The cost of keeping a rural water system running - Cost tracking of three rural water supplies in Uganda

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Abstract

Life-cycle costs of rural water systems have until now been poorly documented and paid little attention to. Most actors such as donors, NGOs, governments and other stakeholders tend to focus on the capital costs and do not know what it costs to run and maintain systems over time. This paper uses the life-cycle cost (LCC) approach to track the different costs of three rural water projects in Uganda over a period of seven years, managed through the community management model. The paper shows that a substantial amount is required to keep a rural water system running, and that only a small part is covered by the community. A substantial expense is the direct support to the community by the NGO and capital maintenance costs, whereas operation costs are relatively low compared to the total cash flow needed. This shows that it is necessary to commit funds over a long period of time, or create effective and well-funded support mechanisms to ensure operation and maintenance of rural water supply systems.

Introduction

This paper will use real numbers from three rural water supplies in Uganda over a period of seven years and analyse the different cost components of operation, maintenance and renewal of a rural water supply. Due to the low functionality rate of rural water systems in many developing countries, development partners and governments are increasingly trying to identify better models and systems in order to increase access but at the same time increase sustainability of water, sanitation and hygiene (WASH) services (Lockwood et al 2010). The aim of this paper is to shed light on an area that until now has been poorly documented and researched in order to provide background information for policy arguments as well as improving the planning and budgeting of the NGO currently supporting the projects. It will present the costs over seven years tracked in rural water projects in Uganda, using a community management approach where community members are responsible for operation and maintenance and the general management of the system.

The life-cycle cost approach

The methodology used to categorise the costs was developed by the WASHCost project, an initiative run by the IRC International Water and Sanitation Centre[1]. According to the programme, life-cycle costs (LCC) are defined as the "aggregate cost of ensuring delivery of adequate, equitable and sustainable WASH services to a population in a specific area" (Fonseca et al 2010). Currently, WASH projects are normally valued based on the initial costs to build

[1] See www.WASHCost.info

them, and the cost of giving communities initial training to ensure cost recovery. This is mostly due to the absence of support structures, or a lack of coordination between the support carried out by government and NGOs. The lack of support structures has its roots in the community management model taken up by most countries in the developing world in the 1980s, which puts the full responsibility of operation and maintenance on the communities. In addition, there is a strong focus on *new* infrastructure construction due to excessive donor focus on achieving the Millennium Development Goals (MDGs) and the reluctance of donors to commit to funding over a longer period of time (Koestler et al 2010). If the life-cycle costs of rural water supply systems were better documented and understood, it would be clear that it is much cheaper to invest in support systems for capital maintenance and capacity building than to fully rehabilitate broken down systems every 3-4 years (Koestler et al 2010).

The organisation

The projects studied were constructed and are still supported by the small, Norwegian organisation Fontes Foundation. The organisation is different from other NGOs in many ways, and its history is reflected in the cost data. For example, the organisation took over the water projects in question from a different organisation in 2007, after one of them had already been running for three years. The initial period is characterised by the struggle of the small organisation to create its own donor base, and most of the work was carried out on a voluntary basis by committed promoters and family members. In addition, the organisation was supported by its sister organisation, the consultancy firm Fontes AS, with infrastructure and investments. The organisation is mainly funded by private donors, something that is reflected in an incremental approach to the construction and expansion of the water systems since improvements are made when money becomes available. Despite the challenges with raising money for ongoing support through one-off donations, follow up and capacity building has been made possible through the engagement of local employees and voluntary work.

Background of project implementation

The case study sites are situated in Katunguru Sub-County, part of Queen Elizabeth National Park in Rubirizi District in Western Uganda. The three communities Katunguru, Kazinga and Kisenyi have 730, 860 and 1040 inhabitants respectively. The communities are generally poorer than their neighbours living outside the national park, due to many restrictions. However, they have still seen a remarkable development since Fontes Foundation first started working there in 2004.

