



case study

## Sustainable transfer of manual well drilling to the private sector in Niger

**PRACTICA**  
FOUNDATION

unicef 

  
EnterpriseWorks/VITA

### EXECUTIVE SUMMARY

This case study examines the impact of professional manual drilling operations on the access to potable water. For many years there was the lack of a coordinated effort and continuity of approach, which slowed the emergence of the manual drilling sector. The development of the private manual well drilling sector was encouraged by three large small-scale irrigation projects funded by the World Bank and the European Union. There was, however, no spontaneous transfer of manual drilling from the irrigation sector to the rural water supply sector. Advocacy of the methodology by UNICEF has demonstrated how manual drilling can complement other methods of supplying water to rural communities. UNICEF has funded several demonstration programs and the mapping of areas suitable for manual drilling in Niger. For a professional manual drilling sector to further develop in Niger there remains a need to simultaneously upgrade the technical ability and management efficiency of the drilling enterprises and to integrate a new cadre of quality control companies into manual drilling activities. Critically important for the completion of successful and sustainable rural water supply programs are improved training and follow-up for water users and a viable supply chain for pumps including maintenance. This applies throughout the rural water supply sector and is not restricted to manual drilling activities.

### BACKGROUND

Niger is an arid country whose northern two-thirds lie within the Sahara Desert. Water is one of the country's most pressing needs, particularly in rural areas. According to the Joint Monitoring Program (2008), 68% of Niger's rural population, more than 7.7 million people, are getting their water from unimproved sources. In many parts of the south, where the population is concentrated, there are shallow sandy aquifers with good quality ground water that for centuries have been tapped using traditional hand dug wells to supply drinking water for people, livestock and gardening. With care these same aquifers can be tapped, using manual drilling techniques to provide low-cost safe water points. It is important to note, however, that in low capacity aquifers (high clay or silt content), large diameter dug wells provide a reservoir that recharges overnight and therefore may be more suitable than small diameter drilled wells.



Woman collecting surface water

Country statistics			
Size of Niger	1,267,000 km <sup>2</sup> (6th largest country in Africa) <sup>1</sup>		
Number of inhabitants	15,306,252 in 2009 (16th most populous country in Africa) <sup>2</sup>		
Average income	700USD GDP/cap/year <sup>3</sup>		
Population living below the world poverty threshold	63% <sup>4</sup>		
	In Niger	Urban population	Rural population
Access to water in 2006 <sup>5</sup>	42 %	91%	32%
Aimed access to water in 2015 (by the Government) <sup>6</sup>	78%	85%	60%
MDG target access to water <sup>7</sup>	71%		

<sup>1</sup> <https://www.cia.gov/library/publications/the-world-factbook/geos/ng.html>

<sup>2</sup> <https://www.cia.gov/library/publications/the-world-factbook/geos/ng.html>

<sup>3</sup> <https://www.cia.gov/library/publications/the-world-factbook/geos/ng.html>

<sup>4</sup> <https://www.cia.gov/library/publications/the-world-factbook/geos/ng.html>

<sup>5</sup> WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, 2008

<sup>6</sup> Rapport sur le Progres vers les Objectifs Millenaire pour le Developpement Niger 2003

<sup>7</sup> Based on WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, 2008

## Story of Manual Well Drilling

In Niger manual well drilling until recently has been predominantly used for irrigation wells. It is only within the last 5 years that there has been a major effort to move the technology into the drinking water sector.

### First Wave

The first recorded hand drilled wells in Niger were installed in 1963 by Richard Koegel at a Farmer's Training Centre in Maradi. From this single installation, the idea spread and another 15-20 wells were drilled by Peace Corps Volunteers and missionaries using the tools built by Koegel.

### Second Wave

In the 1970s Peace Corps volunteers in Niger introduced manual drilling in Balleyara. The activity was dependent on the presence of the volunteers, who organized the work and the supply of materials, and who provided the initial financial subsidies. These subsidies were gradually eliminated over a three year period.

