

A Brief History of Hand Drilled Wells in Niger

Only the Beginning

This field note describes the history of hand drilling and water-lifting techniques introduced in Niger over 30 years and now firmly in the hands of local enterprises, farmers and household water users. Recommendations for the way forward are included.



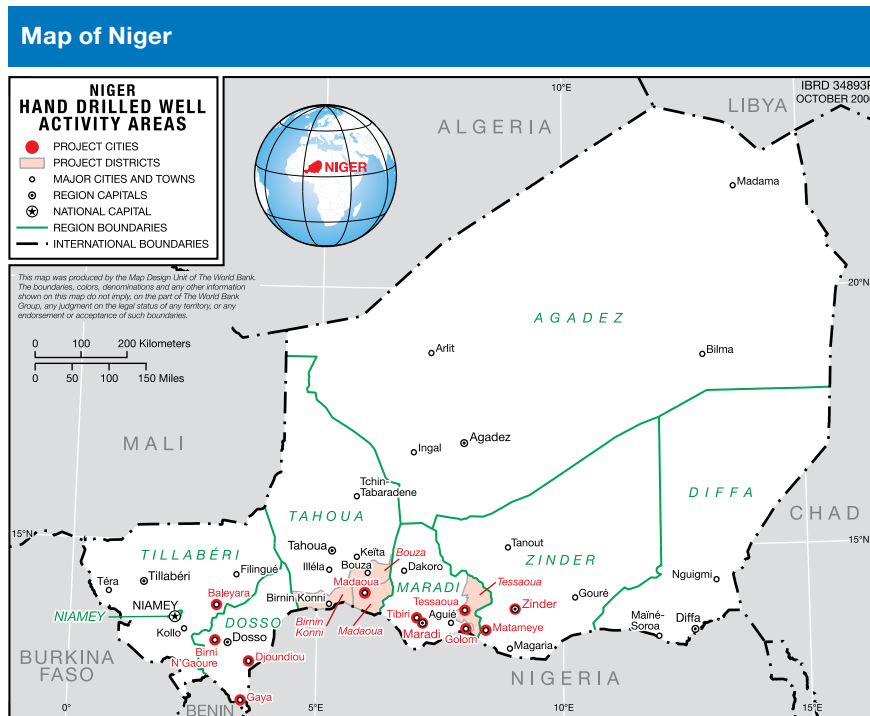
Executive Summary

This field note traces the development of wells and water-lifting technology in the water scarce country of Niger. It describes a range of hand-augering and water-lifting techniques that have been introduced over the past 30 years, primarily in southern Niger. It traces the role of non-government organizations in terms of pioneering the technology and supporting the growth of a locally based business environment to increase access to the relevant technologies. The research points to the necessity for investment in the early stages – to develop and test the technologies within specific localities, build the skills of independent drillers and pump manufacturers, and careful support to private sector market development.

Introduction

The history of hand-drilled wells in Niger resembles a long river with many tributaries, traversing a vast landscape. Thanks to dedication and commitment from non-governmental organizations (NGOs) spanning over 30 years, hand-auger drilling is now firmly in the hands of local entrepreneurs in several parts of the country and locally-fabricated pumps have enabled farmers to utilize more water in their fields, and villagers to draw water from closer to their homes.

The period from the introduction of hand-augered wells and treadle



pumps to the present may seem very long in current project-development thinking. But it is the words of Souradji Hassan, a blacksmith who has been manufacturing treadle pumps for last seven years that led me to call this paper 'Only the beginning – A History of Hand Drilled Wells in Niger'. When asked about his experience with the technology and plans for the future, he remarked, "It is still early days" and proceeded to retell his experience of the 20-year history of making ox carts in Niger.

This field note is based on research undertaken by the author on a 3,500km journey, consulting more than 60 stakeholders (farmers and market gardeners, manufacturers of treadle and rope pumps, hand drillers,

conventional drilling contractors as well as Government, NGO and donor representatives). The document provides insights from this remarkable history and shows the undoubted potential for further popularization of hand drilling and low cost water-lifting technologies in Niger and beyond. The research is part of an initiative by the Rural Water Supply Network (RWSN) to improve the cost-effectiveness of borehole provision across sub-Saharan Africa.

Water Sources in Niger

In much of Niger, as in many other parts of West Africa, hand-dug wells have for generations been used as water sources. Traditionally, these water sources were unlined, or supported with wood.



