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Financial and operational performance indicators applied to public and private water and wastewater utilities

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Abstract

Purpose – The paper seeks to assess the performance of 234 public and private water and wastewater utilities from industrialized and developing countries.

Design/methodology/approach – A group of financial and operational indicators was calculated for the sample utilities.

Findings – Some indicators calculated for the private sector, represented by US and UK water and wastewater utilities, demonstrated better values compared with public utilities, such as staff number per 1,000 connections and return on equity ratio and tariffs charged. On the other hand, the percentage of unaccounted-for water and the debt to equity ratio evidenced no advantage in private over public utilities. Further, the performance of water and wastewater utilities of developing countries and Egypt does need improvement.

Originality/value – A key problem in most of water and wastewater utilities is the absence of performance assessment tools. To this end, this research utilized indicators as a means of performance assessment of water/wastewater utilities.

Keywords Water industry, Water supply and waste systems, Public sector organizations, Industrial countries, Developing countries, Egypt

Paper type Research paper

Introduction

The water and wastewater sector constitutes a major portion of the construction industry. This is true for all countries, both developing and developed. Countries, on the other hand, are keen to improve the performance of their utilities. This growing concern has also extended to international financial institutions such as the World Bank, which has performed several studies to identify the problems that hinder the performance of water utilities, particularly in developing countries. Tariff structure and staffing issues were two of the most important obstacles facing public utilities, staining them with inefficiency and poor performance. Therefore, the calculation of a group of indicators that assess both the financial and operational aspects of utilities is essential prior to any action taken to enhance the performance of these utilities.

Background

"High costs, low efficiency and unreliability – these are the characteristics of many public utilities in developing countries" (UNICEF, 2001). According to Idelovitch and Klas (1997), the finance of water and wastewater utilities exceeds the capabilities of the public sector, thus resulting in poor performance and low productivity of a significant number of public sector utilities.

The World Bank defined performance indicators as tools providing means of measurement of fulfillment of any project's objectives, success and prediction of

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obstacles that may hinder operation (World Bank, 1995). Performance indicators organize the relationship between the different utility components. This organization facilitates the indication of problems and their possible solutions (World Bank, 1999a).

The World Bank states that performance indicators are essential tools that identify areas in need of improvement, set targets for improvement, and simplify the monitoring of utilities operation by government officials, allowing them to modify policies and programs accordingly. They also serve the interest of private investors to identify market opportunities through evaluating the overall performance of utilities (World Bank, 1999b).

Tariff is usually structurally divided into a fixed portion used to cover the fixed costs borne by the utility, and a variable portion directly related to the volumetric consumption of users. This type of structuring is not applicable in the absence of a metering system. The average consumption is estimated based on historical consumption data and charges are calculated accordingly (World Bank, 1996).

The World Bank viewed current tariff rates in several developing countries as "below market rate": one piece of advice was to charge higher rates, which the Bank deemed necessary to give private companies an incentive and sustainable profit (Raja Siregar, 2003).

Unfortunately, the water sector faces many problems that render it incapable of attracting private participants. Most of the assets of water and wastewater utilities are underground, leading to the status of the system being unknown. This is in addition to the losses associated with an inadequate system, such as the collection of revenues and water leaks. Many of the revenues collected often reflect only one-third of the water supplied (Brook Cowen, 1997).

Further, studies proved that the water industry is capital intensive. The ratio of fixed assets to annual tariff revenue is 10:1, compared to 3:1 for telecommunications and 4:1 for electricity. As such, investors comprehend the fact that the payback period is lengthy, and that the cost of investment in this sector can only be recovered after many years (Idelovitch and Klas, 1997).

The World Bank argued that "public sector providers waste too much water, typically losing 40 to 50 percent of their volumes through leaks and thefts". The Bank supported and vigorously pushed private participation, adding that "private participation in water and wastewater utilities has generally resulted in sharp efficiency gains, improved service, and faster investment in expanding service" (Raja Siregar, 2003).

Privatization in the UK led to the formation of ten companies in England and Wales that served as water/wastewater utilities, in addition to 18 water companies representing the majority of existing utilities in the UK. On the other hand, in the USA, private operators operate not more than 15 percent of all utilities (World Bank, 2000).

