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## DELIVERING WATER, SANITATION AND HYGIENE SERVICES IN AN UNCERTAIN ENVIRONMENT

# Capital maintenance study, the case of water supply systems in selected small towns

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This Capital Maintenance Expenditure (CapManEx) study of seven Small Towns' Water Systems provides understanding of the recurrent cost elements needed for sustainable services delivery. Field visits were carried out to the water systems and copies of available records on O&M were obtained. A data classification guide was used to classify the data and adjusted to the year 2011 using Gross Domestic Product deflators. The classified data was annualised to find the average total cumulative cost. The results showed average recurrent cost of the water systems for period of five years to be around USD 5 per capita/yr corresponding to less than USD 0.7 per m<sup>3</sup> of water production/yr. The major component of the total recurrent cost is the Operational and Minor maintenance Expenditure (OpEx) with the CapManEx representing less than 25%. The water systems finance CapManEx from water tariffs, but savings towards CapManEx are not based on the policy guidelines.

#### Introduction

The WASHCost<sup>1</sup> project has developed and tested the Life Cycle Cost Approach (LCCA) as a methodology for costing the provision of sustainable Water, Sanitation and Hygiene (WASH) service in four countries including Ghana. In Ghana, the first LCCA application looked at costs and service levels of rural water and sanitation in three regions. The work revealed the key cost elements in Ghana that have not been receiving adequate attention but are necessary for the delivery of sustainable services. These key cost elements are Expenditure on Direct Support (ExpDS) and those associated with operations and maintenance, mainly Capital Maintenance Expenditure (CapManEx), Operational expenditure (OpEx) and Capital enhancement expenditure (CapEx Enh) Catarina et al (2011) However, the actual magnitude of these key cost elements needed to ensure the much desired sustainable services is not well understood. A good understanding of especially the recurrent expenditure (OpEx and CapManEx) is important for planning and budgeting, as well as tariff designs to help improve service delivery.

This study is therefore focused on providing better understanding of the recurrent expenditure for small towns' water schemes based on seven well performing Small Towns' Water Systems namely: Kuntanase, Wiamoase, Mafi Kumase, Bekwai, Juaben, Hwidiem and Suma Ahenkro. In addition, the study also examines existing policy and practices in addressing capital maintenance. This is key to contribute to the discussions on establishing innovative financing mechanisms that better address capital maintenance needs

<sup>&</sup>lt;sup>1</sup> WASHCost is a five year action research project investigating the cost of providing water, sanitation and hygiene services to rural and peri-urban communities in Ghana, Burkina-Faso, Mozambique and India (Andhra Pradesh). The objectives of collecting and disaggregating the cost data over the full life-cycle of WASH services are able to analyse cost per infrastructure and service level, and to better understand the cost drivers and through this understanding to enable more cost effective and equitable service delivery. WASHCost is focused on exploring and sharing an understanding of the true cost of sustainable services (see www.washcost.info)

in the small towns' water sector of Ghana. The policy implications and recommendations for practice are also drawn from the key findings.

## Data collection and analysis

Field visits were carried out to the water systems, and copies of available records/data on recurrent expenditure, operations and maintenance (O&M) were obtained. A data classification guide for the recurrent cost of operations and maintenance was used to classify the data as indicated in table 1.

Table 1. Cost data classification and descriptions		
Life cycle cost components		
OpEx	Salaries, Vendors' commission;	
	Accounting fees;	
	Electricity charges;	
	Minor repairs of borehole head works;	
	Minor repairs of borehole screen, environment;	
	Repair of meters;	
CapManEx	Replacement of pump;	
	Replacement of intake valves (if surface water);	
	Major repair/reconditioning of storage tanks;	
	Flushing of boreholes;	
	Replacement of pump motor;	
	Major electrical repairs at pump house;	
	Major excavation/relaying/movement of piped network;	
CapEx Enh	Network extension.	

The classified recurrent cost data (for the past five years) were adjusted to the year 2011 using Gross Domestic Product (GDP) deflators for the various years established by the World Bank. The adjusted cost data were annualised by finding the average of total cumulative cost. Further analyses were carried out to determine the annual average recurrent expenditure per person (users) and per unit volume of water produced. Also the relative magnitude of OpEx and CapManEx for the systems was also determined.

## Policy and practices on CapManEx for Small Towns' Water Supply in Ghana

In Ghana, tariff calculation for rural and small towns' water services is governed by CWSA tariff setting guidelines and is regulated by the Legislative Instrument, CWSA (2011). The cost components contained in the 4th schedule of CWSA (2011) makes provision for replacement cost, rehabilitation and expansion works when developing tariffs, and thus CapManEx and CapExEnh are supposed to be paid entirely through tariffs. This is shown in table 2 below. It is important to note that the tariff collection cost to be paid to the vendor is charged as 20% of the total regular operation and maintenance expenditure (items 1-5), before the provision for CapManEx, CapExEnh and Sanitation are made. This is made so in order to make the tariff not too expensive. In practice however, 20% of the total sales of water is paid to the vendor before the revenue accrued from water sales are declared. This practice is for convenience sake, and also to serve as motivation to the vendor.