Traditional hand dug well lined with wood

Development projects have introduced 'modern' wells, which are lined with concrete rings, or bricks with mortar, to improve safety and water quality. The Niger Government estimates that in addition to the countless traditional wells, the rural population (78 percent of the total population¹) is served with modern sources comprising some 13,000 cement-lined wells, 7,000 machine-drilled boreholes fitted with hand pumps, and many small-scale piped supplies². Government assumes that the modern sources supply 250 users each.

The 2004 Government figure for rural water coverage was 59 percent. There is no official figure for the functionality rate

of hand pumps, but several stakeholders in NGOs and Government indicate that in some areas as few as 20 percent of the hand pumps are functional. It is thus likely that over half of Niger's rural population still relies on traditional water sources. Funding for rural water supply for 2006 to 2009 is earmarked at US\$ 41 million per annum (US\$ 164 million in total). This is only 54 percent of the funds needed to meet the 2009 target of 65 percent coverage³.

Government policy for rural areas is to provide one modern water point per 250 people. Maintenance is the responsibility of the users, with each region having its own particular approach to dealing with pump

sustainability. Access to spare parts for pumps has been problematic.

Regularly hit by drought and famine, the majority of Niger's population depends on rain-fed agriculture. Small-scale irrigation, undertaken on a limited scale, primarily in southern Niger, provides some security from famine. Some of the market gardeners, who traditionally used calabashes and leather bailers to water their crops, are now using improved water-lifting devices (Box 1).

Groundwater Exploitation

Exploitation of groundwater through hand-drilled wells involves four stages: drilling, well lining, well development and installation of a water-lifting device.



Fetching water at a cement-lined well

¹ United Nations Development Programme. 2005. Human Development Report.

² Mamane, B. 2003. Les inégalités d'accès à l'eau potable, l'eau productive et à l'assainissement, la place et l'implication du citoyen dans les prises de décisions. Rapport du Niger. Published by Green Cross International, ALMAE & WSSCC.

³ Government funding estimates to meet the target of 65 percent coverage by 2009 are US\$23 million (2006) and US\$ 86.8 million per annum (2007-2009). (AGRIFOR Consult. Appui à la Finalisation des Plans d'action des Programmes et du Plan d'action Global de la Strategie de Developpement Rural. Rapport d'étape de la mission. 9 novembre 2005. Niamey.)

Hand augering (Box 2) involves drilling a small-diameter borehole with a cylindrical or helical soil auger. This method can penetrate certain sands and silts and some clay formations. Hand-percussion drilling, which can penetrate harder formations, was practiced in many parts of the world before being replaced by mechanised technology. It involves lifting and then dropping a very heavy cutting tool to break the material, then removing the cuttings with a bailer.

There are many types of water-lifting devices. In the 1970s improved bailers (also known as Zimbabwe bucket pumps) made of a metal or PVC tube with a loop in the top and flap valve in the bottom, were introduced to lift water from hand-drilled wells. These are still used in many wells in Niger, although some have been superseded by locally made treadle pumps (foot or hand-operated suction or suction/pressure pumps) as shown in Box 1, or even motor pumps.

Maintenance of treadle pumps, as explained by Kabiru Yahaya, a farmer near Matameye, can be done by users themselves or in local workshops.

Since 2005, the rope pump, which can lift water from 20 meters, (compared to the treadle pump limit of 7 meters), has been locally manufactured and promoted in Niger.

The Journey from Experiment to Uptake

Richard Koegel of the United Nations Food and Agriculture Organization (FAO)

Box 1. Calabashes and treadle pumps – changes in irrigation practices



Sabiou Boubou (left) uses his calabash to lift water. He raises the smooth round vessel from his hand-dug well, and in one swift movement places it on the raised earth behind him. The calabash rocks and releases its water into the small canal running to his vegetable plot. The positioning is always perfect and the rhythm hypnotic. However, Sabiou, one of the last remaining farmers still using the calabash, said he wished to own a treadle pump (right).

Manzo Kanta Adam, a neighbor now in his 60s, explained that the land covered by immaculate vegetable plots used to comprise a small lake which diminished over the years and finally disappeared completely. As a child, Manzo and his neighbors would carry water from the lake for their sugarcane, tomato and spice crops. As the water dried, the farmers followed it by digging wells, which were lined with wood and later cement. Treadle pumps were introduced several years ago. Manzo 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.