A World Bank working paper on water and sanitation in Latin America opposed the above notion and concluded that the private sector does not perform better than the public sector, only that it does not perform any worse. Similarly to improving efficiency, another study by the Bank concluded that there was no significant difference between the public and private sectors (Joy and Hardstaff, 2005).

Objectives

This research is mainly targeted at evaluating the performance of a group of public and private water, water/wastewater and wastewater utilities located in industrialized and developing countries. The purpose of this performance assessment is to formulate a trend for the performance of public sector utilities against private utilities, which in turn gives an indication of whether public utilities can operate more efficiently when

managed by the private sector. Further, this assessment may help identify the problems that hinder the performance of public utilities. Once identified, they may be used to help decision makers in the formulation of reform programs and corrective measures to enhance the performance of these utilities.

Research methodology

This research employed indicators as a means of performance assessment. A group of financial and operational indicators was calculated for the study sample to assess the financial and operational efficiency of the utilities. Results of these indicators are presented for the regions included in the study. Finally, a comparative analysis of the results based on the type of ownership structure and the service provided was performed.

Data collection

The data gathered in the study is an amalgamation of 234 utilities, comprising public and private utilities as shown in Figure 1. Each sector is further divided into water utilities, water/wastewater utilities and wastewater utilities. Regions compared in the study are the USA, the UK (industrialized countries), developing countries and Egypt, as will be seen later.

Africa, Southeast Asia, and Latin America are considered among the developing countries. Countries included in Latin America are Brazil, Chile, Costa Rica, Argentina and Colombia. Southeast Asia comprised Korea, Pakistan and The Philippines. Africa included Côte D'lvoire, Senegal, Benin, Morocco, Nigeria and South Africa. Data accumulated from areas of Latin America, Southeast Asia and Africa was grouped and reported as results of developing countries. The UK and the USA each represent the results of industrialized countries.

The sample utilities studied in Egypt are Alexandria Water General Authority (AWGA), Alexandria General Organization for Sanitary Drainage (AGOSD) and Beheira Water Company, all of which are chosen for several reasons. First, each utility represents one type of service. AWGA provides water services, Beheira Water Company provides water/wastewater and AGOSD provides wastewater. Second, the availability of organized financial data for these utilities enabled the process of indicator calculation. Third, the financial and operational performance of AWGA is worth studying, compared to the other Egyptian utilities, as it is the only utility in Egypt to cover its costs.

As per Figure 1, the data sample maintained only two private water utilities in developing countries represented by Africa. This is due to the limitation of data availability in developing countries as well as the limited experiences of private utilities operating in developing countries. In addition, the contracts of some private operators were not renewed following to public opposition to tariff increases, which led to a high percentage of non-repayment, reaching 60 percent in Chile. Therefore, limited comprehensive data was published in this regard.

The financial data that was used in calculating financial and operational indicators of Tables I and II were balance sheets and income statements for water and water/wastewater utilities in the above mentioned countries. Data sources were as follows:

- World Bank;
- annual reports for international utilities published on the internet;

