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34th WEDC International Conference, Addis Ababa, Ethiopia, 2009**WATER, SANITATION AND HYGIENE:
SUSTAINABLE DEVELOPMENT AND MULTISECTORAL APPROACHES****Preliminary assessment of economic sustainability
of water supply schemes in rural highlands of Oromia***F. Fulgoni, M. Paba, R. Save & G. Cancelliere, Ethiopia*

REVIEWED - LOCAL

The study consists in a preliminary analysis about the economic sustainability of rural water supply schemes management in the highlands of Oromia region and it aims at providing the WaSH sector in Ethiopia with a methodology for reviewing tariffs and post-project management. A quantitative analysis is carried out through the Average Incremental Cost method and by assessing the Break-Even Point achievement of a stratified sample of water schemes, respectively considering: O&M, Depreciation and Capital Investment Return. Despite the limited sample dimension, the methodology has been proven consistent with the challenging situation of the rural water supply sustainability. Hence the study offers relevant findings and reflections on the fragile link between tariff setting and cost-recovery necessities and the implications of low economic sustainability, which is often the main cause of water schemes malfunctioning. Finally, a more comprehensive investigation on the same theme across the sector in Ethiopia is suggested.

Objective, scope and methodology

The objective of the study is to assess the main factors influencing economic sustainability of water supply management in the rural highlands of Oromia region of Ethiopia and to provide qualitative and quantitative inputs for further water tariff reviews. Being a pilot exercise, it focuses on the assessment of the methodology and on the evaluation of the relevance of the findings it can deliver, with the intention of:

- Analyzing Operation & Maintenance (O&M) cost structure for different types of water schemes;
- Comparing existing approaches in tariff setting;
- Suggesting a tool for setting tariffs at any moment in the life of a water supply scheme.

The methodology included: the selection of the water schemes to be visited, the collection of data and their quantitative and qualitative analysis.

The selection of the water supply schemes has been done in order to have a sample representative of different water supply technologies and implementing modalities in the target area. The sample includes 67 functioning water supply schemes. The *woredas* (district administrations) involved are 23 and the users, according to local estimations, are around 547,000, roughly 2.3% of the rural population of Oromia.

Data collection has been based on structured interviews and performed stratifying the sample into "Simple" and "Complex" water supply schemes. "Simple" water supply schemes are those with a single distribution point, based on a low cost technology such as Springs with Development (SD), Hand Dug Wells with Hand Pump (HDW+HP) and Shallow Wells with Hand Pump (SW+HP). "Complex" are those with more advanced technology, with more than one water point and serving a greater number of users such as Springs with Gravity System (S+GS), Bore Holes with Gravity System (BH+GS) and Springs with Motorized System (S+MS). An important difference is that Simple schemes usually have a Flat Tariff, where users pay a fix monthly contribution per household, whereas Complex schemes have a Uniform Tariff, where users pay proportionally to their consumption. A similar number for each sampling *stratum* has been kept: 32 Simple schemes and 35 Complex schemes.

Average incremental cost and break even point analyses

The Average Incremental Cost (AIC) analysis is an extension of the cost-effectiveness analysis for estimating the average unit cost of service provision. This forward analysis is used to approximate the marginal cost pricing conditions needed for establishing indicative tariff structures.

In this study, the present value of project cash flows has been divided by the present value of the water consumed to produce an average cost per m³ of water sold.

The main inputs for the AIC model are:

- the ordinary O&M costs;
- the extraordinary costs (or replacement of major parts);
- the capital investment (estimated at the present time – see below);
- the life of the water scheme;
- the water consumption.

Starting from these inputs, the model provides, as outputs, three values of the average cost per m³ of water consumed to be compared with the existing water tariffs:

- AIC O&M, the average cost per m³ of water consumed to recover only O&M costs;
- AIC O&M+D, the average cost per m³ of water consumed to recover O&M costs plus the Depreciation
- AIC+CIR (Capital Investment Return), the average cost per m³ of water consumed to recover the O&M costs plus the Capital Investment, which means that the water scheme management will pay back the investment that an external entity - government or donor- made for the project at beginning.