In 1987, twenty years after Koegel left Niger, and 10 years after FAO published Self Help Wells (Koegel, 1977) containing descriptions of manual well drilling techniques, Lutheran World Relief (LWR) reintroduced manual drilling to Niger. LWR's goal was to develop a system that would use locally fabricated tools and train local well drillers to install wells for farmers at one-tenth of the cost of a concrete well. LWR was successful in developing locally made lightweight tools that, at less than \$200 per set, were inexpensive and well adapted to Niger's sandy soils. However, although the wells were much less expensive than the alternative, they proved to be too expensive for many farmers, who continued to rely on large open pits that barely penetrated the sandy aquifers.

At the time, PVC well casing was only available in Niger either through large drilling projects or as recycled material in the local scrap markets. LWR began placing orders for well casing to be imported from Abidjan via local merchants. This was meant to encourage the merchants to maintain a stock of casing so that it would be available for the well drillers. A local manufacturer of

well drilling equipment was trained so that tools would be available for an expansion of the initiative and to replace broken or lost equipment. LWR continued to promote manual drilling and attempted to address constraints over the nine years (1987-1996) that it was active in the sector.

To encourage widespread adoption of the manual drilling techniques, LWR demonstrated the wells to technical staff from the Ministry of Water and Ministry of Agriculture and to other partners throughout the country. LWR prepared manuals and trained well drillers from the Tarka Valley Project and private well drillers in Balleyara and Magaria.

The Tarka Valley Project was a small-scale irrigation project in the Tahoua Region funded by the European Union from 1989-1997. They promoted manually drilled wells and motorized pumps for irrigated horticulture. By the mid-1990s, due to experience gained during this project, the Ministry of Agriculture accepted, hand drilled well construction as the norm for small scale irrigation.

### Third Wave

In 1997, the World Bank-funded Private Irrigation Pilot Project contracted EnterpriseWorks/VITA (EWV) to promote low cost irrigation technologies, including tubewells and treadle pumps, in Niger. EWV believes that sustainability can only be achieved if the private sector provides products at a profit for a price that users are willing and able to pay. After consideration of the farmers' incomes from their gardens and the cost of tubewells, EWV determined that a lower cost solution was required. Since the main cost of the tubewells was the imported well casing (125/140 mm) they modified the installation procedure so that the heavy wall well casing was used only as a working casing and the final casing used an inexpensive 110 mm diameter PVC drain pipe that was readily available in most urban centers. This reduced the cost of the wells four-fold to about \$50 for a 10-meter deep irrigation well. These wells were completed without sanitary protection around the top of the well.

The irrigation products were branded and promoted through demonstrations at markets or farmers' days, and through radio

and television advertisements. Eleven well drilling enterprises were trained and assisted to acquire manual drilling equipment on credit. More than 776 wells were drilled during the life of the project, with the majority of the wells being purchased directly by the gardeners. In an effort to establish a database for future reference most of these wells were tracked using GIS.

A recent study by Practica Foundation found records indicating that, since 1960, over 18,800 wells have been drilled by hand in Niger. This drilling has been carried out by a total of 42 well drilling enterprises. The data is presented in Table 1 below. This total does not include many private wells, which were not recorded in any database.

**TABLE 1. HAND DRILLED WELLS IN NIGER**

Project/Enterprise	Number of Wells	Period
<b>Irrigation Wells</b>		
Peace Corps and Lutheran World Relief	3,500	1960-1996
Tarka Project (PBVT)	3,500	1989-1997
Pilot Private Irrigation Project (PIIP)	776	1997-2002
ASAPI	46	2002-2008
PIP2	9,497	2003-2008
<b>Drinking Water Wells</b>		
EnterpriseWorks	147	2002-2009
Winrock	90	2007-2008
Entreprise Daouda	1,300	2005-2008

Sources: Study of low-cost boreholes. Practica Nov. 2008 and EWW project documents

An important factor in the large scale uptake of manual drilling for irrigation in Niger was the parallel introduction of a low-cost treadle pump. Having this locally made low-cost pump widely available encouraged farmers to invest in improving their water sources. The price of a treadle pump is less than one-quarter of the cost of a motorized pump.