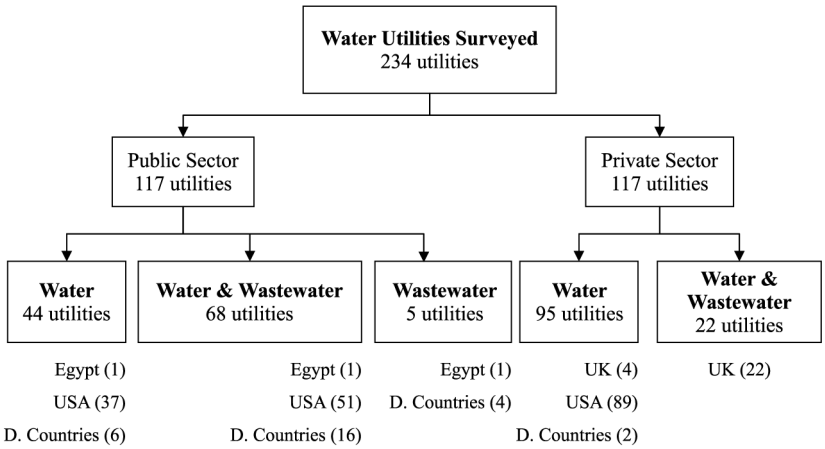

Figure 1.
Water and wastewater surveyed utilities breakdown

- the American Water Works Association (AWWA) provided financial data for the majority of public sector utilities in the USA, compiled on CD, and published by the Association; and
- the Office of Water and Sanitary Services in the UK (OFWAT) provided statistical, operational and financial data for the utilities under study.

Most of the data was for a period of three years. Due to the difficulty encountered in gathering such data, the exact years were not consistent along all utilities and all regions. For this reason, it was impractical to calculate the maximum and minimum for each ratio per utility; rather, an average of three years was taken and a single number represented each ratio/indicator per utility. After calculating all the ratios and indicators for each utility within a single region, the average for all the utilities was taken to reach a single representative figure for each region.

The USA and the UK comprised small, medium and large-sized utilities, while the remaining regions in the study included only large-sized utilities. For US and UK utilities, a further division was made based on the size of the population served. Small utilities serve less than 250,000 persons, medium-sized utilities serve a population between 250,000 and 500,000 and large-sized utilities serve a population exceeding 500,000.

A statistics test (ANOVA test) was performed to verify the significance of the size factor. According to Aczel (1996), "[the] ANOVA test is a statistical method for determining the existence of differences among several population means".

The assumption was made that there was a difference between small, medium and large-sized utilities. This assumption was tested using the following equation:

$$\text{ANOVA test} = F_{(r-1,n-r)},$$

where $(r-1)$ and $(n-r)$ are the degrees of freedom. They were calculated then used in the F distribution tables with an assumption level of significance of 0.05. The results obtained from the table were compared with the results of the above equation.

The results of the table were higher than those of the equation. Therefore, the results fell in the rejection zone and the size factor for the UK and the USA was insignificant. Hence, the size classification of these utilities had no direct effect on the values of financial and operational ratios.

Table I.
Results of financial indicators

Ratio	Sector	Utilities	USA	UK	Africa	Southeast Asia	Latin America	Egypt
Current ratio	Public	Water	4.797	N/A	1.095	1.500	N/A	1.529
		Water and wastewater	5.220	N/A	N/A	1.250	1.300	1.695
		Wastewater	N/A	N/A	N/A	5.600	N/A	0.960
	Private	Water	1.533	0.390	N/A	N/A	N/A	N/A
		Water and wastewater	N/A	0.317	N/A	N/A	N/A	N/A
Asset turnover	Public	Water	0.157	N/A	0.590	N/A	N/A	0.183
		Water and wastewater	0.162	N/A	N/A	N/A	N/A	0.085
		Wastewater	N/A	N/A	N/A	N/A	N/A	0.007
	Private	Water	0.286	0.383	N/A	N/A	N/A	N/A
		Water and wastewater	N/A	0.325	N/A	N/A	N/A	N/A
Debt to equity	Public	Water	0.580	N/A	0.870	0.090	N/A	0.850
		Water and wastewater	0.710	N/A	N/A	0.510	0.470	0.310
		Wastewater	N/A	N/A	N/A	N/A	N/A	0.293
	Private	Water	1.200	0.490	N/A	N/A	N/A	N/A
		Water and wastewater	N/A	0.670	N/A	N/A	N/A	N/A
Return on sales	Public	Water	0.158	N/A	N/A	N/A	N/A	0.063
		Water and wastewater	0.172	N/A	N/A	N/A	N/A	−0.419
		Wastewater	N/A	N/A	N/A	N/A	N/A	−70.350
	Private	Water	0.104	0.125	N/A	N/A	N/A	N/A
		Water and wastewater	N/A	0.126	N/A	N/A	N/A	N/A
Return on equity	Public	Water	0.07	N/A	N/A	−1.00%	N/A	3.00%
		Water and wastewater	0.05	N/A	N/A	−1.00%	−3.85%	−5.50%
		Wastewater	N/A	N/A	N/A	N/A	N/A	−9.60%
	Private	Water	0.090	0.080	N/A	N/A	N/A	N/A
		Water and wastewater	N/A	0.070	N/A	N/A	N/A	N/A
Working ratio	Public	Water	0.735	N/A	1.030	0.950	N/A	0.701
		Water and wastewater	0.760	N/A	0.860	0.650	0.750	1.317
		Wastewater	N/A	N/A	N/A	N/A	N/A	48.130
	Private	Water	0.68	0.67	0.83	N/A	N/A	N/A
		Water and wastewater	N/A	0.623	N/A	N/A	N/A	N/A

