Do operation and maintenance pay?

Erich Baumann

Life-cycle costing can help planners estimate not only how much handpumps cost to install, but how much they cost to maintain. This article shows how it is done, and demonstrates that spending more on regular maintenance often works out cheaper in the long run.

Currently, in rural water planning, high priority is given to accelerated service delivery and the investments needed for meeting the MDGs. New water facilities are built and sustainability does not receive enough attention. Little consideration is given to the management of established assets. RWS (rural water supply) facilities are not based on fit-and-forget technology. Investments have financial and managerial implications throughout their life cycle.

Investment costs are judged with benchmarks such as cost per capita. Such judgements are made regardless of the operating and maintenance costs and very often in ignorance as to whether the facility actually produces the amount of water that was planned. Planners and decision-makers do not give enough thought to the life-cycle consequences that follow from the investments, with the result that handpump failure rates can be anywhere from 15 to 50 per cent, averaging around 30 per cent in Africa.

RWSN (the Rural Water Supply Network) focuses on establishing principles to encourage successful public and private sector participation in improving the sustainability of handpumps in RWS. The following article tries to identify why efforts for improved operation and maintenance (O&M) management are at the core of sustaining investments.

Life-cycle costing and cost management

In everyday life, we clearly accept that a decision to invest has consequences. For example, when we decide to buy a car, we know that once we have paid for it, there will be more costs to come: road tax, insurance, fuel, maintenance, repairs, etc. We expect it to run for 100,000 miles, and the decision regarding which model we buy is based on several considerations: on-road/off-road conditions, running costs, longevity, repair services, re-sale value, etc.

The life-cycle costs of a facility include investment (planning, design, construction, and equipment), operating costs, maintenance cost over its whole life and eventually disposal or replacement cost. Cost management is the process of planning, budgeting, co-ordinating, controlling and of reporting all cost-related aspects. It involves identifying all costs associated with the investment, making informed choices about which options will deliver best value for money, and managing those costs (who pays for what and when?) throughout the life of the project.

Investment costs represent only a proportion of the life-cycle costs. In RWS, different organizations are normally responsible for investment and subsequent funding for O&M. Consequently, there is little incentive to apply the principles of life-cycle costing to purchasing policy. However, it would be helpful if procurement officers did a life-cycle cost analysis and looked into supply chains for investments.

What is done in a life-cycle cost analysis?

- Forecasting the whole-life costs associated with the investment.
- Evaluating the competing options during purchase on the basis of whole-life costs, which are more reliable indicators of 'value for money' than the initial construction costs.
- Judging the performance vs. cost trade-off.

Life-cycle cost analysis reveals that the cheapest is not always the best. Money spent on a good design can be saved many times over in construction and maintenance costs. An integrated approach to design, construction, O&M with inputs from constructors and their suppliers can improve sustainability, design quality, reduce maintenance requirements and subsequently reduce whole-life costs.

Who is responsible for management?

Water supply facilities should be considered as assets and managed in such a way that they last their projected service life. Adequate O&M is quite

