

# The Importance of Manual Drilling in Africa

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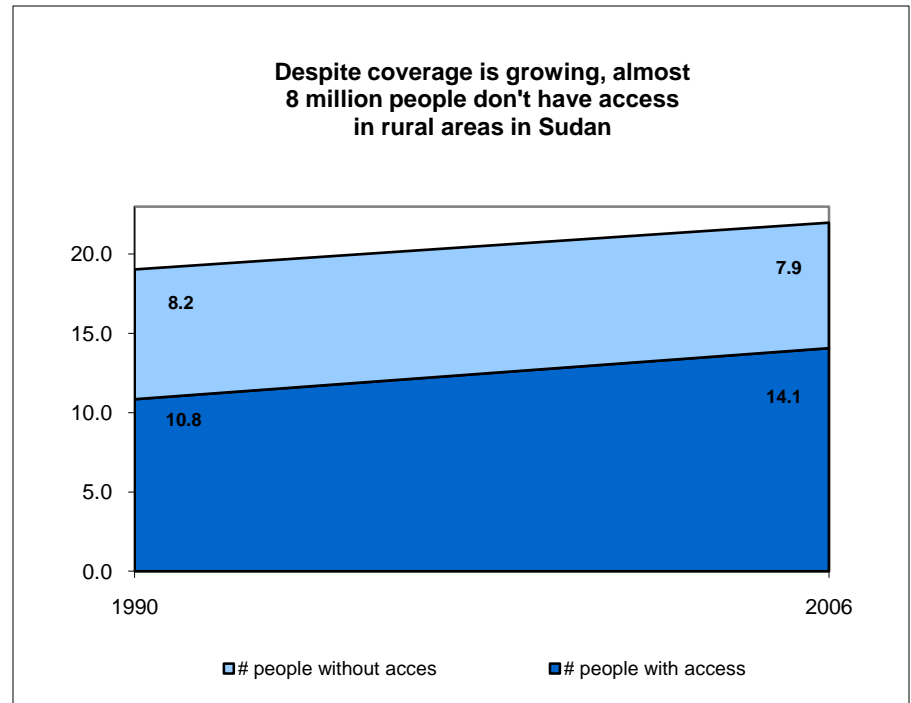
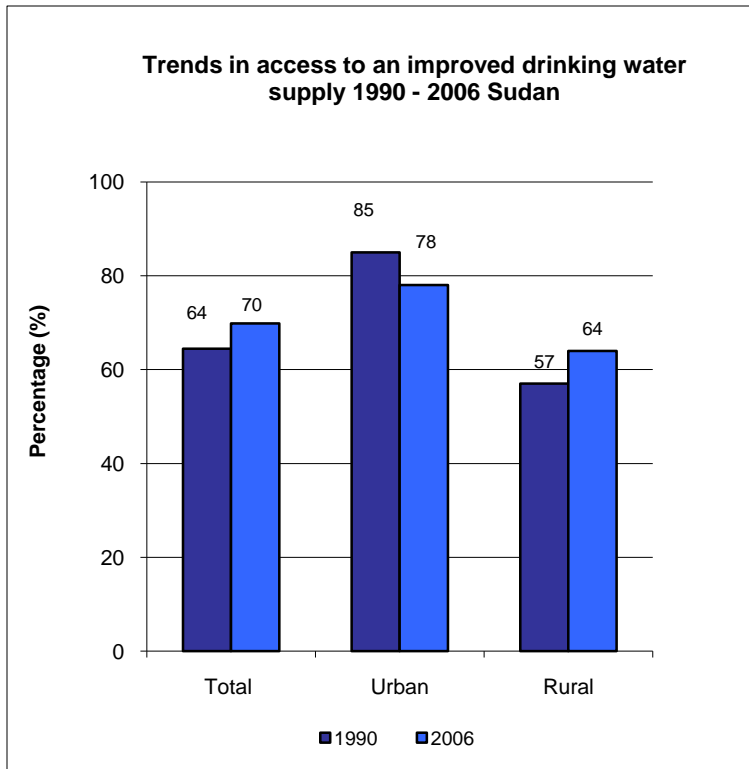
Presentation made at the National Workshop on Cost-  
Effective Boreholes in Khartoum, Sudan, November 2009

