

Cost Effective Drilling
Private Sector Perspective, North Sudan

In the past drilling operations had been carried out by sophisticated drilling rigs at high operating cost. The pumping system used was based on the reciprocating technology which has 4M³/HR at maximum by its design. The overall cost of a water yard was roughly 170.000-200.000 USD. In the early 1980 s after introducing light weight drilling rigs which resulted in reducing the cost of drilling to acceptable level average of 7000 -15,000 us/Boreholes in many African countries. The adoption of Unicef to develop India markII (the hand driven reciprocating pumping system which had been sponsored by Unicef giving the support and the free patent design of India Mark II pumping system which now the major pumping system worldwide at a very competitive cost giving chances to expand the coverage of rural water supplies.

It is estimated that in Sudan there is a need for 10.000-20.000 boreholes, as is the case in many African countries. Some studies shows that almost an average of 1000.000 Boreholes is needed to reach full coverage in Africa, if the idea of encouraging cost effectiveness of borehole water supplies to reduce the average cost by 10%, then a saving of approx 1 Billion will increase the coverage by 10 percent.

Hydrogeology: the productive horizons of safe drinking water is governed by the subsurface geology of the area and its geometry which is reflected in aquifer geological structure. In an anticline and syncline and if there are strike or dip valleys where these values can be measured correctly then it is much easy to identify where to locate drilling points for subsurface fluids be water or hydrocarbon .

And this will reduce the exploration cost of employing geophysical methods and the cost associated with the acquisition, processing and interpretation of the data. In crystalline basement groundwater occurs at fissured, fractured zone at the upper metamorphosed layers. By employing both remote sensing data to support other geophysical methods the cost can be reduced by increasing success rates.

In general rural water supplies is restricted to shallow productive horizons (50-120m) depths which facilitate employing light weight mud/Air Rotary and Cable tools drilling Rigs in clastic secliments and light weight DTH in basement complex. Although it is appropriate to use the hand pumps on (VL0M) but in cases of rich productive horizons in rich aquifer up to 14-18m³/HR from the existing 4" u.p.v.c cased well can be pumped which increase the converge by 14 folds as a potential tool for cost effective drilling, again combined pumps which use renewable solar energy (Day time) and the manual pumping at night and cloudy weather (Aquasolar) may be as an additional advantage towards more coverage.

Cost and prices break- down.

Is there any fight or conflict between the direct cost and a tendered cost (project owners and contractors)?

Components of cost estimate:

- 1- Mobilization and demobilization: Cost of rig movement and preparation of drilling sites (ready to drill) with all associated items, transport of material, personnel, the major elements of this cost are the depreciation cost of equipment, direct cost of moving equipment to site and the cost of man power.
- 2- Drilling operation : The actual cost of progressing drilling to the final depth at a specific diameter, where the cost is governed by type of rig, fuel, water consumption, other consumables and again the cost is governed by equipment depreciation and man power.
- 3- Supply and installation of casing, screen gravel pack, sanitary seal and concrete works for platform construction.
- 4- Development and pumping test: the cost of cleaning the well to flush the mud cakes in clastic sediment is a component that affect the cost of well drilling,

In high yield wells it is less expensive than in low yield wells while in basement it is generally cheaper except in dry sites where more efforts is needed to flush the well, a dry well in B.C is more expensive than a successful well. Therefore the components of costing should be considered for different low yield and high yield wells to reach a reasonable costing parameters taking into consideration the effect of each of the four items listed above .

The cost of drilling in lithified rocks (for 20 ft layer might exceeds drilling 10 boreholes in soft layers of average 260 ft depth) this is encountered in Elgazera 70km South of Khartoum.

Other elements for cost effectiveness:

- 1- Local manufacture of drilling components
 - a- Assembly of rigs will reduce the equipment cost by 30% .
 - b- Local production of casing and screen.
 - c- Local production of pumps and pumping system .
- 2- Exemption and incentive to be entrusted to reduce the cost of imported items.
- 3- Exemption from income taxes, VAT and other taxes at Federal and State Government level .

Hints and guidelines to reduce the cost of water supply in rural areas:

- 1- Total depth of drilling, diameters and type of casing, u.p.v.c reduce the cost rather that to use steel casing (K-type, KV & KV extra), reducing the total depth and the diameter is very important (up to 14-18m³/HR) from 4" u.p.v.c is possible to be considered as another approach for cost effective drilling.

- 2- Employing light weight rigs will reduce the overall cost based on the design and durability
- 3- For each contractor (single), a multiple and cluster of boreholes should be allocated in the same vicinity to have a considerable reduction mainly in logistic direct cost (mobilization, management) etc.
- 4- **Training of hydrogeologists, geologist, ground water engineers** to supervise the drilling operation based on the knowledge of subsurface geology, lithology and mineralogy to avoid failure of borehole design due to lack of sufficient water or unfit water, to ensure lithological description data base to exchange with concerned authorities (GRAS). If borehole logs, completion reports, testing pumping data are compiled, Then it might lead to a better understanding of the subsurface geology to lay master plans for future developments. An improvement in the knowledge of the hydrogeology of any area will increase the success rate by reducing dry drilling, avoid drilling to greater depths which has a direct relation to costing components of well drilling, reduce the cost and minimize the idle time. Eventually it might lead to better quality production and reduction of cost.

Vocational training to train drilling technicians:

(Hands on machine) In India thousands were trained from people who had no chance to complete any type of schooling but many of them reaches an average of 3-4 wells per week and in few years some of them reaches a level of 4000-5000 wells with intensive skills in mechanics, engines repair and overhauling, which can be adopted in all African countries.

5- Test pumping: For aquifer characteristic it might be needed to conduct lengthy pumping operation to end up at a better understanding of the storage coefficient and transmissivity of aquifers, but for low yield wells to be fitted with hand pumps no need to conduct long period testing to reduce the cost.

6- test pumping evaluation (training) .

7- An improved approach to VLOM to meet the MDGS objectives/ before and after construction/ developing a sense of ownership, strong water committees, involvement of women in management and operation. Sound arrangement for financing the operation and maintenance are crucial as availability of spar parts.

8- Government participation by encouraging investment in the private sector to offer a better service by exemption and easy measures to facilitate importation and local assembly and local manufacturing of casing and screens.

9-High costs result from weakness in logistic, management and by improving management skills, to have an overall statistical data of drilling activities, rig operation to be analyzed as well as human resources and financial resources by both private and public sector need to be improved if significant cost reduction to be achieved in our country. A comprehensive cost effective study should find its way sponsored by M. of Irrigation and water recourse, through Public Water Corp in collaboration with concerned stakeholders.

Comparison between the governmental and private sectors

Private Sector	Governmental Body
	maintenance
	Operation time
	Decision making
	Quality of production
	political effect on policy
	Availability of spare parts
	Qualification level of employee
	Flexibility in financial and purchasing

* What is the Future for water well Drilling companies? Bright or Dark?

Many thanks to Unicef who lead the initiative to cover this important subject.

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