Box 2. Hand drilling team in Golom, southern Niger

It is the speed of penetrating the ground, undoing the drill pipe and emptying the auger for the next round that is impressive when observing hand augering. Under the baking sun, Mamoudou Hamza and Cheibou Danjoumey and their team chew cola nuts as they complete a well for Abdul Kamu in Golom. The crew members have different techniques for penetrating different types of soil and sand. Most impressive is when they climb onto the top of the casing and use their weight to sink it into the ground (right). Once the well is drilled to the required depth, the locally cut screen is inserted, followed by the casing. The well is then developed using a treadle pump. Despite the complete lack of shade the crew are undeterred by the immense heat of the sun and move on to drill their second well for the day.



was already involved in hand drilling in Niger as early as the 1960s. Yahaya Abdu, in Balleyara, north of Niamey⁴, was introduced to hand augering by an American Peace Corps volunteer in the 1970s. Yahaya's shallow drilled well, one of seven drilled at the time, has served him with water for both drinking and watering plants for almost 30 years.

The Peace Corps work was followed in the late 1980s by a Lutheran World Relief (LWR) initiative to introduce hand-auger drilling, first in eastern Niger in the district of Magaria, then in southern Niger in the districts of Foulan Koira, Birni N'Konni and Balleyara.

In collaboration with local well diggers and manufacturers, Jon Naugle of LWR championed the work to improve and promote the technology. By 1996, as a result of promotion by LWR and other organizations, the number of hand-drilled wells in southern Niger had grown to an estimated 3,500.⁵

Three major projects have driven the adoption of hand-drilled well technology by enterprises and farmers in Niger:

(i) The Projet Basse Vallée de la Tarka (also known as the Tarka Valley Project), which operated in the Madaoua region from 1992 to 1997, was funded by the European Union.

⁴ Niamey is Niger's capital city

⁵ "Hand Augered Garden Wells" by Jon Naugle, Lutheran World Relief. 1996

⁶ Full name not known.

⁷ FCFA = Franc de la Communauté Financière de l'Afrique/West African Franc. US\$1 = 500 FCFA

⁸ Full name not known

Box 3. Profiles of three Nigerien hand drillers

Ibrahim⁶ is the president of the drillers and pump manufacturers association in Madaoua. He started to work with the Tarka Valley Project 15 years ago, followed by a period in Government in works control and supervision. Once this ended (7 years ago), he purchased his own hand-drilling equipment. Ibrahim now has eight sets of drilling equipment in operation, which he estimates cost about FCFA⁷ 200,000 each (US\$ 400). The equipment includes a motor pump for well development and a trailer.

Hamadou⁸ used to work as a peasant farmer but was trained to drill through the Tarka Valley Project. Much of his work has been in his own village. Although there is plenty of demand he feels that he lacks capital to further expand his drilling business.

Madayana Moudi, who was involved in the Tarka Valley Project, now has four hand-drilling teams (two in Gaya, two in Djoundiou) and intends to start up a fifth. He also constructs irrigation networks, repairs pumps and runs a small garage. He drilled some 25 wells during the Tarka Valley Project and over 500 subsequently. He claims that nowadays four out of five people prefer drilled to dug wells. He has also drilled six potable wells installed with bailers directly in people's homes.



Hand drilling in Niger today



Woman uses hand-operated treadle pump in Karra

This Project enabled hand augering to take root in parts of the Madaoua region. The director of *Projet de l'Irrigation Privée II* in Maradi reports: "When I arrived in November 1991 there were 91 [hand] drilled wells in Madaoua and Bouza Districts [both in the Tarka Valley]...by December 1997 there were over 2,600 drilled wells." These were drilled for farmers by local enterprises.

The project built on existing activities in small-scale irrigation. Traditionally the numerous market gardeners had used calabashes to lift water from the open wells, but as soon as people

realized they could water their crops more efficiently, the hand-augered wells and treadle pumps became popular. With water tables only two to six meters below ground, conditions were favorable and the Tarka Valley is now renowned for exporting onions to neighboring countries.

In Madaoua drilling techniques have not changed since the 1990s. The president of the Driller and Pump Mechanics Association in Madaoua explained: "The market really took off in 2000...now people understand drilling...farmers come with money for pumps and

tubewells...there is plenty of work [in the dry season]... it is hard to know how many [wells] we have drilled today". (Box 3 describes what has become of three drillers from the Tarka Valley Project.)