# Why is manual drilling important for Africa?

- Cost effectiveness option: with the money for doing a machine drilled borehole it's possible to drill 7-10 manually if geological conditions are good
- Empowers the local private sector
- Ready-to-go in emergencies and in difficult areas (light equipment in a pick up truck)
- Suitable for both drinking water and irrigation



# The challenge in Sudan



- The projections for 2015 are that Sudan will have >45 million people, more than 49% leaving in rural areas
- Although 9.6 million people gained access between 1990-2006, the number of people without access increased until 11.4 million during the same period
- In 2006, the 70% of people without access leave in rural areas
- To meet the MDG, **11.2 million people need to be served before 2015**

# UNICEF Experiences in Africa



- Chad
- Senegal
- Niger
- Madagascar
- DRC
- Togo
- Others preparing

**High potential in other areas, specially dry areas like Sahelian countries, sand areas (coast, rivers, etc)**

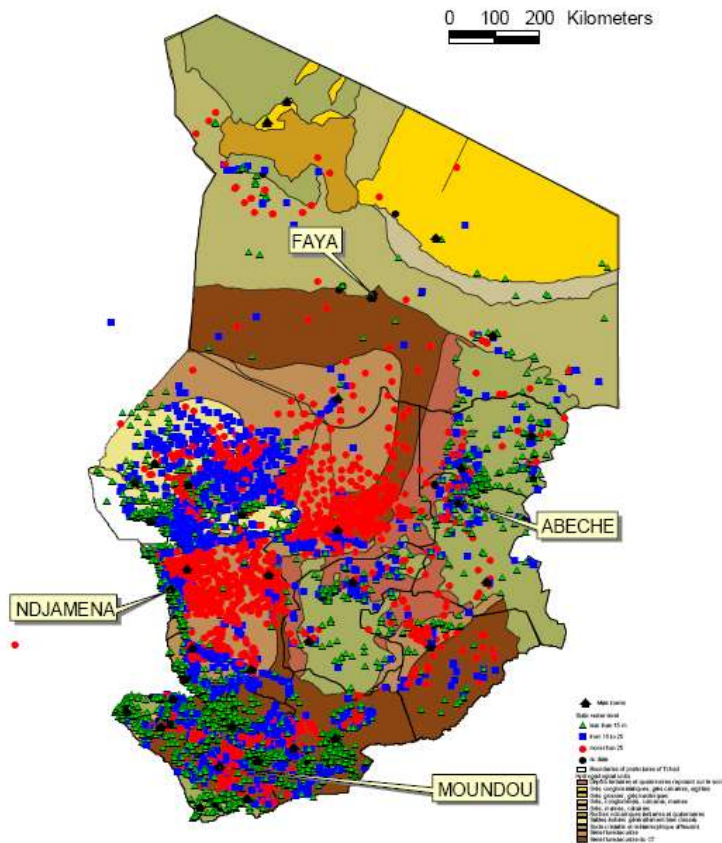
# Support the initiative

- Prepare materials that can be useful at
  - Global level for advocacy
  - Country level for implementation in order to professionalize the local private sector
- Build partnership
  - Expert Organizations: EWV & Practica Foundation
  - Other agencies to adopt this perspective



# HQ/RO support for materials (1)

Mapping the potential  
for manual drilling (Target audience: Countries, Governments, Donors)



## WCARO

- 1- Sierra Leone
- 2- Benin
- 3- Cote Ivoire
- 4- Guinea Bissau
- 5- Cameroon
- 6- Liberia
- 7- Niger
- 8- Senegal
- 9- Burkina Faso
- 10- Mali
- 11- Nigeria
- 12- CAR
- 13- Guinea
- 14- Mauritania
- 15 - Togo
- 16- DRC

