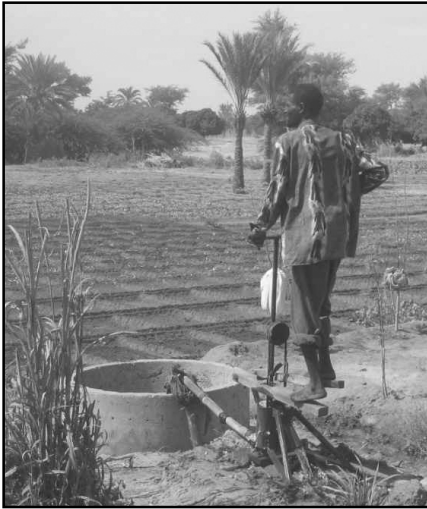
Water quality

Government is concerned about the quality and quantity of irrigation water. In general, professionals conceptualize two waters: one for drinking and another other for crops and animals. Villagers rarely, if ever, make this distinction.

Water-quality problems can be caused by contamination from the surface, or from contaminated aquifers. If a well is unsealed, or a dirty bailer is used, contamination can occur. Aquifer contamination can be due to faecal matter, or chemicals (naturally occurring or introduced). Little work has taken place to substantiate concerns about aquifer contamination in Niger. However, many hand-dug wells promoted by professionals tap shallow groundwater. Professionals often argue that these are only slightly deeper than garden wells,



Hand-auger drilling in Golom



Combining a treadle pump with a hand-dug well is popular among market gardeners

Box 1. From calabashes to treadle pumps

Sabiou Boubou from Matameye was using his calabash to lift water when we saw him. He would raise the smooth round vessel from his hand-dug well, and in one swift movement, place it on the raised earth behind him. The calabash would rock and release its water into the small canal running to his vegetable plot. The positioning was always perfect and the rhythm regular, almost hypnotic. However, when questioned, Sabiou immediately spoke of wishing that he owned a treadle pump to ease his burden. He is one of the few remaining farmers in his community still using the traditional calabash to irrigate.

Manzu Kanto, a neighbour in his sixties, explained that this land, now covered by immaculate vegetable plots, used to comprise a small lake which diminished over the years and finally disappeared completely. As a child, Manzu and others would take water from the lake to their sugarcane, tomatoes and spices. As the water table fell, the farmers began digging wells, which were lined with wood and later cement. Treadle pumps were introduced several years ago. Manzu is one of many owners of treadle pumps in the area. He is proud of the fact that he has kept the pump maintained since he bought it, either by undertaking repairs himself or taking it to local artisans.

making them less susceptible to aquifer pollution. However, their open nature renders them as susceptible to contamination as the hand-drilled irrigation wells.

Water quantity concerns relate to the overuse of the groundwater resources. Generally, hand-drilled wells need to be of sufficient depth to ensure that they provide water through the dry season until the rains recharge them. The sheer number of people practising small-scale irrigation in some areas has raised concerns about water resources, although the suction limit of the pumps currently being utilized (6–7m) is self-limiting.

Marketing and quality

It was during PPIP I that EWV focused extensively on commercializing the technologies. Local drillers were

provided with equipment on credit and supported to drill demonstration wells. Treadle pumps were manufactured by local enterprises and sold directly to the users. Hand drillers generally came from the area in which they worked, to enable peer pressure to be exerted for high-quality work. Shoddy workmanship was not tolerated by EWV, and farmers were corrected in their use of the pumps.

Marketing was undertaken through demonstrations in the villages and through advertising. Farmers learned that maintenance of the treadle pump is simple and can be undertaken by themselves with the help of local artisans. The development of a more affordable smaller treadle pump was the key to widespread adoption.

The cost price of the treadle pump models were negotiated with the drillers

in 1997 by EWV, widely publicised and have remained the same until today. They allow a considerable margin, making the pumps one of the most profitable items that the artisans produce. Hand augering costs from US\$50 to \$300 depending on depth, diameter, distance and materials (this amounts to 15–20 per cent of the cost of a hand-dug well of similar depth). A hand-augered well, fitted with a treadle pump, costs from \$120–460. The fact that drillers tended to work locally, and depend on low-cost transport, keeps the costs down. This can be compared with a deep well which, depending on depth, distance, clustering between borewell contracts and other factors cost in the range \$5,000 to \$20,000 for a well installed with a handpump.

Unlike PPIP I, PIP II introduced subsidies of 90 per cent, and required agents to assist farmers to prepare funding proposals. The agents thus became intermediaries. The high subsidy has overcome the constraint of lack of capital, speeded up adoption of the pumps and wells and enabled bulk supply. However, it has been suggested that the needy farmers do not always benefit, and that the subsidies have drawn people towards applying for motor pumps when this may not actually be the best technology for them. PIP II has also provided equipment grants to manufacturers, but it is still too early to determine the long-term benefits of these inputs.