(ii) *Projet Pilot de l'Irrigation Privée (PPIP I)*, was a World Bank funded project, which commenced in 1997 and ended in 2001, and operated in the four regions of Tillabéri, Dosso, Maradi and Zinder (but not in the Tarka Valley). As part of the project, an American NGO called Enterprise Works/VITA (EWW) was responsible for implementing the manual irrigation component – the

development and promotion of hand-auger drilling and treadle pumps. The EWW team was lead by Jon Naugle, formerly of LWR. PPIP I trained 14 manufacturers in the fabrication of the treadle pump – 12 were still operating in late 2005.

(iii) The *Projet de l'Irrigation Privée* (PIP II), a follow-up project to PPIP I, commenced in 2002 and is still in progress, covering all eight of Niger's regions. This project, primarily a development program providing implementation support, subsidizes farmers to construct hand-drilled or hand-dug wells and purchase motor or treadle pumps. It also provides support to treadle pump manufacturers.

Capacity-building of traditional blacksmiths

The foundation for the adoption of hand drilling technology and treadle pumps was set by several independent projects that built metalwork skills and helped to establish workshops in rural Niger. This has contributed considerably to today's local manufacture of drilling equipment and pumps.

Marketing

From a project approach to private sector involvement

The earliest hand-drilled wells were introduced by projects that did not attempt to commercialize the technology. A move towards non-subsidised private sector involvement started when EWW began providing

drillers with equipment on credit, advancing FCFA 50,000 (US\$ 100) for constructing each of the first 20 demonstration wells. Over time, the drillers paid off the cost of their tools and became fully commercial.

Treadle pumps were manufactured in local workshops. The manufacturers initially sold pumps to the project for demonstration purposes and later sold directly to users. Manufacturers learned to respond to demand, and prices for their products were established.

Box 4. Hand-augered wells for drinking water



Madayana Moudi (a hand-auger driller) gave the gift of a hand-drilled well (left) to his friend Mahamoud Maddou, a headmaster in Kago village, Djoundiou. The well is situated near the fence in Mahamoud's back yard. At first glance it is obvious that the protruding cracked PVC tube would benefit from the protection of a small concrete apron and improved drainage. However, this hand-drilled well and bailer was not provided by a donor funded project, but was entirely paid for by the driller himself, an entrepreneur trying to open up new markets.

Subsequently, two other people in Kago village have paid for hand-drilled wells in their back yards. Nobody, out of a population of about 300 in the village, uses the cement lined well (right), for drinking water anymore – people now queue at the three hand-drilled wells.

Most people currently defecate outside the village in the fields. However, Mahamoud has built a latrine in his back yard, some 50 meters from the hand-drilled well. It is ironic that the elites, and the wealthy, more likely to invest in a hand drilled well in their home, are the very ones likely to construct a pit latrine too. The issue of contamination between the well and latrine remains an unanswered but very important question.

Meanwhile the enterprising driller, Madayana is buoyant about unlocking markets in other villages that want hand-drilled wells for drinking water.



Transporting hand-auger equipment by ox cart

Establishing markets

It was a challenge to market products that were unknown to farmers. The entry point for treadle pumps was farmers who were already selling their irrigated produce. To interest the farmers, EWV would install and demonstrate a treadle pump on an existing hand-dug well, and after using the pump for a week or two, the farmer would generally want to keep it. They found it less tiring than the traditional calabash or 'shadoof' method. The farmer would then be informed about where the pumps could be purchased, and at what price. Thus a link between farmers and pump manufacturers was established early on, and gradually demand from neighbors grew. Radio and television advertisements were also used.

"It is really important to demonstrate the technology to the farmer...[initially]

you need to identify those who are interested and take the technology to them. People should be sensitized by other villagers [because] those who stay in the village are more trusted... One needs to work at the pace of the village. At the start it is important to find people who are courageous. Afterwards [other] people see how the technology is used. To get people to understand something new takes a lot of patience."

Mohaman Sani, treadle and rope pump manufacturer, Maradi.

Treadle pumps were installed for both hand-dug and hand-augered wells, which expanded the market. Likewise, the availability of the pumps encouraged investment in hand-augered wells. Both drillers and pump manufacturers were located within the area they served. Over time a smaller, cheaper and lighter treadle pump model was introduced contributing to

more widespread adoption. There are now four treadle pump models available, including a hand-operated version. This was specifically designed for women as they cannot climb onto the foot-operated treadle pump due to cultural reasons.