The assumptions made in this study for the AIC model are the following:

- any past Investment Capital Cost has been estimated at the present time, taking into consideration the effect of ageing and use (Depreciation);
- the annual O&M costs are considered constant for the first 5 years and with an increasing of the 50% after 5 years of activities;
- the replacement of major parts has been estimated according to manufacturing indications on lifetime, estimated for each scheme typology;
- the duration of water schemes is assumed of 20 years;
- the Discount Rate as been considered of 10%;
- the annual water consumption has been assumed constant for the rest of water scheme life;
- the Depreciation rate considered is of 3%.

The economic sustainability of a water scheme management, for each of the three AIC values considered, is reached when existing water costs are equal or higher than the AIC ones.

The Break Even Point (BEP) analysis consists in the estimation of the point at which, for a given service, costs or expenses and revenues are equal: there is no net loss or gain, and one has "broken even".

In this study, using the same inputs of the AIC analysis, the model provides 3 values of BEP in order to recover the O&M costs, the O&M costs plus the Depreciation, the O&M costs plus the Capital Investment Return.

The assumptions and limitations of this analysis are:

- the BEP analysis is a supply side (ie.: costs only) analysis and it does not advise about what sales are actually likely to be for the product at various prices;
- it assumes that fixed costs, such as caretaker's salary and replacement of major parts are not subject to time-related fluctuations;
- it assumes that average variable costs are constant per unit of output, at least in the range of likely quantities of sales. The variable costs taken into consideration with a linearity law are fuel and oil or electricity expenses and salaries related to the water sold.

The economic sustainability of a water scheme is reached if the current water consumption is equal or higher than the BEP consumptions.

In this research, the BEP analysis has been carried out only for the Complex schemes where a Uniform tariff system is in place.

Data elaboration consisted in: an analysis of the O&M costs structure, the creation of a database for inputs and outputs, the Average Incremental Cost analysis (AIC, Fane & White 2003) and the Break-Even Point analysis (BEP). Qualitative and quantitative elaboration of the results followed.

Findings

Quantitative analysis

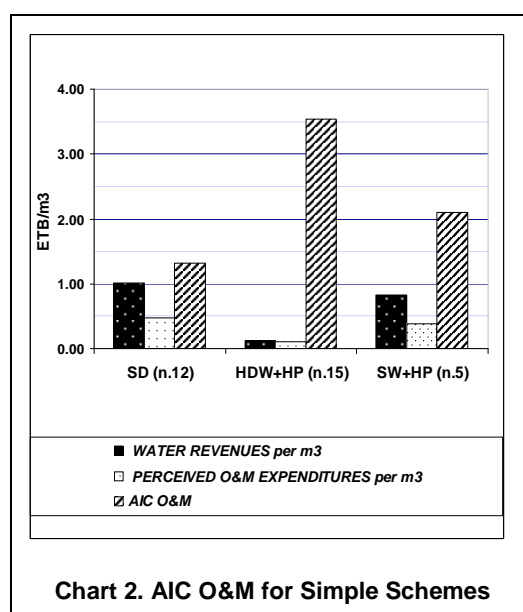
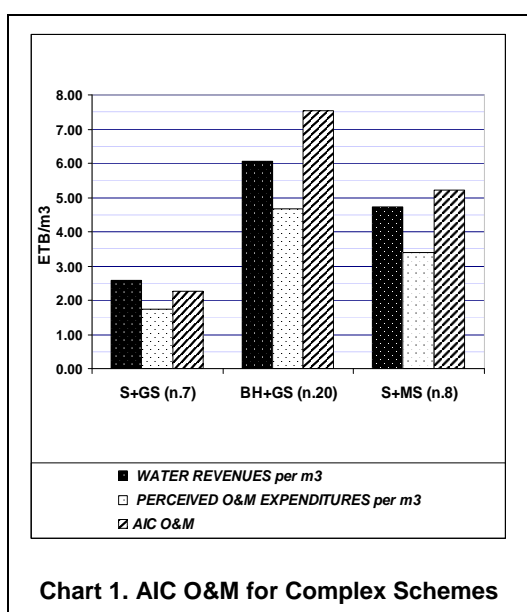
Water tariff

Although in presence of policy guidelines from national and regional authorities, water tariffs are set locally by woredas and/or WASHCOMs (community committees for water schemes management). The survey found that average water price is lower for Simple schemes than for Complex ones. In particular motorized schemes tariffs are the highest due to the cost of fuel. On the other hand, in many of the Simple schemes visited, interviews revealed that people do not pay at all for the water consumed (up to 73% of the cases for the category of Hand Dug Wells) or, sometimes, they pay in kind appointed caretakers.

