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Live monitoring of rural drinking water schemes using mobile phone infrastructure

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WATER, SANITATION AND HYGIENE:
SUSTAINABLE DEVELOPMENT AND MULTISECTORAL APPROACHES

Live monitoring of rural drinking water schemes using mobile phone infrastructure

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Post-installation monitoring of rural drinking water projects is costly and time consuming, but at the same time a necessity to ensure a project's sustainability. Limited financial and human resources restrain the level at which facilitators can follow up on their projects, leaving them with little up to date information. The recent mobile phone revolution in Africa has drastically improved the qualitative information flow between remote project sites and facilitators. The solution presented here uses the same technology to improve the quantitative information flow. A specially developed solar powered unit, with a built in GSM-modem, collects daily data about sales, expenditures and production from the water committee which is operating the system. The data is instantly transmitted and presented to the facilitator by a web interface and any unexpected variations will alert the facilitator, allowing for a swift reaction.

Background

The Norwegian NGO Fontes Foundation has several years of experience in implementing and monitoring rural drinking water systems, and has specialized on treatment of surface water by using small scale treatment units. These treatment units are commonly installed through a participatory approach, involving the community both in implementation and operations. A common arrangement is to have a locally elected water committee to oversee the operations of the water scheme. The committee is responsible for hiring local water technicians which carry out the day-to-day work. Caretakers are put in place at each tap station, and the consumers pay for the water, generating revenue for the committee. The following arguments are based on Fontes' experience, and the presented monitoring tool was customized for the above mentioned projects. However, the arguments can be applied on a broader basis and the presented monitoring tool can be adjusted to fit other settings of drinking water scheme operations (or other revenue generating development projects).

Post-installation challenges

After the infrastructure for a drinking water project is completed, focus is shifted towards sustainable management of the project. The intention is to let the community manage the drinking water system independently, which requires a handful of new skills and practices to be learned by the community. Besides handing over the technical operation of the drinking water scheme, a management structure has to be put in place, and sound financial management has to be ensured. Local management and accounting practices, rather than technical issues, are often the main pitfalls challenging sustainability, thus requiring much attention after the inauguration of a drinking water project.

Limitations of traditional monitoring

Fontes' experience shows that close follow up and monitoring is essential during a period of 1-2 years. Skills and confidence have to be built over time in order for the water committee to increase its ability to solve problems. The challenge for the facilitator lies in letting the community operate the scheme as independently as possible, but at the same time step in quickly and provide guidance when a problem arises.

There are several existing tools to help the facilitator monitor the health of a project. A frequently applied monitoring approach, with variations, is a reporting system where the water committee submits a monthly report about the project. The report provides a substantial amount of both quantitative and qualitative data on project performance. However, the monthly reports' ability to keep the facilitator up to date is limited by the four week interval. Also, due to the projects' remote locations, it can take a month or even more between a report is written by the committee and received by the facilitator.

The solution

Because of the limitations of the conventional paper-based reporting systems, Fontes Foundation had to look for other options of how to improve monitoring of rural water projects. The aim was to improve the quality and relevance of the information gathered without increasing costly presence in the field or overloading the staff with administrative tasks related to monitoring. The answer was found by taking advantage of readily available technology, a novel combination of such, and the condensed quantitative information financial data provides.

As with any business operations, financial data represents an indicator on how the management (water committee) and the production (technicians) performs, as well as on the customers' (community) satisfaction with the product (drinking water). Money is collected from the tap-caretakers every day, and since the treasurer of the water committee already accounts for income and expenditures on a daily basis, it was natural to take advantage of this. A special solar powered input device was developed (see Photograph 1.), which allows the treasurer to easily enter information about sales and expenditures, and the technicians to enter information about water production. Although the continuous dataflow is dependent on the treasurer and the technicians entering data daily, this also has advantages, as the commitment of the treasurer and technicians is put to a test and quantified at an early stage. Using the nearly omnipresent cell phone coverage (even in rural areas), the collected data is sent to a server which processes the data and makes it accessible (through a web page) for the facilitator's staff (see Figure 1.). In this way a close eye can be kept on the performance of the project, and since the data is digitalized from the very beginning, it allows for automated processing which reduces administrative costs.