Table II.
Results of operational indicators

Ratio	Sector	Utilities	USA	UK	Africa	Southeast Asia	Latin America	Egypt
Unaccounted-for water (percent)	Public	Water	10.08	N/A	20.04	40.00	N/A	34.03
		Water and wastewater	10.81	N/A	15.83	49.50	37.70	32.00
		Wastewater	N/A	N/A	N/A	N/A	N/A	N/A
	Private	Water	14.46	15.60	20.44	N/A	N/A	N/A
		Water and wastewater	N/A	13.81	N/A	N/A	N/A	N/A
Staff per 1,000 connections	Public	Water	2.05	N/A	6.32	N/A	N/A	4.9
		Water and wastewater	3.06	N/A	7.115	N/A	1.425	6.5
		Wastewater	N/A	N/A	N/A	N/A	N/A	8.3
	Private	Water	2.04	1.125	3.19	N/A	N/A	N/A
		Water and wastewater	N/A	1.5	N/A	N/A	N/A	N/A
Labor cost/operation cost (percent)	Public	Water	29.82	N/A	22.25	11.10	N/A	39.00
		Water and wastewater	39.40	N/A	18.99	47.80	63.55	N/A
		Wastewater	N/A	N/A	N/A	N/A	N/A	67.00
	Private	Water	27.80	N/A	23.73	N/A	N/A	N/A
		Water and wastewater	N/A	N/A	N/A	N/A	N/A	N/A
Average tariffs ($\$/m^3$)	Public	Water	1.29	N/A	0.19	N/A	N/A	0.065
		Water and wastewater	0.69	N/A	0.705	N/A	N/A	0.080
		Wastewater	N/A	N/A	N/A	N/A	N/A	0.04
	Private	Water	0.92	1.08	0.6	N/A	N/A	N/A
		Water and wastewater	N/A	1.45	N/A	N/A	N/A	N/A

Accordingly, there was no necessity for further classification of utilities by size. Thus, the sample study consisted mainly of large-sized utilities.

Selection of financial and operational indicators

The financial and operational indicators utilized for this research provide an acceptable starting point for the assessment of water and wastewater utilities (World Bank, 2000). These indicators do not provide definitive answers to utility problems; however, they identify areas that are worth further analysis (World Bank, 1996).

Selection of the financial indicators is based on their representation of key financial ratios, namely liquidity, operating, coverage, leverage and profitability ratios. Moreover, the financial indicators used in this research are used by the World Bank as indicative ratios for the assessment of water and wastewater utilities.

The operational indicators used in the research are considered a useful tool for managers of water and wastewater utilities to utilize and define the operational performance of their utilities. Though not fully comprehensive, they are regarded as a sufficient starting point for the assessment of the operational performance of the water and wastewater sectors World Bank, 1999b).

Results

Financial indicators results

Results of financial ratios gathered from the 234 utilities are summarized in Table I. The table lists the results of the financial ratios categorized by the type of ownership and the type of service provided. The ratios are explained at length in the following sections.