During PIP II there has been a considerable increase in demand for services by drillers and pump manufacturers. Subsidies have been introduced to overcome the constraints of lack of capital among drillers, manufacturers and farmers. To qualify for subsidies, farmers are required to prepare proposals. This has led to the introduction of agents to assist them. One manufacturer complained about this, saying, "It is not the real market gardeners who are benefiting [from PIP II], but rather the people who know how to prepare a proposal."

Not all treadle pumps are sold through the PIP II project. Local manufacturers have secured their own markets in various ways, such as enabling farmers to pay in two instalments, rewarding farmers for bringing neighbors to buy, and taking pumps to the fields for demonstrations. New markets are being explored by drillers themselves as they drill wells for domestic use (Box 4). Tunfafi village, near Madaoua, is an exceptional case where every household now has a hand-augered well.

Prices

In Niger, a hand-augered well fitted with a treadle pump, costs from US\$ 120 to US\$ 460. These costs include the hand-augering service, which covers the labor, transport, screen and casing materials – costing from US\$ 50 to US\$ 300 (Table 1). Prices vary

according to the depth, diameter, distance and materials used. The fact that drillers tend to work locally means their transport costs remain low and that they are likely to be familiar with conditions in the locality.

Success rates for drilling vary: a driller in the Tarka Valley quoted a success rate of 70 percent to 80 percent, while a crew in Golom quoted 89 percent. Often the farmers themselves select the sites and bear the costs of drilling dry wells.

The prices the drillers can charge are affected by quite different factors from place to place. In Golom, prices have increased as people have got to trust the technology and are prepared to pay more. In Tibiri, by contrast, prices have been forced down, apparently due to increased competition.

The cost of hand augering is about 15 percent to 20 percent that of hand digging (for a similar depth). Although hand augering can penetrate deeper into the aquifer it is not necessarily the best option, as hand-dug wells offer more storage capacity and are better in places where flow rates are very low. In 1997 (during PPIP I) EWW negotiated sale prices for the treadle pump models with the manufacturers. The prices they set and publicized widely, allowed a considerable margin (profit plus overheads) for the manufacturer, making the treadle pump one of the most profitable items to produce. These prices have remained unchanged since 1997, partly due to relatively high margins in the first place, but also due to the fact that the currency in Niger is pegged to the Euro, so it does not suffer from high inflation. However a common complaint from the manufacturers is

Table 1. Prices of hand augering and treadle pumps

Item	Details	Sale Price (FCFA)	Price (US\$)*
Hand augered well (110mm)	Golom (12m)	80,000	160
	Golom (9m)	50,000	100
Hand augered well (140mm)	Madaoua (12m)	150,000	300
Hand augered well (110mm)	Tibiri	50,000	100
	Matameye	60,000	120
Hand augered well (50mm)	Tibiri	25,000	50
Treadle Pumps (can be installed on 50mm diameter)	Small 'Bangladesh'	35,000	70
	Large 'Bangladesh'	60,000	120
	Hand Operated	80,000	160
Rope pump (can be currently installed on 110mm diameter)	Rope pump incl. Installation	70,000 to 80,000	140 to 160

*FCFA = Franc de la Communaute Financiere de l'Afrique/West African Franc. US\$1 = 500 FCFA

that the introduction of intermediary agents by PIP II has pushed down their margins, despite the fact that PIP II still pays the same price.

Sales

There are now over 12 treadle pump manufacturers in Niger, and dozens of hand augering teams. Based on the observations, data and interviews, the author estimates that there are well over 5,000 hand-drilled wells in use, and a similar number of treadle pumps, with many people using both. Figure 1 presents data collected by EWW during PPIP I, as well as information from the RWSN study in late 2005 for 14 drilling enterprises. They have drilled an average of 19 wells per year (ranging from 0 to 221). On average there has been an increase in the number of wells drilled per year, peaking at 177 percent in 2000. Sales dropped by 28 percent between 2003 and 2004. For individual

enterprises there are cases where there have been no sales in a particular year. One enterprise had a major increase in sales between 2002 and 2004 due to the increase in demand generated by PIP II.