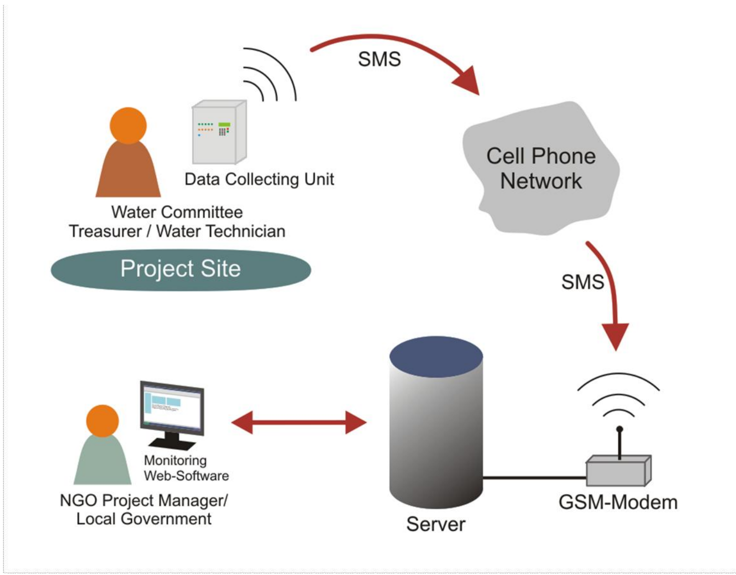


Figure 1. Schematic overview of the information flow.
The server can be installed locally, circumventing the need for an internet connection. The server does not have to be powered at all times, since the cell phone network stores SMSs for about a week.

Source: Fontes Foundation

Based on statistical calculations, the software can alert the project coordinator if production drops drastically, indicating there might be a problem, be it a technical or managerial issue. The ability to react swiftly and address problems straight away represents the main benefit of the automated monitoring system. In this way the "up-time" of the project can be increased and the all-important trust from the community (the customers) can be built.

Other benefits of the live monitoring scheme

The fact that the data is processed automatically also provides the project manager with information that otherwise would be too much work to process. Based on data such as distribution between variable and fixed costs, profit/loss per litre produced, and early spotting of (local) financial trends, better financial advice can be given to the community. The data collected can also be used effectively when negotiating with local government for support or subsidies, or to build trust amongst the donors of the project.

Examples from data collected by prototypes

Figure 2- Average Daily Water Sales in Litres: The graph shows the daily average water produced and sold in the village of Kazinga in western Uganda. The dip in sales in May and June was caused by a problem with the generator which powers the electrical pumps. An average consumption of 7'770 litres a day (September) represents an average consumption per person per day of 10,3 litres. Considering that the villagers also have access to non-potable water for washing clothes etc., this level is satisfactory but will hopefully increase.

In May 2008 the price of water (currently 0,002 USD / litre) was increased by 50% to cater for increased fuel costs. Interestingly the sales volume has recovered to the same level as prior to the price increase. This can indicate that the price elasticity of demand, even in rural areas, is very low for drinking water. The small change of demand despite the significant change in price can be explained by the fact that drinking water is an indispensable good for life.

Figure 3 - Distribution of Operating Costs: The diagram shows the distribution of operational costs which the water committee has to cover itself. The data is collected from the village of Kisenyi, Uganda, during a period of 6 months, and indicates that even drinking water projects in rural Africa are exposed to the currently volatile fuel prices. Presenting such a graph can also be helpful when pitching the need for solar power to potential donors.