Liquidity ratios

The liquidity ratios measure the utility's ability to meet its short-term financial obligations in a timely manner (Brigham *et al.*, 1999). The current ratio is an indicative of the utility's liquid position:

$$\text{Current ratio} = \text{current assets}/\text{current liabilities}.$$

The results of the current ratio are preferred to fall within the range 2.6-3.0 (Dumol, 2000). Table I indicates that in case of water utilities, the USA has the highest current ratio of 4.8. This means that there is an amount of $4.8 liquid assets for each dollar of liability. However, sound analysis should be used to prevent misinterpretations. If a large volume of current assets is due to a high inventory or accounts receivable, then a high current ratio does not necessarily indicate a liquid position. Balance sheets of US public water utilities indicate that 50 percent of current assets are due to reserves and funds rather than inventory and accounts receivable. Therefore, they do not encounter the same risks associated with failure to collect account receivables.

AWGA has a ratio of 1.53, which is below the study average but in line with the results of developing countries. AWGA balance sheets for the three years studied indicate that more than 50 percent of the utility's current assets were generated from inventory and receivables, thus decreasing the utility's liquidity.

The general trend in the results of water/wastewater utilities is nearly the same as those of water utilities. The US average ratio is 5.22, higher than the study average and the ratio of developing countries and Egypt. An examination of US utilities' balance sheets revealed a high percentage of illiquid current assets, exceeding 50 percent of the total assets. Results for Beheira Water Company are similar to AWGA. They remain below the study range but maintain the same level of performance as developing countries.

The study average does not apply to wastewater utilities due to the difference in the type of service, and hence the financial performance. The only regions where data was available for wastewater utilities were developing countries versus Egypt, namely AGOSD. The current ratios were 5.6 and 0.96, respectively.

The current ratio results of public sector water utilities in general are higher than their private counterparts. The ratio for US private water utilities is 1.53, the UK private water utilities are 0.39 and water/wastewater is 0.317. However, this drop in the results of private utilities indicates the difficulty encountered in meeting their short-term obligations, particularly in the UK water and water/wastewater utilities.

Operating ratios

Operating ratios are used to measure the speed with which the accounts are converted into cash or sales. The asset turnover ratio illustrates the utility's efficiency in using its assets to generate sales (Gitman, 1997):

$$\text{Asset turnover ratio} = \text{net sales}/\text{total assets}.$$

As per Table I, water utilities in developing countries have the highest asset turnover ratio, followed by AWGA then the USA. Balance sheets of US public utilities indicate a large volume of fixed assets, thus causing a drag down in the US ratio. On the other hand, comparing the sales of the above utilities indicates that the sales of AWGA are lower than the USA and developing countries. The low sales figure of AWGA could be attributed to the high percentage of unaccounted-for water.

The US average turnover results for water/wastewater utilities are 0.162, and in Beheira Water Company 0.085. This reflects the variation in the sales figure. The low sales of Beheira are probably due to the low tariffs charged.

The only wastewater utility viewed in this ratio is AGOSD. Its average ratio is 0.007 for the years studied, which is recorded as the lowest turnover ratio among all public and private utilities.

An overall increase in the asset turnover ratio of the US private sector is noted in comparison to the public sector. The average ratio for US private water utilities is 0.286, compared to 0.157 for public water utilities. UK utilities maintained a higher turnover ratio compared to the US utilities.

Leverage ratios

The leverage ratio indicates the dependence of utilities on debts as a method of finance. A utility with a low ratio denotes stronger capitalization, which can absorb greater risk:

$$\text{Debt to equity ratio} = \text{total long} - \text{term debt}/\text{total common equity}.$$

Table I shows that AWGA's results are similar to developing countries and higher than in the USA. The results for developing countries and AWGA are higher than the water and wastewater study average, which recommended a ratio of 0.4-0.6, indicating the high dependence of both areas on debt as a method of finance. The USA, on the other hand, maintained a fair ratio of 0.58, ensuring the availability of capitalization anticipating any unpredictable risks.

Water/wastewater public utilities exhibited a different trend compared to water utilities. The USA has the highest debt to equity ratio of 0.71, followed by developing countries' average results, then Egypt.

The result for AGOSD was 0.293. The relatively high equity invested in AGODS is the reason behind this low ratio. This is due to the limited revenues generated by the utility, probably resulting from the underestimation of wastewater tariffs.

US water utilities have the highest debt to equity ratio in the private sector, which is also higher than public US utilities. The ratios for UK water and water/wastewater utilities are 0.49 and 0.67, respectively. However, both UK utilities have a relatively balanced debt to equity ratio.