Locally made hand drilling tools

## 45 years of manual drilling for irrigation - What have we learned?

The first wave of hand drilled wells in Niger is something that has been repeated in many countries around the world. An NGO or individual with a specific goal transferred manual drilling technology as a means of reaching that goal. A few wells were drilled, and the effectiveness of the approach appreciated but there was little time and few resources to actively promote the idea outside the area in which it was initiated. Generally, all traces of those interventions disappeared, unless there was a written record, such as an associated published manual.

The second wave, characterized by an outside agency, such as an NGO, developing manual drilling in order to implement a program has also been repeated around the world. Usually the agency is the driving force, owning the tools, employing the well drillers, selecting the sites, sourcing the materials and providing the funding. Under this scenario, the activities continue until the funding ends. Since no one relies on this activity for their livelihood, there is little incentive to expand and frequently no incentive for the beneficiary to invest in their own water supply. If this phase continues for a long enough period, there are likely to be private sector spin-offs, as have been seen in Niger.



Hand Augering for Irrigation Well

Perhaps as many as 30 private sector well drillers trace their origins back to the Tarka Valley Project. While there was some private sector involvement in this project it was not sufficient to launch manual drilling into the mainstream of the water sector in Niger.

The complete integration of the private sector, which happened in Niger as part of the third wave, provides a “model” for development in other countries. It occurred because the goal of

capacity building and the sustainable transfer of technology was emphasized. Thus the focus was not limited to the installation of a certain number of wells or pumps. Success was viewed as being dependent on building the private sector's capacity and professionalism by providing the tools (both technical and managerial) and the knowledge to create and respond to demand. This approach relies on the willingness of consumers to invest in improving their lives when they are presented with the right product at the right price. Unfortunately, it requires resources and time that many donors are unwilling to commit since it is dependent on the provision of training and follow-up over a period of years. Many of the irrigation wells in Niger were paid for by the users, and hand drilled tubewells have become the product of choice for irrigation in Niger both by individuals and by donors. Well diggers report that there is little demand for hand dug wells because the tubewells are the preferred option. It seems that finally hand drilling has come into the mainstream in Niger after 45 years, at least for irrigation.

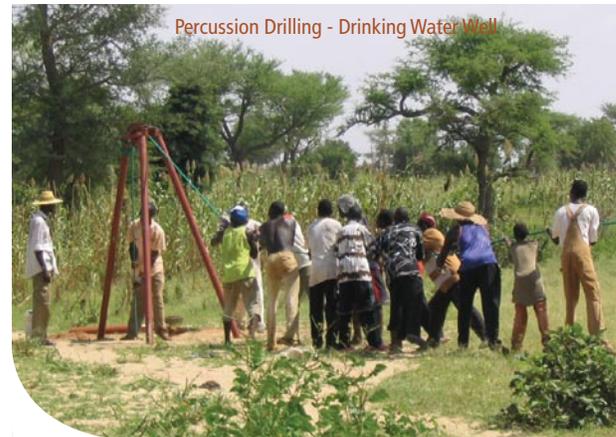
## From Irrigation to Drinking Water

In 2002 EWW had begun to work with four manual well drilling enterprises to build their capacity to address the need for potable water. While these enterprises were experienced in drilling irrigation wells they had neither the tools nor the training to drill deeper wells for drinking water. EWW implemented a series of capacity building projects with funding from a variety of donors including: AGFUND, UNICEF, World Bank, US Department of State and USAID. The goal was to improve these enterprises' capacity to drill deeper wells in a wider variety of formations using alternative manual drilling techniques including: percussion, rota-sludge and jetting. To increase the professionalism of these enterprises so that they could respond to the demand from donors, NGOs and the private sector they received additional training. This training, in hydrogeology and good manual drilling practice was conducted by Practica Foundation. In addition, business training was conducted by the National Center for Management Improvement (CNPG).