Buyers for the treadle pumps comprise both projects and farmers themselves. Adamou Fall, who started to manufacture the pumps in 1997 in Niamey, estimates that 80 percent of the 1,000 pumps that he has sold have been to individuals, with the remainder to projects. He explained that the people who buy the pumps “are neither rich nor poor, generally do not have much land and sell their produce.” On the other hand, Ango Kommandawa in Tibiri claims that 70 percent of his clients are PIP II agents, 20 percent are drillers and 10 percent are peasants.

Souradji Hassan, a manufacturer from Zinder, sells more pumps through PIP

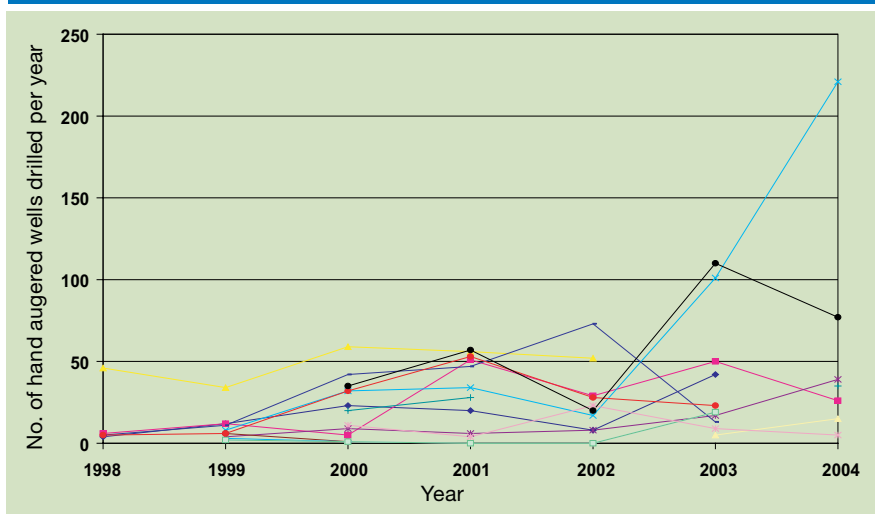
II than to individuals. The RWSN study found that artisans and drillers made significant financial gains from the sale of treadle pumps and drilled wells. Garba Maygizo, a treadle manufacturer in Gaya, said he constructed three homes with the money he made during PPIP I. Momoudou Hamza (from Golom) explained that nowadays his existence is based on hand drilling. As a result of the venture he is able to afford three wives and has bought a motorcycle.

Financing Issues

During PPIP I the manufacturers, drillers and market gardeners lacked capital, and manufacturers would normally make pumps only in response to an order, often requesting a down-payment from the farmer. As confidence in the products and manufacturers grew the amount of deposit paid by farmers has increased – initially they paid 15 percent (of US\$ 70), now they pay 85 percent. PIP II offers farmers subsidies of 90 percent of the cost of the well and pump, provided their proposal is approved. PIP II also provides grants of up to US\$ 12,000 for artisans to improve their equipment, purchase lathes and other machines.

A manufacturer in Tibiri said a drawback of the subsidy scheme is that it encourages people to apply for motor pumps even in cases where this is not the most suitable technology. He believes this has caused a drop in treadle pump sales, although he considers this to be a passing phenomenon, “...[once PIP II is over]

Figure 1. Annual sales of successful hand (auger) drilled wells for 14 drillers



people are likely to abandon the motor pumps when they break down.” In Karra, Mintu Garba and fellow market gardeners prefer the treadle pump: “Motor pumps need fuel and are not viable for small plots,” she says.

Manufacturers and Hand Drillers: Variations on a Theme

The background of the nine manufacturers interviewed for the study varies considerably. Mahaman Sani Rabo finished the Lycée (secondary school) with a specialization in metalwork construction while neither Maman Dan Chitou nor Souradji Hassan attended school. Souradji started work as a welder, eventually buying his employer’s equipment. Adamou Fall and Maiga Shafagan had a history of work with LWR from the 1980s. Ango Koumandawa, Mounkaila Oumarou, and Aboubakar Salifou honed their metalwork skills in development projects⁹ which upgraded the skills of traditional blacksmiths, giving birth to some of the first highly skilled metal workers in Niger, and contributing much to the skills pool of today’s treadle pump industry.

Common to the treadle pump manufacturers is their diversity of production including metal beds, doors, ploughs, trailers and wire fencing. Some have auger equipment of their own, plus one or more drilling teams.