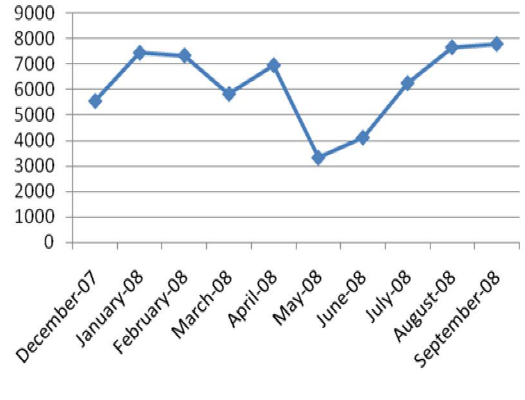


Figure 2. Example of collected data – Average daily water sales in litres

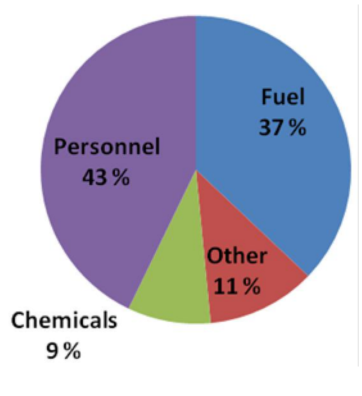
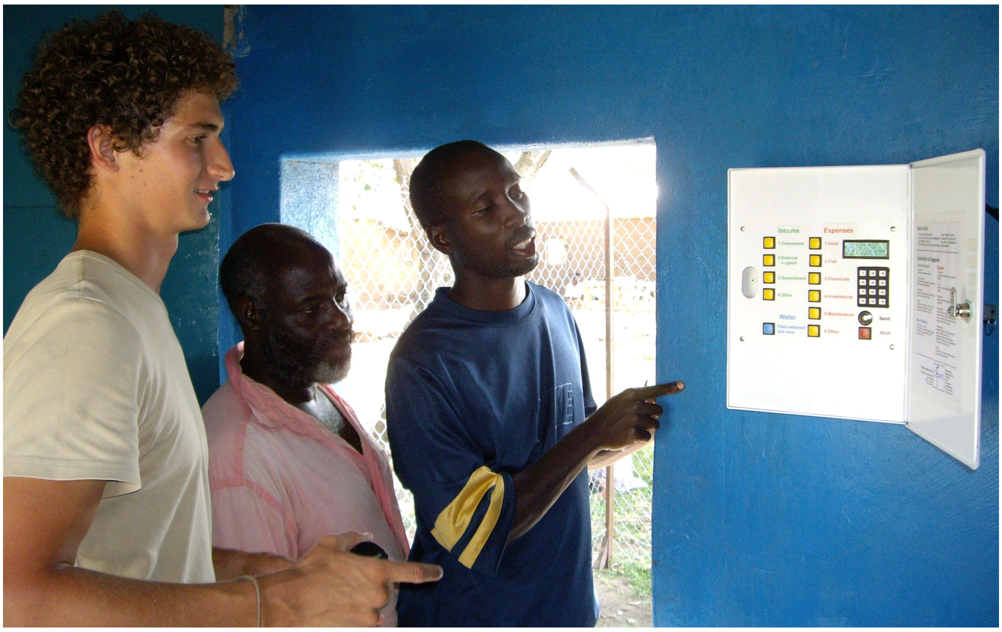


Figure 3. Example of collected data – Distribution of operating costs



Photograph 1. The Data Collecting Unit, mounted in a pump house in Kazinga, western Uganda

Source: Fontes – Koestler

The GSM monitoring system

- The GSM Monitoring Pilot Project was initiated in January 2007 by Fontes Foundation in cooperation with Fontes AS, mainly funded by the latter.
- By November 2007 a prototype of the input device had been developed (in house).
- In December 2007 two prototypes were installed in the field and have provided data since then.
- Currently, Fontes Foundation is looking for funding and partner NGOs in order to implement a higher number of Data Collection Units. This would allow for further testing of the concept and the technology.

Costs

- The hardware costs are estimated to be around 1'600 USD per input device, including solar panel (small series).
- In addition, approximately 95 USD per month are needed to service the server and pay for communication fees.

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