Based on EWW's experience of the advantages of installing locally made treadle pumps in manually drilled wells constructed for irrigation, a locally made rope pump was introduced for use in wells drilled for drinking water. By training two manufacturers to make these pumps it was ensured that a low cost, locally made pump would be available for deeper (25 m) drinking water wells. The rope pumps have proven to be popular with small communities and also with individuals who either want a drilled well in their compound or to have a pump on an existing dug well.

The benefits of manual drilling for the provision of improved drinking water supply remain relatively unrealized. For this reason it is important to increase awareness of how manual drilling complements other rural water supply methods. This is essential in order for it to become widely accepted as an option

for water supply in Africa. In 2006, the Rural Water Supply Network (RWSN) invited manual well drillers to their international conference in Accra Ghana to share their experiences. In 2007, USAID funded a manual drilling workshop in Niger. This brought together international manual drilling experts and local well drilling enterprises for 10 days to exchange ideas and explore improvements in manual drilling techniques. This was followed by a field visit and seminar organized by the Ministry of Water and financed by UNICEF to examine the experiences with low cost options for water supply including hand drilled wells and rope pumps.



These interventions have raised the profile of manual drilling for drinking water wells in Niger. They have also improved the capacity of four drilling enterprises to drill wells, and have provided drinking water for more than 36,000 people. However, a piecemeal approach of this sort is not considered the best way to develop a professional manual drilling sector. Efforts are being made to engage Government and to initiate a program, funded for 3-5 years, with the goal of building a professional manual drilling sector in the country. It is necessary to have enough time and resources to provide training and ongoing back-up for drillers, quality control personnel and communities. Experience has shown that training alone is not sufficient to transfer knowledge, follow-up in the field is essential. In addition, branding and product promotion are key elements in establishing sustainable markets. All of these cannot be easily accomplished through a series of 6-12 month projects, each focused on the installation of a small number of wells.

## Current Situation in Niger

Niger is not on track to meet the MDG drinking water target because coverage in 2006 was more than 10 per cent below the rate needed for the country to reach the MDG target, and the 1990-2006 trend shows decreasing coverage. The latest inventory of water points for smaller rural villages is given below in Table 2.

In many of the areas where concrete wells have been constructed, manually drilled wells would be feasible.

**TABLE 2. SITUATION FOR DRINKING WATER WELLS IN NIGER IN 2008**

	Concrete Wells	Boreholes with Handpumps
<b>Situation for Drinking Water Wells for Small Communities</b>		
Agadez	632	108
Diffa	1 021	55
Dosso	2 193	1 747
Maradi	4 185	1 136
Tahoua	2 689	622
Tillabéri	2 121	2 282
Zinder	1 810	3 410
Niamey	90	113
Niger	14 741	9 473

Source: Ministère d’Hydraulique Niger 2009

There are currently almost 50 manual drilling enterprises in Niger drilling wells primarily for irrigation. Manual drilling has become accepted by both farmers and the Ministry of Agriculture as the norm for shallow irrigation wells in areas where the water table is within 6-7 meters of the surface. Some of these enterprises also drill wells for households and for communities.

There is neither a certification procedure for manual well drillers nor any formal quality control structure in Niger. Thus, unless the organization that hires them provides quality control, there is no assurance that these enterprises are providing good quality water. In terms of mechanized drilling capacity there are 3 drilling companies with more than 50 employees and 6 drilling enterprises with less than 50 employees, all having their own drilling rigs. There are 5 companies that have the capacity to respond to tenders for large drilling contracts that may require the ability to drill up to 200 m, necessary in some regions in Niger.