## ESARO

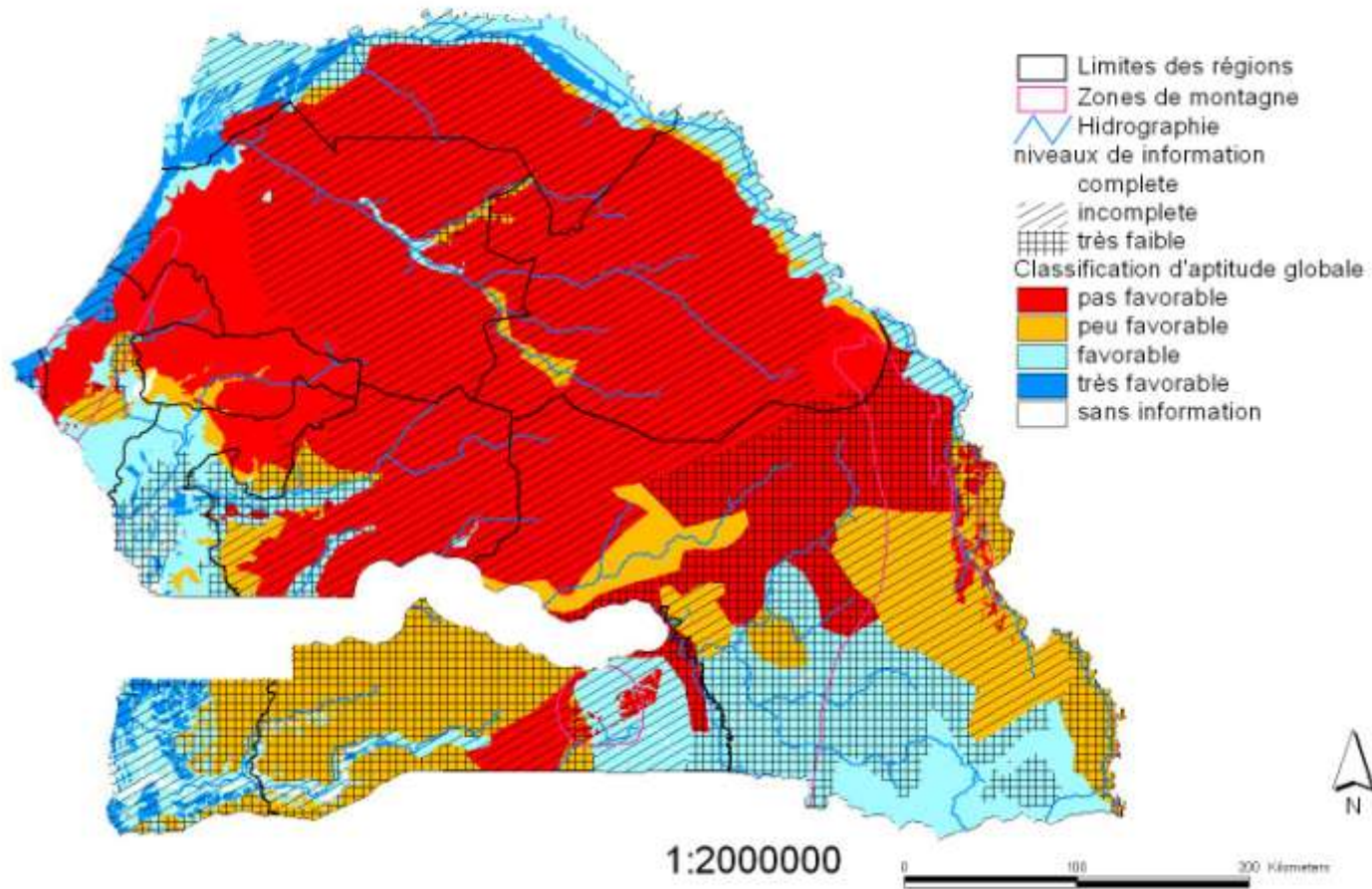
- 17- Madagascar
- 18- Burundi
- 19- Tanzania