Revenues vs expenditures

Economic sustainability of water schemes management is reviewed through a comparison of revenues and expenditures. One of the main outputs of this research is the proven presence of expenditures which are not properly accounted for by the WASHCOMs. This started off a deeper analysis of management costs structure for different typologies of schemes.

For Complex schemes (Figure 1) the revenues, expressed per unit of water delivered, include not only the incomes from the water sold but also other profits such as water meters renting, house connection fees and shower facilities fees. The chart compares revenues with those O&M costs actually declared by the WASHCOMs and with the AIC O&M costs. In general, the average of the O&M costs declared is smaller than that of revenues, which means that the overall perception of WASHCOMs is that their schemes are sustainable. But when these values are compared with the AIC O&M costs, it becomes clear that in reality sustainability is not easily reached in many cases. The gap between the columns of AIC O&M costs and the declared O&M costs can be seen as “unperceived costs”. These unperceived costs, which, in some cases, can be up to 40% of the total value of the scheme, can be explained as subsidies from local administrations and as fully overlooked costs.



Maintenance subsidies from Woredas, Zones (provincial administrations) and the Region are very common, and expected by users and WASHCOMs. But they are often not explicitly declared and not properly budgeted for by those supposed to provide them and, therefore, difficult to be estimated. In other cases the

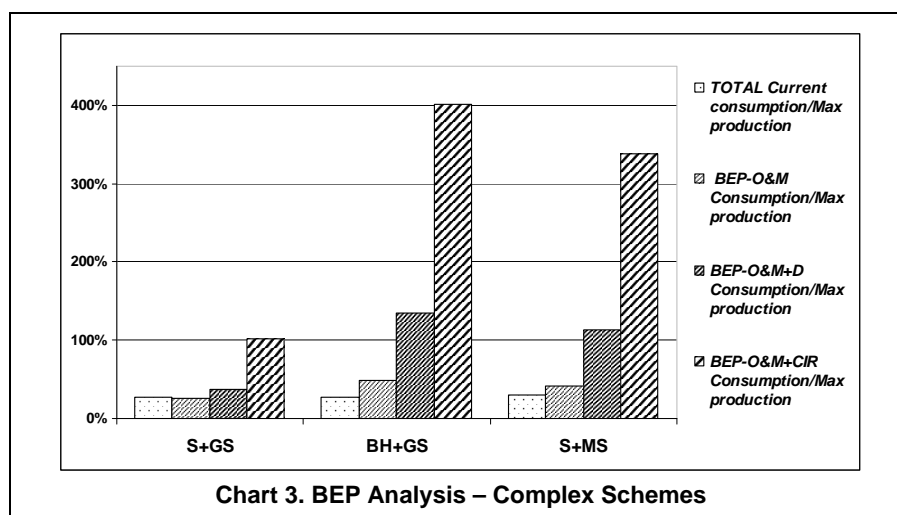
existence itself of some of the O&M costs (such as extraordinary maintenance) is not acknowledged by WASHCOMs and users, for example because of the recent implementation of the scheme or a low accountability of WASHCOMs. In both situations there is high risk of long lasting malfunctioning of schemes as they age and incur into technical failures (only 35% of BH+G and 38% of S+M have been found economically sustainable). This trend is different for Springs with Gravity System, where, on average, revenues are bigger than AIC O&M values which denotes that the most of these schemes (71%.) have actually reached the economic sustainability (but only for O&M costs). If O&M+D and O&M+CIR are considered, water schemes management falls far short of the economic sustainability, particularly for motorized systems.