Profitability ratios

Measures of profitability are numerous, each relating the profit generated by the utility to its sales, equity or assets. The importance of these ratios lies in their ability to reflect the efficiency of liquidity, asset management and debt management of utilities on their operating revenues (Gitman, 1997). The profitability ratios used for this study are:

$$\text{Return on sales ratio (ROS)} = \text{net income}/\text{net sales}.$$

A significant difference in ROS ratio was noted between AWGA and US water utilities, with a 15.8 percent average ROS in the US versus a 6.3 percent average in AWGA. This gives an indication of the volume of expenses and the limited sales volume encountered in AWGA compared to the USA.

The results of water/wastewater utilities were similar to water utilities, being slightly higher in the USA at 17.3 percent. Beheira Water Company recorded a negative ROS of -41.9 percent, which is a result of the continuous negative net income generated by the company in the three years studied.

AGOSD also recorded negative ROS, although much lower, exceeding 100 percent. Two factors contributed to this result:

(1) the large volume of expenses, including operating expenses, taxes and interest paid; and

(2) limited revenues attributed to the nature of the service provided.

The results of US private utilities are lower as compared to US public utilities. UK and US private utilities have similar results. US private water utilities have a 10.4 percent ROS, while UK water utilities have a 12.5 percent ROS and UK water/wastewater utilities have a 12.55 percent ROS. Both UK utilities have nearly the same results, which indicates that the expense minimization strategy and the efficiency in operating costs management do not change as the service provided changes:

$$\text{Return on equity ratio} = \text{net income}/\text{total equity}.$$

ROE is a key evaluation ratio that assesses the success/failure of any business entity. US water utilities have the highest ROE, followed by AWGA with 3 percent, then the average for developing countries.

As for water/wastewater utilities, the USA again has the highest ratio, followed by the average for developing countries, then Egypt: the latter two have negative ROS ratios.

As for wastewater utilities, AGOSD has the highest negative ratio. This result is anticipated in the sense that the utility is limited to wastewater services only.

Private sector results are more attractive than public sector results. US and UK private utilities had the highest ROE for their water and water/wastewater utilities. The US water utility average ratio was 9 percent. The ROE for UK water and water/wastewater utilities was 8 percent and 7 percent, respectively.

It is worth mentioning that the results of developed countries such as the UK and the USA should not be compared to the results of developing countries. A 9 percent return is an attractive rate of return on investments carried out in the USA, where US treasury bills at the time when this study was conducted were priced at a rate of return of 4.5 percent. In contrast, a time deposit placed in a bank in Egypt in the same period would yield a 10 percent rate, rendering the same return unattractive to local or foreign investors, who would in the latter case be looking for a minimum rate of return of 14 percent to overcome the various risks encountered.

Operational indicators results

The results of operational ratios gathered from the 234 utilities are summarized in Table II.

Unaccounted-for water percentage

The percentage of unaccounted-for water is a key operational indicator representing the percentage of loss in the water produced, but not billed. It amalgamates the different types of losses (World Bank, 1996).

Unaccounted-for water percentage can be explained as the difference between water supplied and delivered to the system and water sold as a percentage of net water supplied.

The highest average unaccounted-for water percentage was noted in AWGA (34.03 percent), followed by the average for developing countries (30.02 percent), while the lowest percentage was in the USA (10.08 percent).

In water/wastewater utilities, the results for Beheira were very similar to developing countries, while the US results were the lowest. US water and water/wastewater had almost the same percentage of unaccounted-for water at 10.8 percent and 10.08 percent, respectively. This implies that the service type does not affect this particular operational factor.

An increasing trend in unaccounted-for water was observed in private utilities over public ones. US private water utilities had an average unaccounted-for water percentage of 14.46 percent, UK private water utilities 15.6 percent and water/wastewater utilities 13.81 percent. As for developing countries, the ratio is nearly the same among both sectors.

Cost and staffing

The cost and staffing indicators include staff number per 1,000 connections and labor cost as a proportion of operational costs.