## MENA

- 20- South Sudan

# Senegal suitability for manual drilling

SENEGAL  
CARTE D'APTITUDE GLOBALE AUX FORAGES MANUELS





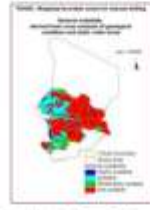
# HQ/RO support for m

# Professionalizing Manual Drilling in Africa

## Mapping the potential for manual drilling

### Overview

The potential for manual drilling is being mapped in 10 countries based on available data including hydrogeology, satellite imagery, and population density. This will provide a clear indication of the countries with the highest potential to benefit from the 4 to 10-litre per second hand-dug wells that can be installed in arid and semi-arid areas to supplement other conventional means of providing safe water.



**Partnership with Pratica Foundation and EnterpriseWorks/VITA** (PRACTA) and in partnership with several countries to conduct a study for African countries aiming to establish the professionalization of manual drilling. This initiative includes the capacity of the local private sector to deliver to the market the most promising demand for safe water in each area.

**First steps in the mapping process** include: identifying the steps to identify feasible areas, the capacity for manual drilling, the main types of soils, vegetation and climate, and the hydrogeological data. Steps are done at national level in order to have an initial knowledge of manual drilling potential and hydrogeological data. Local-level data from drilling techniques is gathered to define the most well-suitable areas to increase the probability of safe water for the local population in arid regions.

With the support of the Government (Ministry of Water Resources) key informants are identified as

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 UNICEF: [unicef@unicef.org](mailto:unicef@unicef.org)  
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 Pratica Foundation: [pratica@praticafoundation.org](mailto:pratica@praticafoundation.org)

## Selection of Well Construction Methods

### Overview

For the construction of safe groundwater points different well construction methods exist. Wells can be drilled with machines, drilled manually or dug by hand. Before selecting the most appropriate method, several criteria should be assessed.

### Selection Criteria

Shallow drilled wells are very high in quality, but also very expensive. The cost of a machine drilled well varies between countries and will generally be



Manual drilling

In the range of US\$ 5,000 – 15,000 for a 30-meter deep well. Hand dug wells are very useful in formations with low permeability due to their capacity to store water which will evaporate. However, the total yieldability may be low. Hand dug wells tend to a wide range of cost and quality categories. In some countries hand dug wells are dug in dry wells and dry lines. These have a very low yield (US\$ 100) and a very low yield. When a hand dug well is dug in a permeable layer and lined with concrete rings, the yield will be high, but the price will come close to that of a machine drilled well.

In many countries manual drilling techniques are still used up to 100 meters. Costs of 30-meter deep wells vary from about US\$ 1000 – 2,500, depend-

ing on geology, locality and application (such as irrigation wells or high quality community wells for potable water).

### Going to scale

As mentioned above, machine drilled wells are very high in quality and a good way to construct safe water points. The large communities and good water supply systems. However, the investment cost for an enterprise to produce additional waterlines is high (minimum a US\$ 100,000), making difficult to rapidly scale up the capacity to the local private sector.

In the case of manual drilling and digging, much less expensive tools are required, making the most investments US\$ 5,000 to an enterprise to enter the market or to expand capacity much easier. In addition, the drilling time required for manually



Machine drilling

drilled wells (1 day – 2 weeks) to much less than the time needed to construct a hand dug well (1-3 months). These different barriers make manual drilling an attractive option, where the hydrogeology is suitable, with a very high potential to scale up the capacity of this sector.

### Overview

The goal of this initiative is to develop a professional private manual drilling sector in at least 10 countries in Africa. Starting with an assessment of the potential for manual drilling to expand the networks and the development of the tools required for building the private sector capacity. This program will require technical assistance in form of training to professionalize the private sector so that they can respond to the demand for safe water from governments, donors, villages, and individuals.

### Mapping the Potential for Manual Drilling

The potential for manual drilling is being mapped in 10 countries based on available data including hydrogeology, satellite imagery, and population density. This will provide a clear indication of the countries with the highest potential to benefit from the 4 to 10-litre per second wells that can be installed in arid and semi-arid areas to supplement other conventional means of providing safe water.