Despite the subsidies, not all enterprises are solely dependent on PIP II for markets. The continued purchase



Madayana Moudi hand drills a well in his friend's backyard in Kago village, Djoundiou

Sustainable rural water supply



Hand auger equipment can be transported cheaply by ox cart

of the technologies has also been by some enterprising individuals. One manufacturer estimated that 80 per cent of the 1,000 treadle pumps sold have been to individuals. Another claims that 70 per cent of his clients are PIP II agents, 20 per cent are drillers and 10 per cent are the farmers themselves.

PIP II has placed a high emphasis on price-based competition and this has resulted in drillers travelling from different areas. These have little social concern for their customers, with the result that quality has deteriorated. Some farmers have also suggested that the pumps now produced wear out more rapidly.

New frontiers

Hand augering is limited to sands and clays, and treadle pumps are limited to lifting water from depths of 6–7m. EWV

is now trying to push new frontiers with private enterprises, using hand percussion drilling. This technique can drill deeper and penetrate harder formations. Together with the rope pump, which can lift water from about 20–30 m depth, it should be possible to provide water for domestic use across the hamlets of Niger. These are not included, however, in the government's plans.

Hand percussion drilling is an ancient technique involving the lifting and dropping of a very heavy cutting tool to break through clay and rocks, and then removal of the cuttings with a bailer. The percussion rig shown in the photograph on p 5 was fabricated in Niger, with locally available materials. The main constraint is labour to lift and drop the tools: communities are not always easy to mobilize. Hand percussion drilling is a riskier venture than

auger drilling and the increased flexibility means that it involves a longer, less predictable drilling time (several days rather than a few hours).

The rope pump can currently be purchased from two local manufacturers. By February 2006, 17 had been installed on hand percussion-drilled wells in hamlets. The rope pump is still new to Africa and well costs are still being worked out but the costs can be estimated as ranging from \$250 to \$1000. Although it is still too early to comment on issues of pump maintenance, the rope pump does not require highly skilled mechanics, and all of the spare parts are fabricated by the two local manufacturers.

Conclusions

There is tremendous potential for hand-drilled wells in many countries in sub-Saharan Africa, although it has taken about 30 years to reach today's level of operation in Niger. However, it has been clearly demonstrated that local private enterprises can be supported to catalyse development, improve farmer livelihoods, and bring drinking water closer to people's homes. The role of outsiders in identifying points of intervention, without stifling local initiatives or introducing inappropriate procedures, needs to be well understood and monitored.

New frontiers are being explored for hand percussion drilling and the rope pump with finance from small grants and trust funds. This situation is common to the development and introduction of hand drilling in sub-Saharan Africa, where projects have commenced only for funding to end before a conclusion has been reached. Not all projects have received the duration of funding that has benefited the hand-augered wells in Niger. Will hand percussion and the rope pump need to make the same long journey or will stakeholders take a risk and invest sufficient time and resources to cross this low-cost frontier and achieve improved rural water supplies?

About the author

Kerstin Danert is an independent researcher and consultant specializing in community water supply and sanitation; she is also the co-ordinator of the Rural Water Supply Network's flagship Cost-effective Boreholes.

Box 2. Hand-augered wells for drinking water

Madayana Moudi, a hand auger driller, drilled a well in his friend's backyard in Kago village, Djoundiou. At first glance a professional clearly sees that the cracked PVC tube that protrudes could be protected with a small concrete apron and improved drainage. However, this well and the bailer are not part of a donor project, but rather entirely paid for by the driller himself in trying to open up new markets.

Two others in the same village have since paid for hand-drilled wells in their own back yards. Nobody, out of about 300 in the village, uses the open well (provided by government in 1989) for drinking water any more. It has been left for the animals. People now queue at the three hand-drilled wells in the village, preferring the taste of the first one. Peering over the surface of the government well, situated between the village and the local school, one can see sticks and other debris floating inside – small wonder that people have chosen to go elsewhere for drinking water.

Most people currently defecate outside of the village in the fields. However, Mahamoud, the owner of the first hand-drilled well, a headmaster and educated man, has built a latrine in his backyard, some 50 metres from the hand-drilled well. It is ironic that the élites and the wealthy, who are more likely to invest in a hand-drilled well in their homes, are the very ones likely to use a pit latrine too. The issue of contamination between the two remains unanswered, but an important question. Meanwhile the enterprising driller, Madayana, is buoyant about unlocking future markets of hand-drilled wells for drinking water in other villages.