



Assessment of the Groundwater Industry Performance in Sudan

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ABSTRACT

This study aimed at identifying and assessing the current situation of the groundwater industry (GWI) in Sudan. This is to reveal the deteriorated performance after privatization. The methodology of the study consisted of a survey questionnaire to obtain information about the GWI performance. Data collected from the questionnaire's feedback was statistically analyzed using SPSS programme. Other data was collected from related authorities, references and verbal statements from specialists, besides getting use of the authors' long experience in the groundwater industry sector. The results were carefully screened and studied and some recommendations were stated and expected to be useful contribution in the enhancement of the performance of this important industry.

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INTRODUCTION

The term groundwater is defined as underground water found in pores and fractures of soil and rocks. It is stored in and moves slowly through geologic formation of soil, sand and rocks called aquifers (Chilton, 1996; Gouluburn - Murray, 2010). Groundwater represents pretty nearly 30% of all the crisp water on earth, which is second just to the polar ice 69%, and two requests of size more prominent than measure of new water in lakes and waterways 0.3% (David, 2006). Ground water is an important source of water supply for municipalities, agriculture, and industry.

About 80% of the inhabitants of Sudan depend on groundwater for their living most of the year (Abdeen, 2013). Groundwater aquifers in Sudan are commonly classified into four groups: Nubian sandstone aquifers, umrawba formation, the recent alluvial wadi-fill aquifer, and Basement complex (Gamal and Abdin, 2012). Among the third world countries, Sudan is considered as a pioneer in the groundwater industry activities. The first start was in 1919 when a water section was established under the office of the undersecretary of the general governor. The first groundwater deep borehole was drilled in the same year in city

of Umrwaba, Province of Kordufan (Swar, 2003).

The section was developed in 1956 into a department named Land Use and Soil Investigation with branches in most of the provinces of Sudan.

In 1966 the Rural Water Corporation was created as a central body with the same rural branches. This corporation had passed through the supervision of many ministries such as Agriculture, Energy and Mining and Irrigation. The administrative feature of this corporation was consisting of a board of directors, general manager and departments. This corporation has executed the greatest rural groundwater services, especially in 1971 when efforts were channeled against thirst and hundreds of wells were drilled all over the country. In 1989 this Corporation had been demoted to an executive central body. The recent National Water Corporation took place under the supervision of Ministry of irrigation. The capacity of the new corporation has been limited to consultancy only, while the groundwater activities with all its constituents were left to the rural departments and contractors (Alhag, 2006).

Recently the majority of the groundwater activities were undertaken by private companies with exception of the groundwater research which was conducted the Ministry of Irrigation; nevertheless the ministry did not efficiently covered all the groundwater research needs. The number of companies was estimated as more than twenty.

The term groundwater industry GWI describes all the technical activities relating to this sector. These activities include geophysical studies for site selection, suitable rigs and equipments for drilling, drilling technique, scientific selection of materials, proper well completion technique, pump selection and water yards design.

This study addresses the severe deterioration invading groundwater industry performance in Sudan. Stress is focused on finding weak and defective technical and organizational practices responsible of this deterioration.

OBJECTIVES

- Recognition of the possible administration causes of deterioration of the groundwater industry performance.
- Illustration of the technical weaknesses which are also considered as causes of this deterioration.
- Contribution in the efforts of enhancement of this industry by suggesting some possible solutions.

MATERIALS AND METHODS

The method used in this study was the Questionnaire Survey to obtain information relevant to the performance of the groundwater industry.

A questionnaire addressing the previously mentioned major research objectives had been designed, tested and distributed among a tested group of 88 employees with a feedback and response offered by 42 of the tested interviewees:

The goal of the questionnaire was as follows:

1. To collect data from the influential stakeholders.
2. To obtain some useful opinions for the study work.
3. To insure the fact of deterioration in this line.

Collected questionnaire forms were classified, tabulated, prioritized and analyzed using Statistical Package for Social Sciences (SPSS) computer program version 12 whereby the results shown in tables 1 to 7 were obtained

RESULTS AND DISCUSSION

Table (1) explains the average, minimum and maximum ages of sample, the volume of sample (number of personnel tested) and the

deviation between ages. Figure (1) shows the frequency and percentage of the activity quality. As seen from the figure the highest

percentage is tilted towards drilling and installation and a lower frequency for completion.

Table 1: Descriptive statistics for Age of Reviewees

	N	Minimum	Maximum	Mean	Std. Deviation
Age of tested group	39	20	67	37.62	10.997
Valid N (listwise)	39				

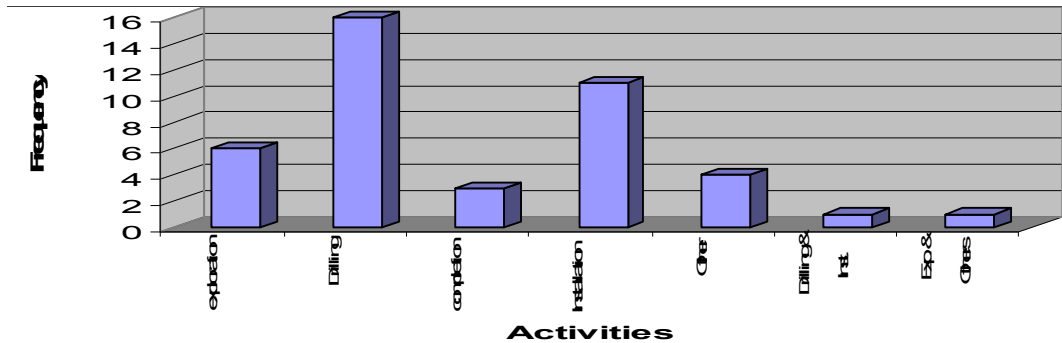


Figure 1: Frequency of activity quality.