The projects of Fontes Foundation in Katunguru Sub-County are all small piped water schemes, with between 1 km and 2 km of pipes and one or two public taps in the first phase. Since the ground water in the Rift Valley is salty, it is necessary to treat surface water. Surface water is pumped from lakes or rivers to a settlement tank, where aluminium sulphate is added to achieve sedimentation. After some hours, the water is pumped through a sand filter and an activated carbon filter, in order to remove the smaller particles. The water is then pumped to storage tanks situated on higher ground, and chlorinated. Most people have access to water spending between 5 and 15 minutes for a round trip, including waiting time. This is because the taps are located centrally in the village, and households at the fringes have a longer distance. The water quality is good, with turbidity less than 5NTU, and at least 0.2 mg/l of free residual chlorine after chlorination. The average quantity per person is 13 litres[2] per person. This is relatively low but is

[2] Data from Fontes Foundation GSM monitoring system

due to the fact that water for washing, bathing and cleaning is collected directly from the surface water source. The price for water is also a restraining factor, however all villages have seen an increasing trend in water sales as more people become aware of the benefits of safe water[3]. Reliability is good, with around one week down time twice a year[4].

In order to understand the cost analysis, it is also necessary to get a picture of how the projects are planned, implemented and operated. This section will give a brief outline of the project cycle used by Fontes Foundation.

Planning

The assessments, baseline studies and data collections are normally carried out during follow up visits of existing projects in the area. In these cases, part of the cost of the travel for the preliminary work has been allocated to the CapEx category.

Implementation

Fontes Foundation uses a special approach for implementation. Since the communities are very poor, capital contributions are difficult to obtain, especially before the communities see what they are going to get. The contribution from the community has therefore been limited to labour to dig the trenches for the pipes. When projects are implemented, a relatively large team from Fontes Foundation spends a number of days in the community, and in 3-4 days, pumps, pipes and temporary tanks and taps are installed so that the community has water in the village. Thereafter, the system is made permanent during the subsequent months with supervision from the local employee. The community contribution of labour has been estimated and included in the cost analysis.

Follow up and support

The systems are managed by democratically elected water committees that sit for two years at a time. Each committee is also formally registered as a Community Based Organisation (CBO). Money is collected every day by caretakers at the taps, where people pay between 75 and 100 Uganda shillings (3-4.5 US Cents) per 20 litre container. The money is managed and kept by the treasurer who distributes money for fuel, chemicals and other costs. All expenses are paid through the revenues from water sales and only in some few cases money was collected in the community on an ad-hoc basis or a loan taken from the village bank. The system is operated by 2-3 technicians from the community, trained by Fontes Foundation. The technicians and the caretakers receive a small remuneration at the end of the month for their work, the rest of the committee works on a voluntary basis. The communities are supported by a local employee helps solving technical and management problems. Since Fontes Foundation also supports a school and has a scholarship programme in the area, the water projects are visited by Fontes Foundation staff from Kampala and/or Norway 3-4 times a year. During these visits the committees are motivated, problems are solved and the technicians are trained. Every year, a water seminar is organised where all committees come together to discuss problems and experiences and learn about accounting, management, hygiene and sanitation and technical issues. The follow up visits have proved to be important for the management of the systems, especially in terms of motivating the committees and community leaders to stay engaged. All projects are seeing constant improvement, both in management and water sales, and it is possible to see how capacity is slowly taking root in the communities as they start to be able to communicate with

[3] Data from the Fontes Foundation GSM monitoring system

[4] Fontes Foundation monthly reports compiled by water committees

each other and solve problems themselves. If technical problems exceed the competence of the local employee, solutions are discussed and communicated from Fontes Foundation. Most managerial problems have been overcome by organising meetings, sensitising leaders and always expecting the community to take responsibility for their own system. In 2009, Fontes Foundation established an office in Kampala, which gives a more continuous support to the local employee and the committees.

Methodology used for collecting and analysing costs

Fontes Foundation has for a long time considered life-cycle costs when planning water projects, but in an indirect way through our experience with communities and local conditions. There was therefore a wish in the organisation to collect data from the projects in order to be able to plan future projects better. The cost tracking exercise was done with a practical objective; to provide data from previous projects in order to plan and cost water projects better in future. The cost data was collected from the following sources

- Organisation accountability
- Budgets
- Local transfer documents
- Community monthly reports
- Travel reports
- Estimates

In 2007, Fontes Foundation introduced a monthly reporting system for all water committees. The monthly report is only two pages long, and captures information such as water committee income (from which water production can be derived), expenditure, problems and solutions. Monthly reports are available for all three sites from December 2007, with some exceptions. For the missing months and the time prior to 2007, operating costs were estimated based on the existing data.