### Implementation and Training Manuals

Manuals are being developed that provide the best practices to local country offices to implement and scale-up the local capacity to provide the manual drilling sector. A general 'implementation manual' for professionalizing the manual drilling sector, possibly the major tool, will be developed and distributed through manual drilling. Consultants and local staff will be trained in the manual drilling techniques, including drilling and manual production, business planning, and marketing. Training materials will be developed in French, English, and Spanish.

### Promotional and Advocacy Materials

Documents are being produced to increase awareness among citizens, governments, representatives and communities of the benefits and benefits of manual drilling as a means of supplementing the other formal WSSs. The materials will include water studies, flyers, posters, and videos.

### Country Level Activities

Using the implementation guide and the technical manuals, countries will be able to assess the existing capacity of enterprises and organizations in the manual drilling sector (e.g. drilling, quality control, business development, etc.) and assist in the professionalization of manual drilling. This will include a clear indication of the countries with the highest potential to benefit from the 4 to 10-litre per second wells that can be installed in arid and semi-arid areas to supplement other conventional means of providing safe water. In addition, technical assistance for wells and the inclusion of manual drilling as part of national water sector policy will be promoted.

### Contact for additional information:

UNICEF: [unicef@unicef.org](mailto:unicef@unicef.org)  
 EnterpriseWorks/VITA: [info@enterpriseworks.org](mailto:info@enterpriseworks.org)  
 Pratica Foundation: [pratica@praticafoundation.org](mailto:pratica@praticafoundation.org)

## Different manual drilling techniques

### Overview

When a borehole is drilled, different types of soil layers can be encountered. To drill through these different soil layers a range of manual drilling techniques have been developed and are used around the globe. In each case the drilling technique used is related to the soil conditions, the nature of the material from the hole, and the depth of the borehole. Therefore it may be necessary to use different manual drilling techniques in different soil conditions. Each drilling technique has been developed for a specific range of soil conditions. Therefore it may be necessary to use different manual drilling techniques in different soil conditions. Each drilling technique has been developed for a specific range of soil conditions. Therefore it may be necessary to use different manual drilling techniques in different soil conditions.



Hand-dug well

### Partnership with Pratica Foundation and EnterpriseWorks/VITA

PRACTA and the partners are currently preparing a guide to improve manual drilling in arid and semi-arid areas. This initiative includes the capacity of the local private sector to deliver to the market the most promising demand for safe water in each area.

### Hand Dug

The hand-dug well consists of a shallow hole dug into the ground. A number of different soil layers can be encountered in the hole and at the end of the hole. The water is collected into the ground through the hole. The water is collected into the ground through the hole. The water is collected into the ground through the hole.



Hand-dug well with concrete lining

A different type of well can be used for each soil type. The water table is the level of the water table. The water table is the level of the water table. The water table is the level of the water table.

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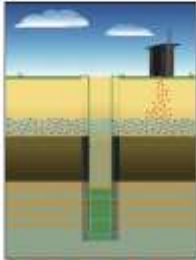


# HQ/RO support for materials (3)

| Communication Tools                     | Status         | Target Audience                      | Target Location              | Responsible for Preparation |
|---|----------------|--------------------------------------|------------------------------|-----------------------------|
| <b>Manuals</b>                          |                |                                      |                              |                             |
| <b>Guide for Country Implementation</b> | <b>Nov.09</b>  | UNICEF Country<br>Office Governments | National Meetings<br>-on One | EnterpriseWorks/VITA        |
| <b>Business training</b>                | <b>Nov.09</b>  |                                      |                              | EnterpriseWorks/VITA        |
| <b>Social Marketing</b>                 | <b>Nov.09</b>  |                                      |                              | EnterpriseWorks/VITA        |
| <b>Sources of Finance</b>               | <b>Dec.09</b>  |                                      |                              | EnterpriseWorks/VITA        |
| <b>Community participation</b>          | <b>June.10</b> |                                      |                              | Unicef                      |
| <b>Ur</b>                               | <b>done</b>    |                                      |                              |                             |
| <b>Ro</b>                               | <b>done</b>    |                                      |                              |                             |
| <b>Ha</b>                               | <b>dec.0</b>   |                                      |                              |                             |
| <b>Jet</b>                              | <b>dec.0</b>   |                                      |                              |                             |
| <b>M:</b>                               | <b>dec.0</b>   |                                      |                              |                             |