⁹ For example by CDARMA (Centre de développement de l’artisanat rural et du machinisme agricole), BIT (Bureau international du travail), CECI (Canadian Centre for International Studies and Cooperation) and CARE



Mintu Garba (right) and fellow women market gardeners at their plots in Karra

Box 5. Multiple uses of water in Karra

Mintu Garba is the chairwoman of a women’s group of vegetable gardeners in Karra, near Birni. Their gardens provide an oasis of green throughout the year against the backdrop of a very dry landscape for much of the year. Onions, lettuce, papayas and squash are among the produce that the women grow for home consumption as well for sale. Mintu told me that she has tended her garden for 30 years. Vegetable gardening was traditionally an activity reserved for old women, but more and more women in the area now have gardens.

The gardens are littered with hand-drilled wells installed with treadle pumps, which the women use to irrigate their plots. The owners of these facilities prefer to drink this water than that of the cement-lined, open well nearby, as it is clearer. Mintu and her fellow women provide one example of people using hand-drilled wells and irrigation pumps for both productive and domestic water.

When asked what makes a successful treadle pump business, their responses were along these lines:

- One needs courage and motivation, and all the necessary equipment.
- Respect the engagement. “Do not only consider the money.”
- Carry out high-quality work to a satisfactory level.
- Repair returned pumps quickly to

create confidence in the company and product.

Although the artisans interviewed spoke of how well they had done with their treadle pump sales, they complained that they lacked sufficient money to reinvest in their businesses. Ibrahim Mamadou of EWW believes lack of reinvestment has more to do with setting priorities: “People often prefer to invest in cows than in their manufacturing business.” He says maintenance is given a low priority, with a tendency to “wait until things completely fall apart.” Poor business management may be a constraint to their development.

The hand drillers interviewed were either well diggers, or they worked on hand drilling projects and subsequently set up as an enterprise (see Box 3); some are also involved in treadle pump manufacture. As with the manufacturers, the drillers do not depend on this activity alone for their livelihood, most of them also farm. Hand-auger equipment owners tend to hire labour to drill and usually pay a daily wage of US\$ 4 to US\$ 5, or a wage per well drilled. Not many of the entrepreneurs venture far from their primary locality unless commissioned by PIP II. The most frequent complaint is of insufficient local supply of PVC casing.

Quality Assurance

In the early days of PPIP I, EWW placed considerable emphasis on assuring the quality of the drilling, pumps and pump use in order to build confidence and



Ango Koumandawa at his workshop in Tibiri

meet user needs. Manufacturers and drillers were very carefully selected with attention to motivation, commitment and reliability. Manufacturers were trained in their own workshops. Pumps not up to standard in the field would be returned to the manufacturer for repair at his own cost. There was regular training and follow-up (including spot checks) of the manufacturers.

Drillers usually came from the area where they worked, so were under peer pressure to produce high quality work. They were penalized if their wells were not up to standard. When PIP II, which has been criticized for over-emphasizing price-based competition, brought in drillers from other areas, they were viewed by some as not taking adequate social responsibility for their customers.

Project field agents and the manufacturer’s agents would visit farmers regularly to check that they were using the pump properly. The agents would improve the way that the pipe was attached to the outlet, the lubrication of the leather, and the pedalling action. Over time the more experienced farmers became mentors for their neighbors.

It is difficult to maintain the quality of the products and service once the technology has moved beyond the pilot phase. However, the Association of Drillers and Pump Manufacturers in Madaoua claims that despite the absence of formal quality assurance mechanisms, there are no serious quality problems with respect to drilling. They say people in the area have a clear idea of what quality is acceptable

and know which drillers are capable of undertaking the work. (This could neither be verified nor contradicted in the RWSN study.)

Common quality problems now associated with treadle pumps are the use of thin gauge material for the cylinder, poor quality wooden planks, and incorrect welding. Kabirou Yahaha, a farmer near Matameye, believes the pumps currently being produced are not all as good as those produced in the days of PPIP I. He says although the pumps cost the same, they wear out faster than before. The pump manufacturers, for their part, complain about how the farmers use pumps.

Another regular complaint relates to the agents who help farmers apply for subsidies. They are said to push the prices of drilled wells down to unrealistic levels. Mounkaila Oumarou, a driller and pump manufacturer in Birni N'gaoure says, "US\$ 30 to US\$ 40 for a well is too little...the danger is that poor workmanship undertaken for that price will ruin the market for everyone." Ango Koumandawa, in Tibiri, has a set price below which he will not drill. As a result he has not drilled for a year. Both price-based competition and the role of agents were under discussion by PIP II in November 2005.