All the data was compiled to a spreadsheet and organised in the different cost categories. Amounts in Uganda Shillings were converted using the average exchange rate of the respective year, and all amounts in the spreadsheet are in July 2010 Norwegian Kroners (NOK). The figures presented in this paper are in United States Dollars (USD).

Cost categories

Based on the WASHCost approach (Fonseca et al 2010), a number of cost component form part of the life-cycle costs. In addition to the categories proposed by WASHCost, a number of sub-categories were created. In this section the categories from WASHCost will be presented along with some examples from the projects for each category, in order to better understand how the costs were allocated. The cost for each category was also sorted by the source of funding; either the NGO, the community or other sources. Examples of other sources are the Sub-County that subsidises the water system in Katunguru every month, or the District contributing water tanks for new projects.

Capital expenditure – software and hardware (CapEx):

These are the costs to construct and put in place the water scheme, including the initial training and sensitisation of users and other stakeholders.

This category was divided into five categories: hardware, travel, salaries, transport and clearing and administration. Hardware includes pumps and pipes, and the construction of intakes and houses for filters etc. The software cost is mostly covered by travel and salaries, because the mobilisation and training was carried out by Fontes Foundation employees. CapEx also covers subsequent enlargements such as the installation of solar panels in Kisenyi in 2009 and the extension with taps to the school and the health centre in Kazinga in 2009.

Cost of capital (CoC):

This is the cost of raising the capital or servicing loans. This category will not be included in this study because the funding was obtained from private donors.

Operations and minor maintenance expenditure (OpEx):

These are the payments necessary on a daily basis to make the system run, and occasional expenses to fix small problems.

This category was divided into fuel, chemicals, maintenance and other costs and salaries. Unfortunately the committees did not always distinguish between maintenance costs and other costs in their monthly reports, so these two categories had to be merged. Maintenance costs are typically the replacement of a valve or buying lubricants for the generator. Other costs involve running costs such as stationary, paying transport for the local employee to assist with a technical problem, paying back loans to the village bank etc.

Expenditure on direct support (ExpDS):

These are costs related to the post-construction support of communities and local governments.

In our projects these are the costs incurred by the NGO to build capacity, support and follow up the projects. It consists of seminars, follow up trips, salaries in Uganda, salaries in Norway and administration. The salary post is generally low, because a large amount of work (maybe as much as 80%) is carried out on a voluntary basis.

Capital maintenance expenditure (CapManEx):

These are costs related to renewal of assets and larger rehabilitations. These costs go beyond the normal maintenance costs, either because the costs are much higher, or because they occur much less frequently than normal maintenance costs. CapManEx has been identified by WASHCost as crucial for sustainability, because these costs are often higher than what the community can bear and in absence of a support mechanism the system breaks down (Franceys and Pezon 2010).

In our example, this category only includes hardware costs, since the works are mostly carried out by the local technicians with support from the local employee. There are relatively few CapManEx costs, except for the replacement of pumps and generator in Katunguru after the pumps were stolen in 2008. In 2010 a river intake was washed away by floods in Kisenyi, and also had to be replaced. The policy of Fontes Foundation is that we support CapManEx, however the community always has to raise a significant amount.

Expenditure on indirect support (ExpIDS):

This includes macro-level support, such as policy planning, sector learning etc. This category is also not included in this study due to the small size of the NGO and the limited in macro-level activities.

Analysis

The cost tracking exercise showed that a substantial amount of money is necessary to run rural water projects over the years. When the total cash flow is broken down into the cost categories mentioned above, it became evident that only a small amount of the total cash flow need per year to keep the projects running is covered by the community in form of operation and maintenance costs (24%)[5]. In order to support the community management model it is necessary to provide continuous capacity building and support to the water committees, which needs to be paid for. In addition, there are some major breakdowns or renewals that are beyond the capacity of the community to pay, and which are also essential to continue the service delivery. The next section will show graphically how the costs are distributed in the case of the Fontes Foundation projects.