One of the concerns expressed by Water Ministry personnel in Niger is the need to ensure that everyone understands that manual drilling alone cannot achieve the MDGs and is ineffective in solving water supply problems where water tables are very deep or where water is found within or below hard rock. A second concern is that donor funding will be attracted to this cheaper solution, and that areas having more difficult hydro-geological conditions will be neglected. From the donors’ point of view, manual drilling can increase the impact for a given budget. However there remain many areas in Africa where manual drilling is not feasible. In order to delineate the favorable zones UNICEF is currently mapping the feasibility for manual drilling in 20 countries in Sub-Saharan Africa. This will provide countries and donors with a better understanding of the options and will provide a basis for the rational allocation of resources.



Well with rope for small community

Manual drilling in Niger for drinking water is still considered to be in a test phase, although it has become the norm for irrigation wells. For this reason there has not been a formal acceptance of the method by the Niger government, who want to monitor the quality of the water and the durability of the installations before deciding on the inclusion of manual drilling in the national water sector strategy. In Niger there is no specific set of standards applicable to manually drilled water wells. Consideration must be given to either the application of the mechanically drilled well standards or the development of specific standards for manually drilled wells. The specifications from a tender for mechanically drilled wells issued by the African Development Bank are presented in Box 1.

### Box 1: Specifications Mechanically Drilled Boreholes (tender document)

#### Sedimentary formations

- Discharge >1.0 m<sup>3</sup>/hr for handpumps
- Diameter of the borehole 311 mm
- Diameter of the casing 120/140 mm
- Drilling log must be maintained
- Filter pack composed of silica sand 1-3 mm dia.
- Clay seal thickness of 1 meter
- Cementing of top of well to a depth of 2 meters
- Casing extends 0.50 m above the surface
- Casing top closed with a locking metal cover
- Average depth of these wells is estimated at 160 m
- Development by pumping until water is clear, average time 6 hours, maximum quantity of sand 1 cm diameter in the bottom of a 10 liter pail
- Pump test 6 hours (4 hrs pumping 2 hrs recovery)
- Water Quality Analysis pH, Conductivity, Na, K, F, Ca, Mg, Mn, Fe (total), As, HCO<sub>3</sub>, SO<sub>4</sub>, Cl, NO<sub>3</sub>, NO<sub>2</sub>



## A Well Driller's Story

Idrissa Hamikane first learned to drill wells in the 1970s when Peace Corps volunteers came to his village of Balleyara. The volunteers provided the tools and the pipe for the well casing and Idrissa and his crew provided the labor. He continued drilling wells and worked with succeeding waves to learn new techniques and share his experience. Almost 40 years later, he is still drilling wells but complains that donors are giving away wells for irrigation through contracts with Niamey based well drillers, so his market with the farmers has dried up.

## Lessons Learned in Niger

- Close collaboration is needed with the Ministry of Water to address understandable concerns and reluctance to adopt manual drilling until it proves effective and safe.
- Non-professional installation of wells by uncontrolled operators may pose risks for the population and for the aquifers.
- The monitoring of water quality and acceptance of all water points, including manually drilled wells, is dependent upon quality control supervision during installation and adequate community mobilization and follow-up.
- Small isolated drilling projects, while important for demonstrating the technology, are not extensive enough to build a national consensus on the acceptability of manual drilling.
- Independent quality control mechanisms are needed when operators are contracted by agencies without the capacity to provide a rigorous control.

- Capacity building does not happen spontaneously, it needs to be the primary program objective.
- Building a sustainable professional manual drilling sector requires capacity building for seven complementary aspects of the sector: tool making, manual drilling, quality control, pump supply, water user training, business management and promotion and marketing.

## Moving forward in Niger

Niger is far ahead of many countries as there are already almost 50 experienced well drilling enterprises in the country. These enterprises can be provided with training, improved tools and coaching to upgrade their skills to improve their capacity to drill high quality drinking water wells. This training will need to be integrated with capacity building in quality control for Water Ministry personnel and private quality control structures.

In addition there is a real need for improved water user training to ensure sustainable management of water points through long term capacity building for community based water users associations. Too often these structures are trained and then left on their own with no support to help them to deal with the inevitable conflicts that arise in the management of a community resource.