**PRACTICA**  
FOUNDATION

Understanding Groundwater & Wells  
in manual drilling



An instruction manual for manual drilling teams  
on hydro-geology for well drilling, well installation and well development




**PRACTICA**  
FOUNDATION

**ETC**  
EFFECT

Rota Sludge  
&  
Stone Hammer drilling

Part one  
Drilling Manual



A. van Wieringen  
July 20th, 2005

[The complete manual consist of three volumes: this part 1 is the Drilling manual, part 2 is the manual for making the necessary equipment, called the Production manual) and part 3 is the hydro-geology manual.

**PRACTICA**  
FOUNDATION

**ETC**  
EFFECT

Rota Sludge  
&  
Stone Hammer drilling

Part two  
Production Manual



A. van Wieringen  
July 20th, 2005

This part two describes the production of the components for the Rota sludge and Stone Hammer manual drilling equipment as developed by PRACTICA foundation. For the correct use of the equipment please refer to part one, the Drilling Manual.



case study

## The impact of manual drilling for the construction of sustainable water-points in Chad

PRACTICA FOUNDATION

unicef

EnterpriseWorks VITA



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 problem of increasing the rate of delivery of improved water supply in Chad.

In the master plan of water supply and sanitation (2002) it was recognized that costly, mechanised drilling alone will not satisfy the water demand in all areas of the country. A decision was made, to actively promote manually drilled boreholes in those areas where such technology was appropriate to increase the coverage of improved drinking water supply in Chad.; This promotional work has, with the support of UNICEF, been implemented through the Ministry of Fishing, Pastoral and Rural Hydraulics. A key part of this strategy has included development of the capacity of Small and Medium Enterprises (SME's) to carry out such work and has further included a mechanism to monitor the quality of the works. This case study shows that effective use of manual drilling in Chad can be highly significant in helping to attain the Millennium Development Goals in the water sector. This is due to:

- favourable hydrogeological conditions in a large part of the country
- dense population within the favourable area
- an existing manual drilling market with plenty of potential for growth
- manually drilled water-points being 3 to 6 times cheaper than mechanically drilled water-points
- quality of construction being the same as water-points that were mechanically drilled
- the use of manual drilling enterprises is estimated to be able to increase the number of wells drilled per year from 750 to 2000- 2500
- manual drilling can be done in areas where accessibility for mechanical equipment poses problems
- significant benefits being available to the local economy if this initiative is used to its full potential

A potential barrier to success is the political instability of the country.

To reach the water sector MDG's established for Chad, it is important that donors and implementing organisations recognise and support manual drilling as a sustainable technological option. Furthermore, manual drilling is considered to have a similar potential in other countries in Sub-Saharan Africa, and may substantially contribute to their attainment of Millennium Development Goals.