Total cash flow

The graph below shows the total cash flow for the Katunguru project and the type of expenditure. It shows that after an investment in 2004, a singnificant injection was necessary in 2009. Otherwise, the cash flow lies between 8000 and 14,500 USD per year. The operations cost stay at a steady and low level. This shows something that is obvious but that is easily forgotten: it requires continous funds to keep a rural water system running, and only a small part of it is the operations cost.

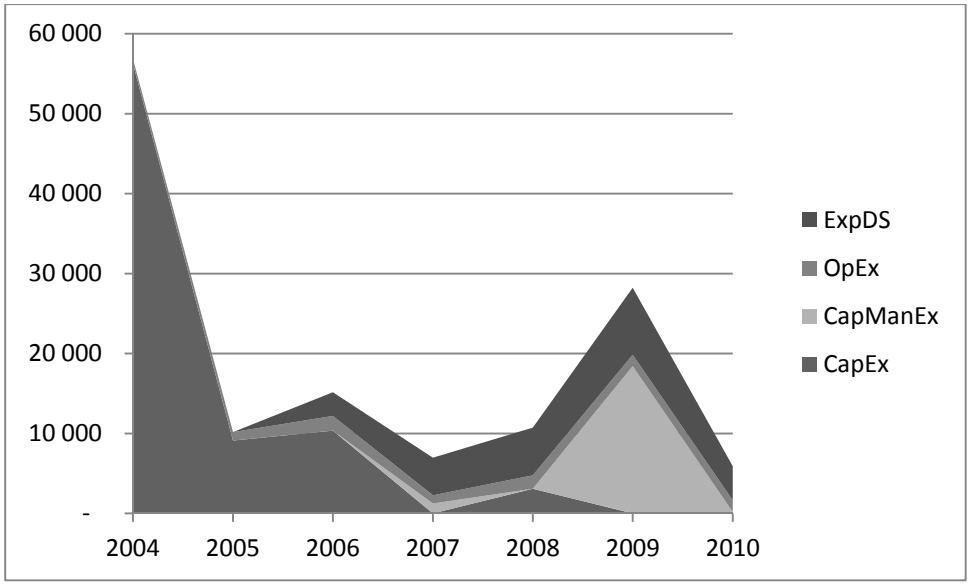

Figure 1: Total cash flow by expenditure for Katunguru in 2010 USD

The graph below has the same topography as Figure 1 but rather than illustrating the cost categories it shows where the funds came from. In the Fontes Foundation projects, the majority of all the money comes from the NGO. The community contributes almost enough to cover the operating costs, but in Katunguru the Sub-County is actually subsidising operations cost to some

[5] The data presented in this section is from the data collection exercise described in the methodology above

extent. Kazinga and Kisenyi do not require these subsidies. The numbers from 2005 show how the District was involved in the implementation (see the area for others), and how a private businessman built a pump house in 2008 with the promise that his guesthouse could buy water from the system. In conclusion, the main source of funding is still the NGO, both for capital costs and for support and follow up.