Staff number per 1,000 connections

Staff number per 1,000 connections is expressed as the total number of staff represented as the number per 1,000 connections of water and sewage. Table II indicates that developing countries' water utilities have the highest number of staff per 1,000 connections, followed by AWGA. For water/wastewater, Beheira has the highest results, followed by developing countries. The USA has the lowest results in this indicator at 2.05 and 3.06 for water and water/wastewater, respectively. The results of this indicator, together with the labor cost versus operating cost, are two key indicators that are most indicative of the labor efficiency of a utility.

The results of the private sector are generally lower compared to the range encountered in public utilities. US water utilities were 2.04, UK water utilities 1.125, developing countries water utilities 3.19, and UK water/wastewater utilities averaged at 1.5.

Labor cost versus operating cost

Labor cost versus operating cost is the total annual labor cost expressed as a percentage of total annual operational cost.

Among water utilities, AWGA has the highest labor versus operating cost (39 percent), followed by the USA, then developing countries (16.68 percent). For water/wastewater utilities, the average results for developing countries are highest compared to the USA.

The substantial variation between the highest and lowest ratios may be explained by the difference observed in the relative labor price. The labor cost is cheaper in some countries, commonly in developing countries rather than developed countries. Moreover, the operating cost in larger companies is expected to be less than that in smaller companies, thus causing a difference in the same ratio between two utilities in the same country, as is in AWGA and AGOSD, where the ratios are 39 percent and 67 percent, respectively.

The results of US private water utilities are less than those of public utilities, while the results of developing countries are nearly the same between both sectors.

It is worth mentioning that labor cost in developed countries includes pension costs, which is lacking in developing countries, thus increasing the value of this ratio among developed countries as compared to developing countries.

Billing indicators

Billing indicators reflect the different charges associated with water and wastewater utilities. The average tariff is used in this study due to the direct and clear representation it gives to water and wastewater charges. The results are recorded in \$US/m^3 charged for water and wastewater services delivered.

Average tariffs

As per Table II, Egypt was the lowest country charging tariffs. Tariffs charged in AWGA are \$0.065/m^3, in Beheira \$0.08/m^3 and in AGOSD \$0.04/m^3. African water and water/wastewater utilities had average tariffs of \$0.19/m^3 and 0.705, respectively. The highest charging country was the USA with an average of \$1.29/m^3.

Though expectations are that private sector tariffs would be higher than public ones, results show that private sector average tariffs are lower. US private utilities charged \$0.92/m^3 versus \$1.29/m^3 in the public sector. UK water utilities charged \$1.08/m^3, and the highest recorded tariff was in UK water/wastewater utilities at \$1.45/m^3.

In developing countries tariffs are usually much further from covering costs. These countries are often characterized by cross-subsidies with the intent to make water more affordable for residential low-volume users who are assumed to be poor. For example, industrial and commercial users are often charged higher tariffs than public or residential users. Also, metered users are often charged higher tariffs for higher levels of consumption.

Miscellaneous indicators results

The working ratio is calculated for the sample utilities. This ratio is expected to be less than 1 under efficient management.

Working ratio. The working ratio is the total annual operational expenses divided by the total annual operating revenues. Table I shows that developing countries had operating expenses nearly equal to their operating revenues. The working ratio for both the USA and AWGA were nearly the same (70 percent). Dumol (2000) specified an ideal range of 0.5-0.8. Both results fell between the defined ranges.

As for water/wastewater utilities, Beheira has the highest working ratio, exceeding 1, which indicates that its operating expenses exceeded its operating revenues. The USA and developing countries had results falling within the study range.

The ratio in private utilities was 0.68, 0.67 and 0.83 in the USA, the UK and Africa, respectively. Africa had the highest ratio, slightly exceeding the study range. The UK and the USA were within the study average. The UK water/wastewater private utilities average ratio was 0.623. The ranges of private utilities for both water and water/wastewater were less than those of the public sector, thus indicating a more efficient management of their expenses.

