COMPARISON OF PERFORMANCE OF PUBLIC AND PRIVATE BOREHOLES

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ABSTRACT

In the last fifteen years, a remarkable increase in the number of privately owned. There has been an increase in the individually owned and operated boreholes within the state because it is claimed that government owned boreholes breakdown too often. Hence, this study is aimed at comparison of the performance of three categories of boreholes namely: public operated boreholes owned by the Government, individual owned boreholes operated for commercial purpose, and private owned boreholes for private use in Rivers State. The comparison is in terms of functionality, operation and maintenance cost, and profit generated. Based on questionnaire completed by the management staff of several water providers and agencies 270 boreholes exist in the study area. Analysis indicate that 58(64.44%) of the total boreholes owned and operated by the government are not functional. The corresponding figures for the boreholes owned by individuals but operated for commercial use and the private owned and operated boreholes are 35(38.39%) and 20(22.22%) respectively. This is attributed to unplanned maintenance programme, poor feasibility studies, and lack of well-co-ordinated comprehensive well development structure. In terms of profit generation and low downtime, results show that the boreholes owned by individuals but operated for commercial purpose are the best while the worst are the private owned boreholes operated for private use. On the other hand, the least cost was obtained for the later.

Key Words: Ownership effect, cost, boreholes private.

INTRODUCTION

Safe water supply is fundamental for environmentally sustainable development. Despite the construction of numerous boreholes in the developing countries and the involvement of several agencies in the development of water supply, only about 25-35% of the rural population and 40-45% of the urban population have access to potable drinking water. Apart from low coverage, there are the problems of poor feasibility studies and lack of appropriate maintenance culture. (Chima, 1990; Agunwamba, 1995a, b; Agunwamba, 2000, 2004). For instance, most of the boreholes sunk in Rivers State stopped production after a short period of operation, due to the shallow nature of the boreholes resulting form inadequate feasibility studies (Solomon, 2002). Also, many boreholes were drilled and handed over to the communities or water board without adequate provision of spare parts, training of community maintenance team, and adequate funding.

Recently, much interest has been shown on the participation of private organization in the operation and maintenance of water supply facilities. Privatization involves redefining the role of the state by disengaging it from those activities which are best done by the private sector with overall objectives of achieving economic efficiency (Bernard, 1998). Privatization may be defined as a systematic transfer of appropriate functions, activities or property from the public to the private sector where services, production and consumption can be regulated more efficiently by market mechanisms. Under privatization the role or the level of involvement of the state in the economy is reduced as more of the functions get shifted to the private sector (Ajileye, 2002).

Braadbaart (2000) reviewed a substantial body of water industry evidence on ownership effects and finds that ownership effects are neither independent nor overwhelming. Water utility privatizations sometimes produce

efficiency gains but not always. According to Baraadbaart (2000) the understanding of how privatization affects water utility is still incomplete. "Economists believe the combination of ownership effects and competition makes privatization produce efficiency and other improvements." However, water supply facility offer limited scope for competition. Therefore, much of the expected gains must stem from ownership effects (Braadbaart, 2002).

Ownership effects are measured in terms of efficiency indicators such as operational cost (Mann and Mikesell 1976) and cost (Bhattacharyya et al; 1994; Neal et al; 1996). Measuring ownership effects is difficult. Ideally, the treatment group of private utilities should be compared to a control group of government managed, but otherwise similar, utilities operating in similar environments. Despite that' some ownership effects of water facility have been investigated in the developed countries. There is the need to conduct a similar study in developing countries because of varying market structures, regulations or macro-economic climate.

Hence, the study aims at comparing the sustainability of government and operated for public us in Rivers State These three major categories of boreholes will be compared with respect to functionality, maintenance policy, causes of failure, inter-failure distribution and profitability using some boreholes in Port Harcourt, Rivers State as case study. As much as possible the appropriateness of design, correctness of method of construction and suitability of the construction materials shall be examined. Also, connected to functionality is how much operation guidelines are followed.