Table 2. Tariff Setting Guidelines		
Components of Tariff		
1.Water Production Cost	Actual cost for this component	
2.Distribution Cost	Actual cost for this component	
3.Routine maintenance and other contracts	Actual cost for this component	
4.Repair Work by staff and private maintenance contracts	Actual cost for this component	

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5.Water Quality Monitoring at plant level	Actual cost for this component
6.Tariff Collection cost ( to vendors)	Not more than 20% of (1-5) total
7.Replacement Cost	20% of (1-6) total
8.Rehabilitation and Expansion	5% of (1-6) total
9.Sanitation Fund	8% of (1-6) total
10. Contingency	2% of (1-6) total

Source: Adapted from CWSA (2011)

The model bye-laws of the Ministry of Local Government and Rural Development and Environment MLGRD&E (2008), enjoins the Water and Sanitation Management Teams to ensure financial viability of water systems. It gives them the mandate to recommend tariffs based on the guidelines in Table 2 for approval by the Metropolitan, Municipal and District Assemblies (MMDAs). The management teams are requested to establish at least three accounts, which shall be designated as follows: 1) Operational Account; 2) Capital Account; and 3) Sanitation Account. They are also instructed to make at least weekly payments of all revenues accrued from water sales and other receipts to the Operational Account from which are paid all regular operation and maintenance expenses. The Capital Account to be used for expenses on major repairs, expansions and replacements (not for routine operation and maintenance) is to receive monthly payments of at least 20% of net monthly revenue. Also from the bye-laws, MMDAs may allocate funds annually from their budgetary allocation to the capital account. Thus, suggesting that the amount to be allocated by MMDAs is not explicit but based on voluntary disposition. The water systems visited under this study finance CapManEx from water tariffs but the allocation of funds into their capital/replacement account is not based on the policy guidelines.

#### The need for innovative mechanism for addressing CapManEx in Ghana

It is a fact that Ghana experiences breakdowns of water systems, and in some cases the systems are abandoned due to lack of funds to carry out maintenance. When this happens the community members go back to their traditional sources of water which are normally polluted and the outcome have always not been in the interest of the nation. This problem has been found to result for two main reasons;

1. Water systems that generate adequate revenue are left to manage their own finances under the Community Ownership and Management (COM) concept CWSA (2010). This concept though requires the water system managers to render financial accounts to the communities, the District and Municipal Assemblies, it has been found to have weak financial controls and that leads to misuse of funds. This has resulted in lack of funding to carry out CapManEx with some water systems in Ghana.

2. Some water systems also due to their peculiarities are not viable and hence the systems managers do not generate enough revenue in order to be able to save towards CapManEx.

For these reasons, there is therefore the need for innovative mechanisms to address capital maintenance needs. Both Pooled Funding from water system managers and Insurance Policies as means of dedicated source of funding for addressing CapManEx have been proposed.

## Magnitude and relative magnitude of recurrent expenditure of the water systems

The average annual recurrent expenditure was calculated in three forms which are: expenditure per system, expenditure per person and expenditure per meter cube of water produced.

The annual average total recurrent expenditure (OpEx and CapManEx) per water systems ranges between a minimum of USD 14,364 (Suma Ahenkro) and a maximum of USD 95,520 (Bekwai) as shown in the Figure 1 below.

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Figure 1. Annual average total recurrent expenditure



Figure 2. Annual average recurrent expenditure per capita

Hwidiem has the least design population of 2,822 people among the selected water systems, followed by Kuntanase of 3,024 people. This means that they are relatively smaller water systems, and perhaps that explains why they show relatively higher average recurrent cost per capita per year. (see Figure 2). Bekwai has the highest design population of 28,000 people and the biggest among the selected water systems. It is also among the systems showing relatively less recurrent cost per capita per year, but not the least. For the principle of economies of scale to have been fully followed, Bekwai should have recorded the least average recurrent cost per capita per year. However, the Bekwai system is operated and maintained by a private operator through a contracting arrangement between the Community, the District Assembly and the Private Person. This arrangement with its financial implications could probably explain its relatively higher average recurrent cost per capita per year, as compared to smaller water systems like Juabeng (design pop. 17,570), Mafi Kumase (design pop. 15,000), Wiamoase (design pop. 12,677) and Suma Ahenkro (design pop. 7,606) which are operated and maintained by WSDBs. Also Suma Ahenkro, a smaller system compared to Wiamoase and Mafi Kumase recorded the least average recurrent cost per capita per year. This could be due to prudent management of its operations and maintenance by its managers.