Consideration should be given as to how a viable spare-parts service can be run

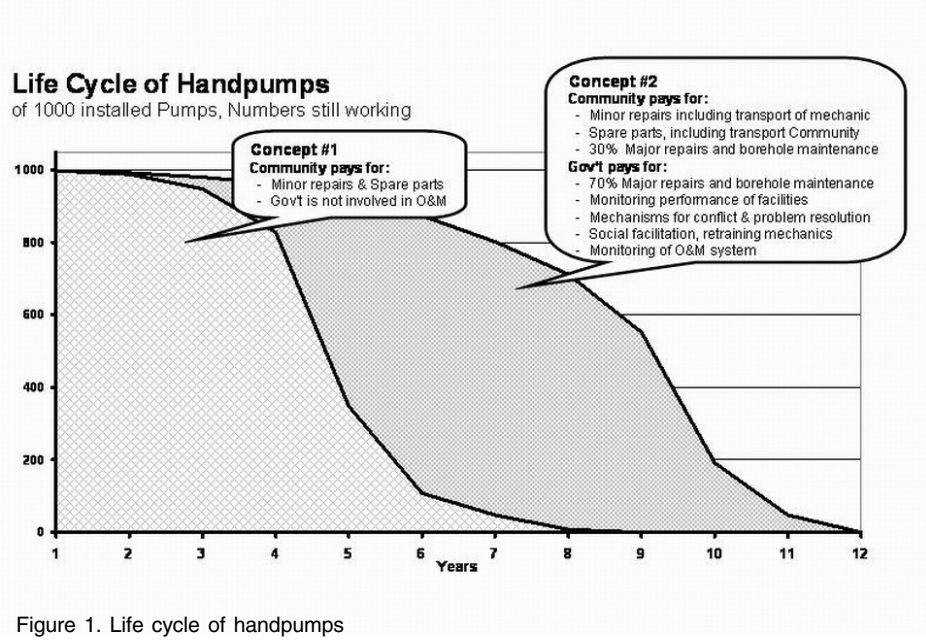

Figure 1. Life cycle of handpumps

complex, it is more than just changing a seal or a bearing. Clear guidelines are needed regarding who is responsible for the various aspects of maintenance and how the costs are shared between the public sector and the communities.

The following section compares two O&M concepts.

Model 1: Community Management

In this common model, O&M is mainly left to the communities. They can carry out minor repairs with little technical support. Local governments have insufficient resources and hardly any incentives to establish functioning support systems. Accordingly, essential aspects of sustained maintenance are neglected and communities find it difficult to get spare parts or support services for repairs that are beyond their capacity. Without follow up, social conflicts, which can hamper effective maintenance, are not recognized or addressed.

Model 2: Community Management Plus

From model 1 to model 2 requires a paradigm shift in how to tackle O&M. The theory that communities can do everything by themselves needs to be reconsidered: O&M is a shared responsibility between communities, local authorities and central government.

Community Management Plus includes a comprehensive O&M policy. This policy identifies the responsibility of the central and local governments for O&M and clearly defines the interfaces between the local governments and the communities. The tasks of local governments in O&M need to be fully recognized. The district water departments need to arrange themselves to fulfil these functions. The budgeting process needs to allocate the required resources to the various departments involved in the upkeep of the facilities. Local governments do not have to do all the work themselves but can contract some or all functions to the private sector. The concept can create a considerable number of jobs either in government or in the private sector (monitoring technicians, community development specialists, handpump mechanics, private sector companies that can be active in the supply chain of goods and services, etc.).

What are the costs?

Under model 1, Community Management, the community would need to collect US$25.00 per pump/yr for repairs and spares. With model 2, Community Management Plus, the running costs are much greater: a total of $235 per pump/yr is needed. The cost components of this setting (administration and management of O&M) can be divided as shown in Table 1. (The figures in this article are typical approximate costs for any African country.)

What are the results?

Experience with model 1 shows that due to insufficient O&M, handpumps last for about five years only. Rehabilitation programmes are needed to bring them back to a functional state at the end of this time. There is a gap in interaction between community and government, therefore rehabilitations have to be accompanied by facilitation programmes, which increases the cost.

Under model 2, the handpump is properly maintained. Small repairs are

Table 1. Total annual O&M costs – model 2

Component	*Paid by*	*Cost ($)*
Minor repairs including transport of mechanic	Community	15.00
Spare parts including transport	Community	20.00
Major repairs and borehole maintenance (cost sharing)	Community 30%	30.00
	Local gov't 70%	70.00
Monitoring performance of individual facilities by the districts	Local gov't	30.00
Mechanisms for conflict and problem resolution	Local gov't	20.00
Marketing social facilitation retraining mechanics and communities	Local gov't	20.00
Monitoring performance of O&M system including supply chains	Gov't	30.00
Total cost for O&M		235.00
The cost contributions would be shared as follows:		
The community would need to collect and pay	$65.00 per pump/yr	
The local government needs to budget	$140.00 per pump/yr	
The central government needs to budget	$30.00 per pump/yr	

Only a limited level of maintenance can be performed by the community on its own

done by the communities. When required the local government supports them in major repairs and borehole cleaning. The local authorities monitor performance, help with conflict resolution and social facilitation. The pump has a service life of approximately 10 years.