Table (2) represents the frequency and percentage of job position in the sample. Geophysical engineers hold the highest

frequency, yet to be followed by heads of departments and tanks and pumps engineers

Table 2: Position of tested individual

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Manager	4	9.5	9.5	9.5
Head of department	6	14.3	14.3	23.3
Drilling engineer	4	9.5	9.5	33.3
Geophysical engineer	7	16.7	16.7	50.0
Geological engineer	3	7.1	7.1	57.1
Hydro-geological engineer	2	4.8	4.8	61.9
Tanks and pumps engineer	5	11.9	11.9	73.8
Technician	4	9.5	9.5	83.3
Command labor	3	7.1	7.1	90.5
Labor	3	7.1	7.1	97.6
Head department and Geophysical and hydro.	1	2.4	2.4	100.0
Total	42	100.0	100.0	

Table (3) shows the average of groundwater industry performance with a standard mean error of 0.1. This indicates that deterioration is invading this industry. Table (4) explains the presence of differences between the average of the perfectness of the groundwater industry performance and the

average of Licard scale (3) in the questionnaire. It proves that the groundwater industry performance is not acceptable, because the significance level value in the table is less than the probability value (0.05). This is in agreement with the findings of Saleim, (2005).

Table 3: One-Sample Statistic

	N	Mean	Std. Deviation	Std. Error Mean
Performance of Groundwater Industry	42	2.8072	0.65093	0.10044

Table 4: One-Step Test

	Test	Value	= 3	95%Confidence Interval of the Difference	
				Lower	Upper
t	df	Sig. (2-tailed)	Mean Difference		
Performance of GWI	-1.919	41	.062	-.19279	-.3956 .0101

Results tabulated in Tables (3) and (4) show a condition of unacceptable performance in the groundwater industry which supports an essential opinion of the author in this study work with respect to deterioration invading companies working in this industry. The deterioration degree in the performance of companies also appears clearly in the frequent complaints from the clients about improper designs with respect to improper site selection, deviated wells, wrong positioning of casing and screen, wrong placement of gravel or cement slurry, improper development and pumping test, wrong selection and installation of pumps and improper tank and distribution network designs. Defect in any of the above mentioned technical issues will cause

negative impact on the success of the groundwater supply project.

The result illustrated in Table (5) explains the opinion of the majority of the tested group (85%) which also supports the idea of the study work that the groundwater industry needs improvement steps to be taken. The result also appeared that 75% of them are ready to contribute in the improvement steps. These support, contribution desire and high percentages are important to the study work because they are considered as encouraging factors.

Table (6) illustrates the level of the general satisfaction compared with the average of the scale (3) and the result is an average of satisfaction. Table (7) shows a T-Test value of 0.009 which explains an average of general satisfaction.

Table 5: Binomial Test

Category	N	Observed Prob.	Test Prob.	Sig.(2-tailed)	Exact Sig. (2-tailed)
Do you feel a need for improvement steps to this industry?				.000	
Group 1	34	.85			
Group 2	6	.15			
Total	40	1.00			
If yes, are you ready to co-operate?				.50	
Group 1	12	.75	.50		.077
Group 2	4	.25			
Total	16	1.00			

Table 6: One-Sample Statistics

	N	Mean	Standard Deviation	Standard Error Mean
Please indicate your general level of satisfaction regarding your post?	38	3.45	1.005	.163

Table 7: T-Test

	t	df	Test Value=3		95% Confidence Interval of the Difference	
			Sig.(2-tailed)	Mean Diff.	Upper	Lower
Please indicate your general level of satisfaction regarding your post?	2.743	37	.009	.447	.12	.78

CONCLUSION AND RECOMMENDATIONS

Conclusions and recommendations emerged from this study work are as follows:

- The groundwater industry activities are mostly nowadays privatized in the Sudan undertaken by companies (contractors). Organizational and technical performance of most of these companies is noticed to be unsatisfactory.
- The majority of groundwater companies are not well established because the official groundwater body has no direct authority towards their registration conditions and licensing. This results in unserious commitment to regulations, legislations and work permits by these companies.
- Companies are not bound to provide complete and proper machineries, equipments, instruments and materials.
 - The official authority should be the direct responsible body of the private companies and their performance.
 - The contractor's structure, staff, machineries, instruments and materials should at least be within

a moderate level and they should practice a self-evaluation process.

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