In terms of water production volumes, recurrent expenditure per unit cubic meter of water produced per year ranges from USD 0.37 (Hwidiem) to USD 0.75 (Juaben) (see Figure 3). The result in Figure 3 does not show any special trend between the average recurrent expenditure per unit volume of water produced and the size of the water system. The cost of water production could be affected by several factors like the cost of water abstraction / (pumping), the quality of the water source and yield of the water source, and that might explain this development.

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Figure 3. Annual average recurrent expenditure per cubic meter of water produced

#### Relative magnitude of recurrent expenditure of the water systems

The total recurrent expenditure was disaggregated into OpEx and CapManEx for six of the water systems that kept operational records in a manner that facilitated the disaggregation. The graph below (Figure 4) shows the disaggregated recurrent expenditure indicating the average annual OpEx and CapManEx of the water systems. The annual average OpEx ranges between USD 11,158 (Suma Ahenkro) and USD 91,323 (Bekwai). As expected the larger systems, in terms of design population like Bekwai, Juaben and Mafi Kumase have higher annual average OpEx as compared to the smaller systems. However, Hwidiem the smallest system amongst them, showed a relatively higher OpEx as compared to relatively bigger systems like Mafi Kumase, Suma Ahenkro and Kuntanase (see Figure 4). This could be due to the fact that CapManEx data are rarely recorded in appropriate manner and some CapManEx figures may have been captured as OpEx for this system. The annual average CapManEx also ranges from USD 1,680 (Hwidiem) to USD 4,196 (Bekwai).

A comparison of CapManEx relative to total recurrent expenditure shows a range from the lowest 4% (Bekwai) to the highest 22% (Suma Ahenkro) (see Figure 5). This might not necessarily reflect the necessary levels of CapManEx for sustainable water services delivery but could be a good guide for planning purposes. This is because this study noted that CapManEx data is rarely recorded in an appropriate manner as also revealed by work of Franceys and Pezon (2010).



Figure 4. Annual average OpEx and CapManEx



Figure 5. Annual average CapManEx and OpEx ratio

### Conclusions

The study establishes the following key facts:

- The total annual average recurrent expenditure (OpEx and CapManEx) ranges from USD 14,364 to USD 95,520, with the annual per capita expenditure ranging from USD 2 USD 12.
- Total annual average recurrent expenditure per unit volume of water produced ranges from USD 0.4 to 0.8
- Annual average OpEx and CapManEx for the systems are USD 11,158 91,323 and USD 1,680 4,197 respectively.
- The CapManEx is less than 25% (ranging from 4 22%) of the total recurrent expenditure.
- The average recurrent cost for these small towns' water systems for the period of the study is around USD 5 per capita/yr corresponding to less than USD 0.7 per m3 of water production/yr. The major component of the recurrent cost is the OpEx with the CapManEx representing less than 25% of the total.
- The water systems finance CapManEx from water tariffs, but the allocation of funds into their capital/replacement account is not systematic and also not based on the policy guidelines.

#### **Recommendations for policy and practice**

Though the findings are limited in scope, based on the sample size used for this study but the results provoke sector reflections on some key issues pertaining to making small towns' water service delivery sustainable. This case study could be considered as providing findings that are indicative in the Ghanaian context especially for the over 400 small towns' water supply systems scattered nationwide. In fact, the recurrent costs of these small towns' water systems are not astronomical in terms of annual cost per capita. This could explain why some stakeholders strongly believe that per the policy guidelines, operators should be able to run sustainable systems. Thus all stakeholders responsible for successful implementation (strict adherence and compliance by Water and Sanitation management Teams) of the small towns' water policy guidelines and MMDAs bye-laws are called upon to their task.

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#### References

- Catarina, F. et al. (2011) *Costing Sustainable Services: The Life Cycle Cost Approach (LCCA).* (WASHCost Briefing Note 1a) The Hague: IRC International Water and Sanitation Centre.
- Franceys, R. and Pezon, C. (2010) *Services are forever: The importance of capital maintenance* (*CapManEx*). (WASHCost Briefing Note 1b) The Hague: IRC International Water and Sanitation Centre.
- MLGRD&E (2008) District Assemblies Model Bye-Law-Establishment and Operations of Water and Sanitation Development Boards. Ministry of Local Government, Rural Development and Environment: Government of Ghana.

CWSA (2010) *Operations and Maintenance Guidelines for Small Towns Water Systems*. Community Water and Sanitation Policy, Ministry of Water Resources, Works and Housing pp 2-4.

CWSA (2011) Community Water and Sanitation Regulation LI 2007. Ministry of Water Resources, Works and Housing: Government of Ghana

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