Discussion

As mentioned above, private utilities were not superior to public ones in all the indicators calculated. Some operational indicators reported the strength of private utilities' performance, such as the number of staff per thousand connections and labor cost versus operating cost. US public utilities exceeded private utilities in staff per thousand connections and labor cost versus operating cost by 0.5 percent and 7 percent, respectively.

Similar results were observed in some of the financial and miscellaneous indicators, such as asset turnover ratio, working ratio, and return on equity ratio. The asset turnover ratio for US private utilities exceeded public utilities by 45 percent, indicating higher sales (assuming constant volumes of assets) and higher utilization of assets to generate operating revenues.

Other financial and operational indicators of public water/wastewater utilities were better than those of private utilities, such as debt to equity ratio, ROS and unaccounted-for water percentage. ROS for US public water utilities exceeded that of private utilities by 34 percent. However, this was not the case for utilities of developing countries and Egypt. Examples abound: the debt to equity ratio of developing countries and Egypt were below the study average, indicating the dependence of different developing countries on foreign investments. Further, the ROS calculated for Egyptian water and wastewater utilities provided an indication of the high expenses and limited sales volume encountered in these utilities, which could possibly be the result of the high percentage of unaccounted-for water and the low tariff charged for the service performed. This research revealed that developing countries have an average percentage of unaccounted-for water exceeding that of US public utilities by 66 percent.

However, it is evident from the above that inefficiency is a major trait of public water/wastewater utilities, particularly those of developing countries and Egypt. Improvements in private sector utilities were apparent in indicators that are highly related to the efficiency of the management of the utility. Therefore, the involvement of the private sector in the management (and possibly ownership) of these utilities would be a solution. There are various forms of privatization that can suit the water/wastewater sector. Involving the private sector should result in higher levels of efficiency at the operational level.

Public-public partnership, on the other hand, is an alternative to privatization. A number of communities have recognized operation and management under local public control. This has saved money and maintained or improved water quality (Energy Program, 2006).

Public-private partnership is another option. It is better to promote viable public-private partnerships and commercialization of services. The core business of water and sewage should preferably be retained by a municipally owned enterprise (Osmo *et al.*, 2001).

It is worth mentioning that there is strong public resistance to the privatization of water utilities. This opposition is stronger than what is acknowledged and published. A survey conducted in 2002 concluded that "privatization remains widely and increasingly unpopular, largely because of the perception that it is fundamentally unfair, both in conception and execution" (Birdsall and Nellis, 2002).

The public argument, being the opposition to privatization, is based on economic factors – prices, profits, jobs and development. It is recognized that privatization of water utilities makes prices higher than they would otherwise be, while at the same time cutting jobs and making the remaining workers less secure. In developing countries in particular, the opposition is also based on a strong sense that public sectors are subject to local decision-making, taking into consideration public interest and governmental policies rather than market forces (Buresch, 2003). This is evidenced by charging lower tariffs and using the public sector to provide employment opportunities in developing countries. These in turn may be reflected as operational inefficiencies of public sector utilities. This is most obvious in the staff per thousand connections, where the high results in this indicator are a mere reflection of the above-mentioned conditions and do not necessarily indicate inefficiency in operation.

All this should not be viewed as the authors' opinion in resistance to economic progress, particularly considering that the paper incorporated a group of utilities from developed and developing countries in both public and private water and wastewater utilities, where in some areas it reached conclusions supporting the fact that public or private ownership makes little difference to efficiency.

Conclusions

The performance of public sector water/waste utilities, particularly those in developing countries and Egypt, does need improvement. An increase in the tariffs charged for water/wastewater services, various forms of privatization, as well as the alternatives presented above, are all possible solutions that can improve the financial position of the utilities, permitting them to offer a higher quality service. Ultimately, this research is an added piece of evidence supporting the urge to make the move sooner rather than later.

Research limitations

The major limitation in this research is the inconsistency of the data collection period among various utilities. This stems from the fact that data was gathered from a diverse sample of utilities located in different countries of the world and hence, the unification of years was an arduous task. However, the divergence of years might lead to slight discrepancies in the results, caused by inflation rates, purchasing power, variation in supply and demand. Nevertheless, the importance of the topic on hand presses the need to use the readily available data despite its shortcomings.

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