Figure 1 indicates the difference in service lives of functional handpumps. For rural water facilities, it is quite easy to calculate the expected benefits. Table 2 shows a cost comparison of the two models for a handpump fitted on a borehole. The two examples are based on the same technology and the same operational conditions, the only difference is the way O&M is organized and performed.

Model 1 assumes minimum O&M. The life span of the pump is five years. After this time, when the pump is no longer functional, the water point is systematically rehabilitated and a new pump is installed. It is assumed that the cost of rehabilitation is 20 per cent of the borehole cost (flushing, apron repair), plus a new handpump is needed, plus 50 per cent of the facilitation cost is needed (retraining of caretakers and committees); this all comes to $4,050.

Model 2 is based on adequate O&M. After 10 years the pump needs to be replaced. It is assumed that the rehabilitation cost is the same as in Model 1, but the facilitation cost is only 30 per cent because less retraining is needed for caretakers and committees, so the total equals $3,550.

This comparison between the two concepts shows that neglecting maintenance ends up in paying 20 per cent more per m^3 of water. This indicates that planning and management of O&M is an important factor in cost efficiency. Neglecting maintenance leads to a great waste in investments and the expected results are a low percentage of functional pumps and a much higher price for each pumped m^3 of water.

However, model 2 requires that the procurement procedures focus on quality rather than on price and O&M concepts need to be structured in such a way that sustained functional supply chains for goods and services can be established.

Table 2. Cost per m^3 of water over 10 years (half the borehole life)

	Model 1	Model 2
Expected service life of handpump (years)	5	10
Investment:		
• Borehole	9 000	9 000
• Handpump with installation	1 000	1 000
• Social facilitation cost	2 500	2 500
Total investment	12 500	12 500
Number of persons served	300	300
Water consumption (lit/cap/day)	20	20
Total water production over 10 years (m^3)	21 600	21 600
Cost for maintenance		
Model 1 = ~ 0.2% of investment/year = $25/yr x 10	250	
Model 2 = ~2% of investment/year = $235/yr x 10		2 350
Cost for rehabilitation		
Model 1 = 2 rehabilitations = $4 050 x 2	8 100	
Model 2 = 1 rehabilitation = $3 550		3 550
Depreciation of borehole = $9 000/20 x 10	4 500	4 500
Total life-cycle cost (10 years)	12 850	10 400
Cost per m^3 of water $	$ 0.60	$ 0.48

Table 3. Costs of O&M borne by community

	Model 1	*Model 2*
Investment $12 500; community contribution = 5%	625	625
Cost for maintenance:		
Model 1 = $25/yr x 10 years	250	
Model 2 = $65/yr x 10 years		650
Cost for rehabilitation:		
Model 1 = 10% of $4 050 (2 times over 10 years)	810	
Model 2 = 10% of $3 550		355
Total cost for community	1 685	1 630

Which concept is 'pro poor'?

One might assume that model 2 puts a much higher financial strain on the community and is not a 'pro poor' option. Communities have to pay $65 instead of $25 per year. But let us have a look at the overall cost for the community after 10 years.

The calculation shown in Table 3 is based on a 5 per cent community contribution to construction costs and on a 10 per cent contribution towards the rehabilitation cost.

Under model 2, the communities are actually paying less for a better service. It is estimated that the percentage of functional pumps could be increased to around 90 per cent. That means that in the long run both government and users are benefiting from paying full attention to O&M.

About the author

Eric Baumann works for Skat in Switzerland, as a technical expert in the field of rural water supply. For 14 years, he has headed the secretariat of RWSN (Rural Water Supply Network, formerly HTN).