In order to have a professional manual drilling sector in Niger there is a need for a long term, strategic intervention to:

- Provide training and tooling for well drilling enterprises
- Ensure that pumps are available and that communities have the means to ensure their on-going operation and maintenance
- Develop with the Ministry of Water a national well standard for manually drilled wells
- Work with NGOs, Communities, and Donors to ensure that quality control mechanisms are in place for all wells drilled for potable water
- Ensure that there is an adequate mechanism for data reporting so that all new water points are recorded in the national data base
- Provide certification of drillers which would facilitate the sanction of un-certified businesses
- Develop branding to be used by certified drillers
- Educate the public concerning the advantages and constraints of manual drilling
- Promote manual drilling at all levels to encourage communities and individuals to consider purchasing their own water points directly (as is currently the case for irrigation wells).

## Conclusions

From the long history of manual drilling in Niger we can see that there are two conditions that are critical for the introduction of manual drilling: favorable hydro-geological conditions and a government that is willing to consider manual drilling as a valid methodology. Other essential conditions include:

- The availability of suitable material for well casing
- Knowledge of appropriate manual drilling techniques
- A motivated and entrepreneurial private sector
- Substantial demand for wells either by private individuals or by villages and donors
- Support from the government for the creation of a professional manual well drilling sector
- An adequate donor support timeframe (3-5 years) for the necessary technical/business training, promotion and consumer education
- Training capacity for well drilling enterprises in hydro-geology, well installation, well development practices, pump installation and maintenance

Additional, but perhaps not essential factors that have favored the mainstreaming of private sector well drilling in Niger include the availability of financing for well drillers to obtain the drilling equipment, training for users in the operation and maintenance of pumps, and the production of technical manuals for well drillers, decision makers, and consumers. In addition the availability of appropriate low cost water lifting devices such as bailers, treadle pumps and rope pumps has been important.



It is important to provide an environment where small well drilling enterprises can emerge and thrive. Factors that can adversely affect small businesses include the competition from organizations that are providing highly subsidized wells and policies that favor large drilling companies over local manual well drilling enterprises.

The lessons learned in Niger can be used by other countries to mainstream manual drilling as a means of providing more people with improved water sources. Indeed, by learning from the experience of Niger the time needed to develop a sustainable capacity in the private sector can be significantly reduced.



## Acknowledgements

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UNICEF, Practica and Enterprise Works/VITA have developed a toolkit for African countries wishing to embark on the professionalisation of manual drilling. This toolkit includes Technical Notes, Technical Manuals, Advocacy Materials, Mapping of suitable areas for manual drilling, Case Studies, and Implementation and Training Manuals. This initiative builds the capacity of the local private sector in order to respond to the ever increasing demand for safe water in rural areas

## ADDITIONAL RESOURCES

- Technical Notes
  - The Case for Manual Drilling in Africa
  - Professionalising Manual Drilling in Africa
  - Selection of Well Construction Methods
  - Manual Drilling Techniques
  - Mapping the potential for manual drilling
- Understanding Groundwater & Wells in manual drilling
- Technical manuals on the drilling methods: Rota sludge drilling, Hand Augering, Manual Percussion and Jetting.
- Mapping of the Potential for Manual Drilling (Chad, Madagascar, Niger, Sierra Leone, Central African Republic, Mauritania, and Togo are in process).
- Chad Case Study
- Professionalising the Manual Drilling Sector in Africa to increase access to safe water in rural areas
- The RWSN hand drilling cluster group, see the website [www.rwsn.ch](http://www.rwsn.ch)

*These materials are available on the UNICEF website, [www.unicef.org/wash/index\\_watersecurity.html](http://www.unicef.org/wash/index_watersecurity.html); Practica Foundation, [www.practicafoundation.nl](http://www.practicafoundation.nl) and Relief International/EWV, [www.enterpriseworks.org](http://www.enterpriseworks.org)*

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