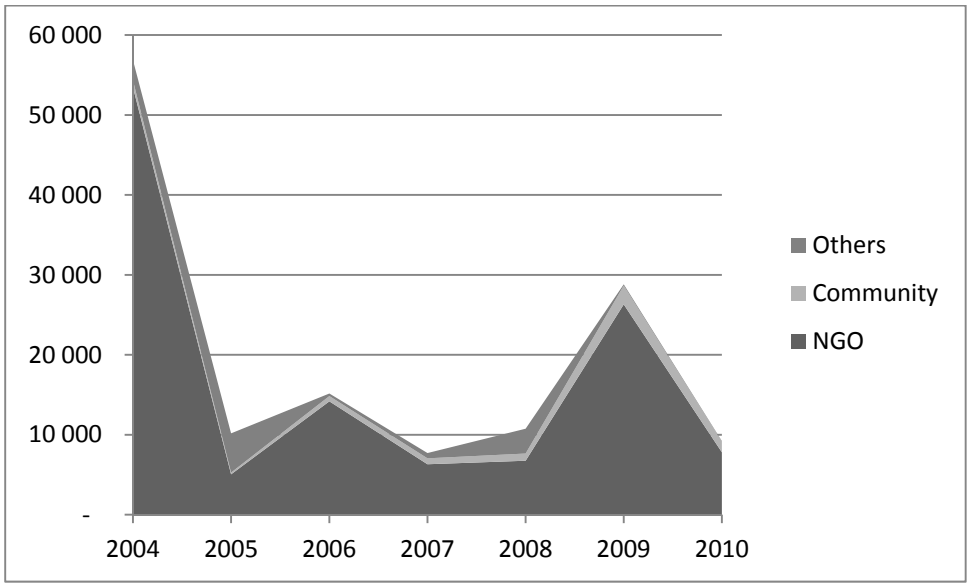

Figure 2: Total cash flow by source of income for Katunguru in 2010 USD

Cost categories

The graphics below show the cost divided into different categories over time. The amounts are in USD and the data for 2010 was doubled in order to give a more realistic trend, since only half of the year has passed.