STUDY AREA

Port Harcourt in River State of Nigeria is a fast developing state. The population of the city (approximately five million) has been growing rapidly, subjecting the available water resources to much stress. Attempt in alleviating this critical problem has resulted in high rate of drilling and installation of boreholes which now constitute over 80% of the sources of water supply in Port Harcourt. The boreholes were constructed mainly by individuals, firms, state and local government authorities. Some of the Government organizations which contributed include the Petroleum Trust Fund, Rivers State Water Board, Directorate for Food, Road and Rural Infrastructure, Federal Ministry of Water Resources, and Nigerian Water Resources Development. The United Nations Children Emergence Fund has also contributed. The practice is that individuals own and operate their own boreholes. The state Government own some boreholes which are operated either by the Ministry of works or by private organizations.

RESEARCH METHODOLOGY

Sources of Data

Data on the general characteristics of boreholes in Rivers State, average yearly maintenance and operational cost of boreholes, and borehole maintenance operations were collected from Waterglass Boat Yard, Sam-G Consultant, State Water Board, Bee Drilling Services, and Cinab Engineering and Geological Services. Petroleum Trust Fund (PTF) and Water Rehabilitation Project Publications provided information on borehole construction and rehabilitation. Data were collected from three categories of borehole namely: Public operated boreholes owned by government, boreholes owned by individuals, but operated for commercial purposes, and boreholes owned by individuals and operated for domestic use. Ninety boreholes in each of these categories were investigated.

Data were also collected through structured questionnaires completed by engineers and geologists who work with drilling companies, State Water Board, Maintenance Companies, operators and owners of boreholes. Interaction with this wide spectrum of institutions was necessitated by the fact that no single institution keeps complete data. Besides, different categories of boreholes were involved. The study was conducted for a period of the three months

ANALYSIS

Estimation of the operational profit was achieved following the method developed by Handlarski (2000). It was assumed that the inter-failure time probability distribution function $F(t)$ is given by

$$F(t) = \frac{\mu}{C}\lambda^{-\mu t} \quad (1)$$

where μ is the mean times, C is a constant and t is the inter-failure time, which is the average time interval between borehole failure. The parameter μ and C were obtained by linearizing equation (1) and fitting measured data to it. The parameter μ is equal to the negative of the slope while $C = \frac{1}{\mu}\exp(-\text{intercept})$.

also, from the data collected, the operation profit was analyzed using the formula derived by Handlarski (2000).

$$P(L) = \frac{R[\pi_L L + (1-\pi_L)\mu_L] - \pi_L C_m - (1-\pi_L)}{\pi_L(a+L) + (1-\pi_L)(b+\mu L)} \quad (2)$$

where R = revenue gained per unit of operation time of machine
L = maintenance interval
C_m = Cost of a maintenance repair
C_b = Cost of a breakdown repair
a = average time taken for a breakdown repair
b = average time taken for a breakdown repair
$P(L)$ = point function (average profit per unit of total time)

$$\pi_L = \int_L^{\infty} f(t)dt \quad (3)$$

$$\mu_L = \frac{1}{1-\pi_L}\int_0^L f(t)dt \quad (4)$$

where $$f(t) = \frac{\mu}{C}\lambda^{\mu t} \quad (5)$$

By substituting equation (5) into equation (3) and (5) we obtain:

$$\pi_L = \frac{1}{C}\exp t(-\mu L) \quad (6)$$

$$\mu_L = \frac{1}{C(1-\pi_L)}[1-\exp t(-\mu L)] \quad (7)$$

Information on the maintenance policy of each borehole was obtained through interviews and recorded borehole repair history. From the data obtained, the above parameters were estimated. With μ, C and L known, determination of π_L and μ_L from equations (6) and (7) becomes simple. The profit function (Eq. 2) was evaluated based on actual operation, maintenance and costs data on all the three categories of boreholes.

RESULTS AND DISCUSSIONS

Results from questionnaire indicated that 58(64.44%) of the total public boreholes operated by the Government, 35(38.89%) of the total boreholes operated by the individuals for commercial purposes, and 20(22.22%) of those operated by individuals for private use were non-operation al due to maintenance problems as shown in Table 1.