### 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.

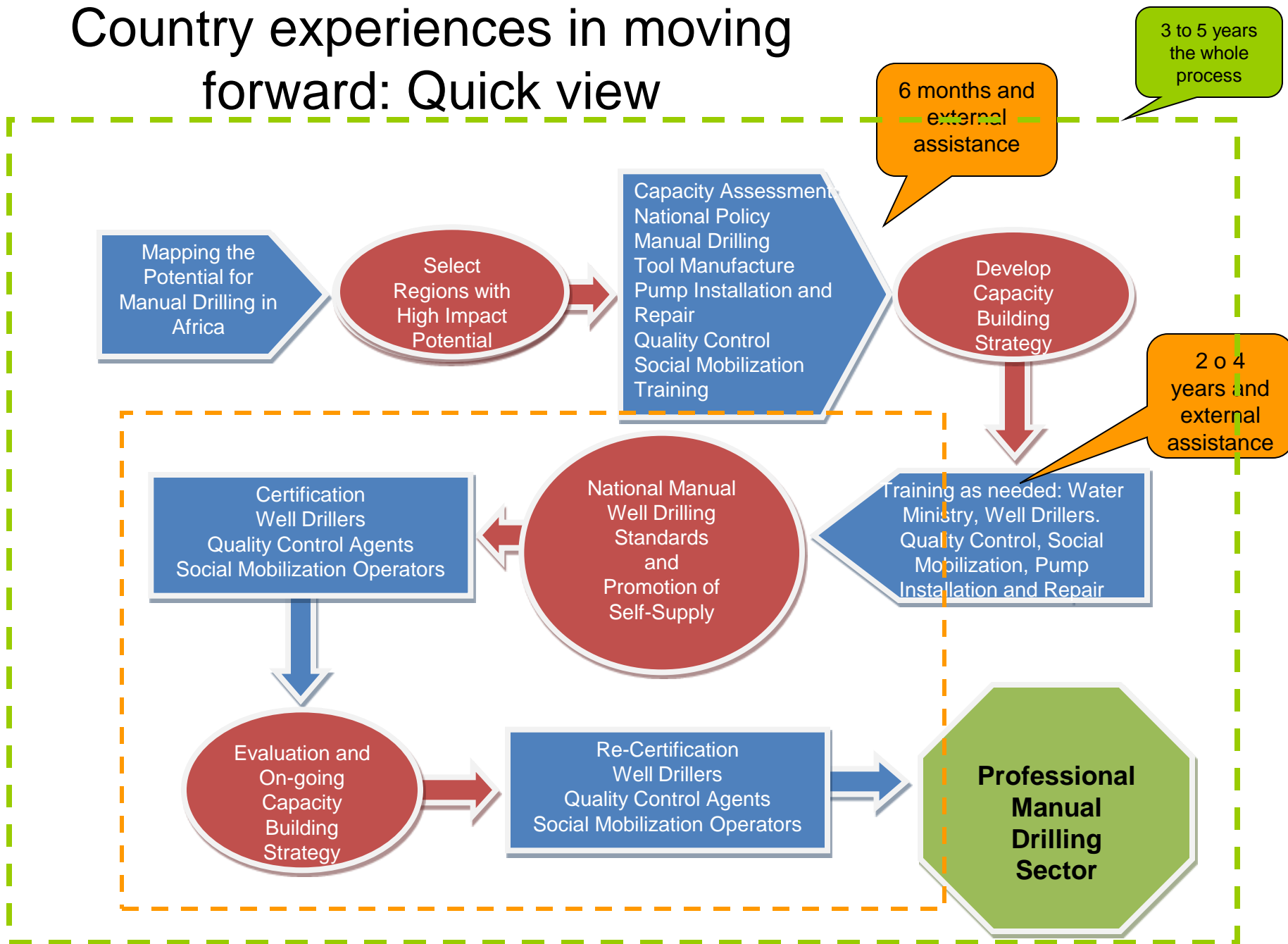
### BACKGROUND

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 experiences in moving forward: Quick view