Risks: Water Quality and Water Resources

There are large numbers of traditional wells tapping shallow groundwater throughout the country. The water

table in the valleys, where most agriculture takes place, tends to be high. Stakeholders within Government, non-governmental organizations and donor organizations tend to think of water as either potable (for human drinking), or for crops and animals. Villagers are unlikely to make this distinction, and farmers use their irrigation wells for drinking water. Some people prefer drinking water from an 'irrigation' tubewell than from a cement-lined hand-dug well while some farmers even carry home water from the 'irrigation wells'. Many stakeholders voice concerns regarding the quality of drinking water and the quantity, or sustainability of agricultural water from shallow groundwater sources.

Many professionals believe that the superficial sandy deposits, which

contain most shallow groundwater in Niger, hold dirty unfiltered water. Some consider this water to be little better than surface water in terms of faecal contamination. There is concern that the use of fertilizers and pesticides, combined with soils with high infiltration rates, means that shallow groundwater may even be polluted with chemicals. Household water treatment may provide a solution to some of these concerns, but these concerns cannot simply be ignored. This is particularly the case as new markets for hand-augered wells are being exploited by drillers themselves.

Very little systematic work has been undertaken to verify or substantiate water quality concerns. Many shallow hand-dug wells are considered by Government to be 'modern' water points. Hand-dug wells may provide



Cutting well screen on site

significant quantities of water, but this does not address the issue of water quality. On the other hand, a spokesperson from the Local Government Hydraulic Department comments that “[Government] asks people not to drink the garden water by providing them with deep wells.” Clearly, there are contradictions.

Another concern is the overuse of groundwater. Thousands of hand-augered wells are being used for irrigation. Although the Tarka Valley is recharged by annual rains, the sheer number of people practising small-scale irrigation has raised concerns, and some parts of the area, such as Tesaou, have already experienced falling water tables. Fortunately, the suction capacity of the pumps being used is self limiting. The Government, PIP II and UNDP are all monitoring water levels. Considerable research and reliable data is required to analyze the risks associated with water quality and water resources.

Conclusions

Research findings

This brief survey has shown that hand-augered wells fitted with very low-cost water-lifting devices are a viable water source for both domestic and agricultural water supply in parts of Niger. Despite their poverty, thousands of households have been willing and able to pay for the construction of these wells and simple lifting devices for their fields and homes.



Yahaya Abdu (Balleyara) demonstrates drinking from his 'irrigation' well

The findings point to the need for countries to invest in the early stages of developing and testing the technologies within specific localities, building the skills of independent drillers and pump manufacturers, and supporting market development. In Niger the private sector, in the form of local enterprises developing and introducing water-supply technologies, provided an engine for economic growth. The essential components were committed enterprises, sufficient incentives, and adequate external support for the development, improvement and demonstration of the market potential of the technologies.

Way forward and recommendations

Reflection on Niger's history of hand-augered wells illustrates that once sufficiently proven, the skills of drillers and pump manufacturers should be built up to catalyze the process of market development. To develop markets, it has been important to be able to offer a choice of hand-dug wells, hand-drilled wells, and a range of lifting devices.

There is considerable potential for hand-drilling technologies that can penetrate harder formations and drill to greater depths, and for corresponding water-lifting technologies. Hand percussion drilling and rope pumps could provide water to numerous small communities in Niger, which are currently not included in Government plans. These technologies could also benefit other countries in sub-Saharan Africa.

Donor and government organizations are encouraged to invest in the development of technologies that can be manufactured and marketed locally. A gradual process is required whereby needs are understood and local capacity is built. The matter of whether to provide support in the form of credit or subsidies needs careful consideration to avoid the creation of artificial 'project driven' markets.

Finally, water quality and water resource concerns need to be carefully researched, taking into account the fact that people often use the same water supply for both drinking and farming. The potential for contamination of shallow groundwater from excreta disposal, fertilizers and pesticides, needs to be thoroughly examined. If more motorized pumps are used, the danger of over-exploitation and depletion of shallow groundwater resources should be investigated.



Fetching water from a cement-walled well

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The Water and Sanitation Program is an international partnership for improving water and sanitation sector policies, practices, and capacities to serve poor people



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