Table 1: Functionality of different categories of boreholes based on analysis of completed questionnaire

S/N	Kind of B/N investigated	No. of B/H Investigated	No. of B/H Functioning	% of B/H Non-Functioning	% of B/H Functioning	% of B/H Non-functioning
1.	Public B/H owned by government (Neighbourhood Water Scheme)	90	32	58	35.56%	64.44%
2.	Public operated boreholes owned by individuals (for commercial use only)	90	55	35	61.11%	38.89%
3.	Private operated boreholes owned by individuals (for private use only)	90	70	20	77.78%	22.22%

The government owned boreholes were drilled, constructed and operated by the State Government under the scheme known as "Government Neighbourhood Water Scheme." The boreholes are for providing adequate and constant supply of good, safe and potable water to urban and rural communities within Rivers State. The private owned boreholes fall into two groups: those drilled, constructed and operated by individuals to satisfy water demand on commercial basis and those which supply water mainly to their owners. The private boreholes have increased in number due to the inability of the government to satisfy the demand of both the urban and rural communities in the state.

The total cost of maintenance, operation and repair of faulty boreholes is far much lower in the case of an individually owned borehole operated for private use than that operated by government (Table 2). This may be attributed to high cost of contracting out government borehole repairs. The maintenance, operation and total cost of boreholes in private operated boreholes owned by individuals are the least. This result may be misleading if analyzed isolation of table 3. From Table 3, the private operated boreholes owned by individuals have very long downtime. This implies that within the period of study the boreholes were not effectively in operation and hence had very low operation and maintenance cost.

Comparison of the average breakdown and preventive maintenance intervals are shown in Table 4. The public operated boreholes owned by individuals have low preventive and breakdown maintenance intervals. The profits generated by the public operated boreholes owned by individuals are highest both for preventive and breakdown maintenance policies. Generally, results tend to support that the public operated boreholes owned by individuals performed better than those either owned by the government or private operated borehole owned by individuals. Similarly, the highest profits were generated by the public operated boreholes owned by individuals (Table 5). Economic interests added to ownership effect are a great motivation for more efficient operation.

Table 2: Comparison of maintenance, operation and total costs between private and public boreholes based on the number of functional boreholes with complete data (n = 10)

S/N	Group of Boreholes	Cost (₦)		
		Maintenance	Operation	Total
1.	Public operated boreholes owned by government (Neighbourhood Water Scheme)	42001 ± 23468	182513 ± 35491	273664 ± 81895
2.	Commercial operated boreholes owned by individuals	11137 ± 2611	51904 ± 602	75850 ± 11665
3.	Private operated boreholes owned by individuals	10513 ± 4264	34032 ± 13847	53492 ± 19249

Only 10 boreholes were examined in each group and cost data averaged over a period of 13 years (1989 – 2002) because of lack of data.

Table 3: Comparison of breakdown time for all the groups of boreholes

S/N	Group of boreholes	Downtime	No of breakdown
1.	Public operated boreholes owned by government	56.3 ± 60.6	38
2.	Public operated boreholes owned by individuals	6.9 ± 6.0	38
3.	Private operated boreholes owned by	70.6 ± 14.2	28

Table 4: Comparison of average breakdown and preventative maintenance interval for the different groups of boreholes

S/N	Group of Boreholes	Breakdown policy	Preventive maintenance policy
1.	Public operated boreholes owned by government (Neighbourhood Water Scheme)	₦6,322	₦96,706
2.	Public operated boreholes owned by individuals	₦36,719	₦225,029
3.	Private operated boreholes owned by individuals	₦3,945	₦95,092

CONCLUSION

The status of boreholes in Rivers State was studied. Lack of maintenance culture, poorly structured and uncoordinated policies, and inadequate feasibility studies have been identified as the major courses for no functioning, long down time and high frequency of breakdown of boreholes in the State. Generally, breakdown maintenance is practiced in all the categories of boreholes analyzed. Results from statistical analysis indicated that savings in cost of operating a borehole could result if a planned maintenance policy is adopted. Besides, the boreholes could result if a planned maintenance policy is adopted. Besides, the boreholes owned by individuals which were operated for commercial purpose gave the best performance in terms of lower downtime, cost and profit generation. The boreholes owned by individuals but operated for domestic use had the highest downtime as well as the lowest profit generated.

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