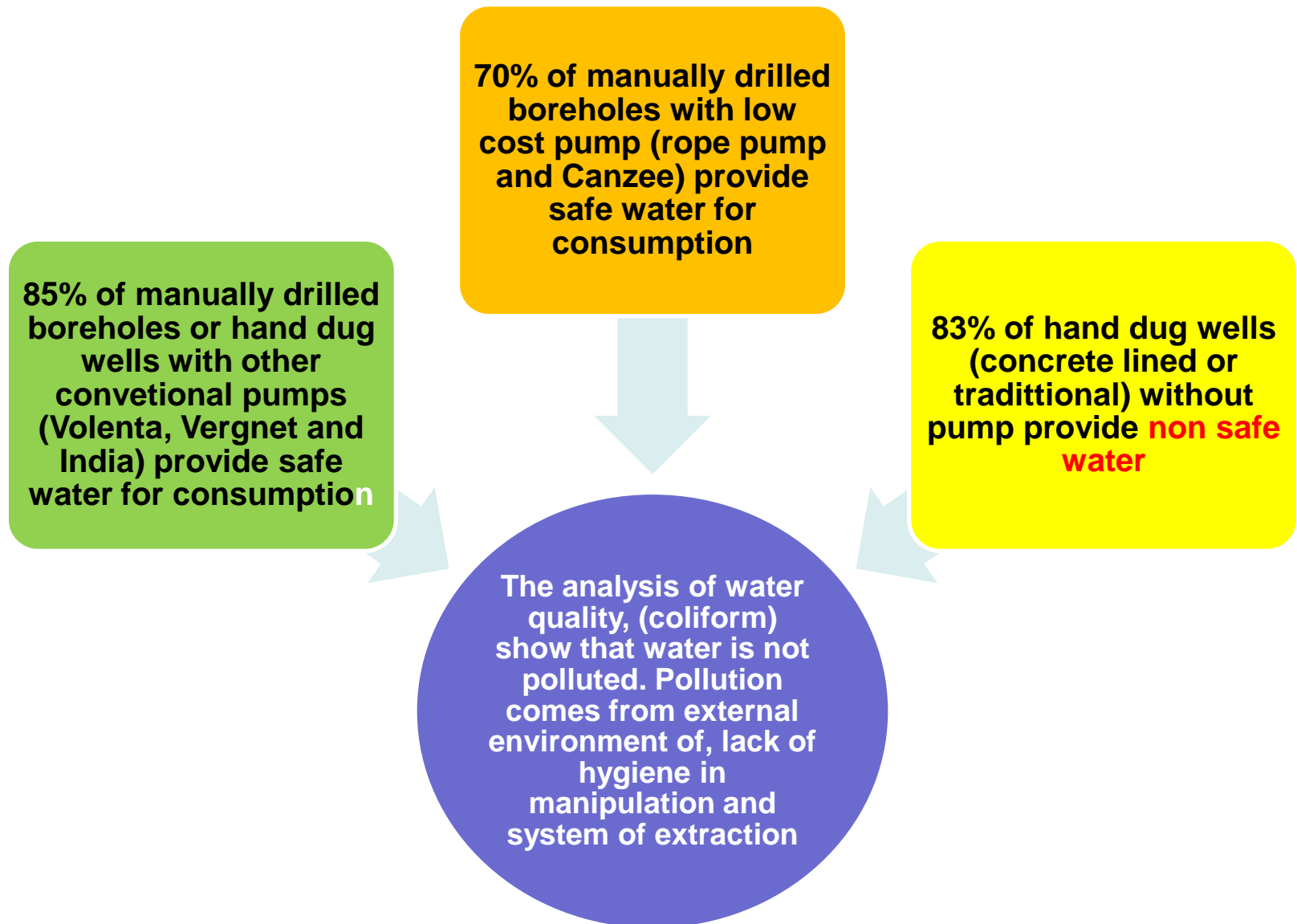


# Market Potential

## Chad: Present drilling market

|   | Mechanical drilling enterprises |
|---|---------------------------------|
| Approximate number of enterprises                                     | 10                              |
| Capacity per enterprise (in bore holes per year)                      | 75                              |
| Total capacity (in bore holes per year)                               | 750                             |
| Target group to date  | villages                        |
| No of people reached per water point (average assumed)                | 400 (for communal wells)        |
| Increase of number of people with access to drinking water (per year) | 300.000                         |
| Cost of a water point (in US\$)                                       | 10.000 to 20.000                |

# Water quality study in Niger



# Key concepts

- Strategies to adopt:
  - Suitable to use only in some areas, not everywhere
  - Complementary to mechanized drilling programs,
  - An option for rural areas
- Complete process: the local private sector is not going alone (mechanism for quality control)
- Conceptualize a capacity building (long) process and not 'only drilling' approach

[http://www.unicef.org/wash/index\\_watersecurity.html](http://www.unicef.org/wash/index_watersecurity.html)