For Simple schemes (Figure 2), where a lower commitment in their management have been observed, the situation is worse as the sustainability is hardly reached for Springs with Development (only 33% of cases) and is not reached for Hand Dug and Shallow Wells (0% of cases). The AIC O&M costs for the Hand Dug Wells are higher than those for the Shallow Wells due to the very low consumption values recorded and inserted in the model, as some of the hand dug well visited were affected by serious water shortage problems.

Water consumptions and break even point analysis

Another important aspect to be considered in analyzing the economic sustainability of water schemes is water consumption. To be noted that actual consumption by individuals and households is very difficult to measure. Nevertheless, for all types of schemes surveyed per capita water consumption is apparently well below the minimum standard of 15 l/p/d (norm set out by the Ethiopian Ministry of Water Resource in the main sector document Universal Access Program).

Through the Break Even Point analysis for the Complex water supply schemes, it is possible to estimate the consumptions required to cover O&M, O&M+D and O&M+CIR costs while keeping the current tariff. Chart 3 compares the current consumptions with those estimated to reach O&M BEP, O&M+D BEP and O&M+CIR BEP. All average values are expressed as percentage over the maximum productions for each Complex scheme type. Values greater than 100% indicate that the economic sustainability is not reachable, unless increasing the tariff. For the Simple water schemes this analysis is not consistent as, according to the Flat tariff system, payments for water are not proportional to the water sold so that any fluctuation in consumptions is not related to schemes revenues.



Qualitative analysis

Improving the economic sustainability

In order to increase the sustainability of Complex schemes it is possible either to raise the tariff, if users are willing and able to pay, or to increase water consumptions (only if current tariffs are sufficient to cover recurrent costs and up to the maximum water source yield), in order to reach the Break Even Point.

This second option includes different activities which can be either implemented singularly or in combination: awareness campaigns in order to increase *per-capita* consumption, promotion of house

connections with smart price policies and reduction in unaccounted for water and, where feasible, expansion of the scheme to reach more neighbourhoods. This last option could entail a consistent additional capital investment, partially to be recovered by the same water scheme revenues.

A similar reflection could be done for Simple schemes. On the one side it is possible to adjust tariffs by increasing the households' contribution. On the other side it is possible, but not easy, either to increase the level of service to maximize users' willingness to pay or to increase water consumption. The latter entails the increase of the number of households for each scheme which implies a direct increase of the revenues. This option is possible only if the water supply system can be extended (for example a spring on the spot could be developed with tank and some supplementary water points) otherwise any planned raise of households' number is against the principle of improving access to safe water because it induces crowding around fewer distribution points instead of widening their number. Being these schemes managed with a Flat Tariff, an improvement of per-capita consumption, although desirable, does not imply any increment in revenues whereas the shift to Uniform Tariff could be unacceptable to most communities.

The solution to improve the economic sustainability of water supply schemes is not necessarily only one but it could also be a combination of those described above and, in any case, it must be properly evaluated according to the existing site conditions, and taking into account possible productive uses of surplus water, such as domestic gardening and small scale irrigation, to generate revenue for recurrent costs.

Conclusion and recommendations

The research has been proved to be effective in the methodology adopted and relevant for the findings achieved, which highlighted issues seriously affecting the sustainability of water schemes and, then, their functionality so ultimately affecting people ability to access water services.

Complex water supply schemes are found to be more sustainable than Simple ones, mainly because of a greater commitment in their management. Despite the fact that Simple schemes are less expensive and easier to repair, this study reveals that Complex systems are those with a more organized and, then, sustainable economic management. Due to the AIC model structuring, important factors such as water schemes non-functionality, users' willingness and capability to pay have not been taken into account here, but to be included in any future and more comprehensive exercise.

Simple schemes organization is often affected by a low sense of ownership among users which brings to very minimal, if not nil, contributions for the water consumed. In addition, the presence of "unperceived" costs, an unclear support by local authorities in schemes management and the low accountability and limited autonomy of the WASHCOMs are the greatest challenging issues to be tackled in rural contexts.

For any water tariff review exercise, it is advisable to pursue a more transparent support and subsidies system of local administrations and an overall improvement of key actors' capacity and accountability.

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