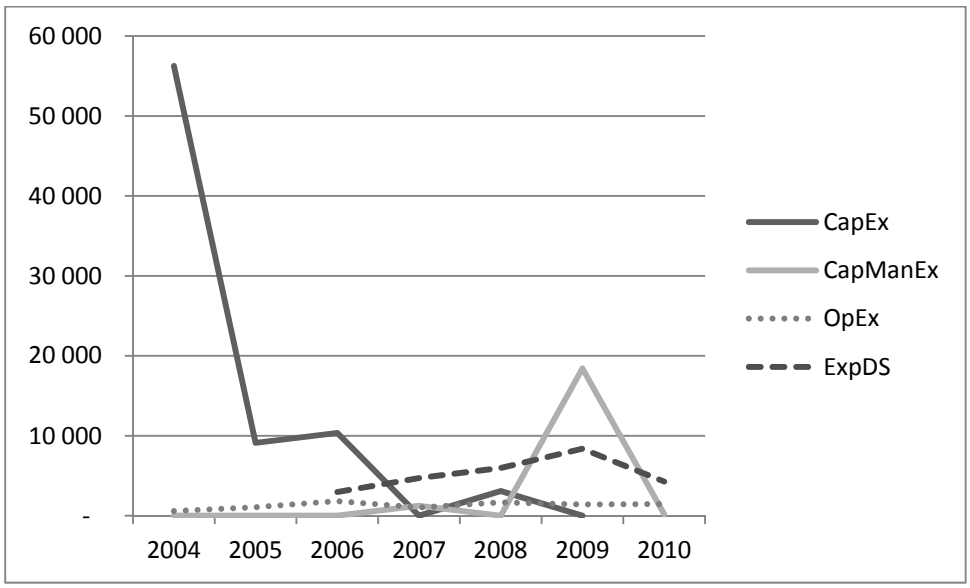

Figure 3: Costs by categories for Katunguru water project 2004-2010 in 2010 USD

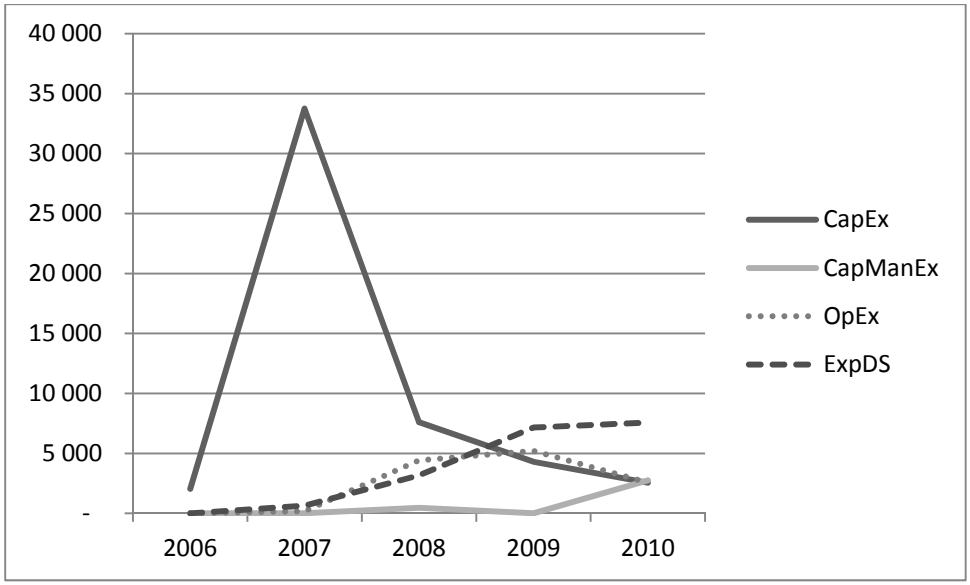

Figure 4: Costs by categories for Kazinga water project 2006-2010 in 2010 USD

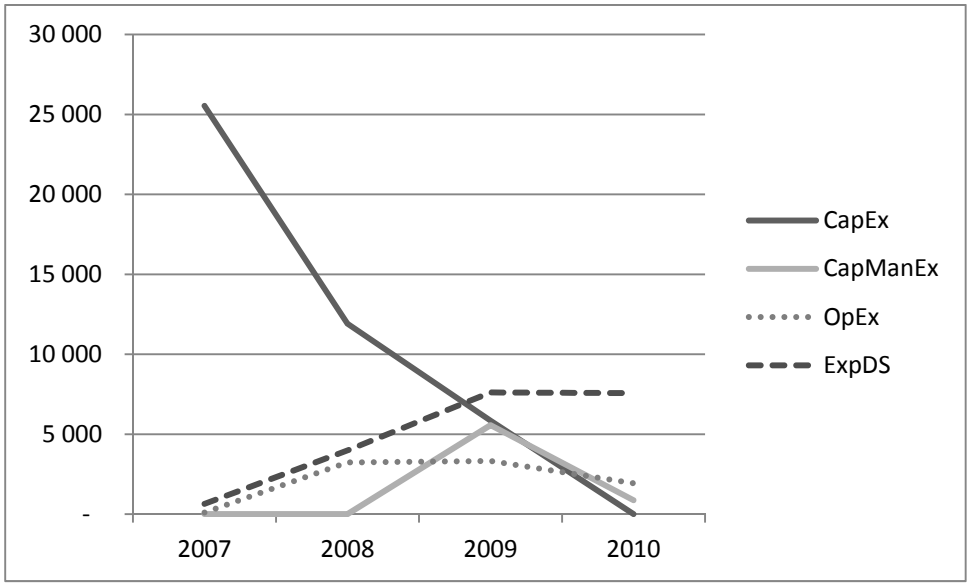

Figure 5: Costs by categories for Kisenyi water project 2007-2010 in 2010 USD

All projects show a decline in **CapEx**, which is natural as these are implementation costs. They include both software and hardware, and on average the hardware costs represented 60% of CapEx. In Katunguru there is an increase of CapEx in 2006, when an extension to the school was added, and in 2008 when a house was built for the new pumps. The curves decline slowly, because for Kazinga and Kisenyi the implementation took place between the end of 2007 and the beginning of 2008. The Katunguru implementation also went over 2 years (water was delivered throughout the implementation period). The Kazinga project starts in 2006 because the assessment, which is calculated as part of CapEx, was carried out in 2006, whereas the assessment for Kisenyi was carried out in 2007. Instead of reducing to zero, Kazinga still has CapEx costs in 2009 and 2010. This is because an extension to the school and health centre was built in 2009, and a new fence was added in 2010. The CapEx graph shows the implementation approach of Fontes Foundation, which is based on an initial installation with small extensions and improvements each year. This is because it is difficult to raise funding for a complete system

at once, but also because it is important for the learning process of the community to start small and increase with time. In addition, the local conditions can never be completely understood before the implementation of a project, and learning after working on the ground result in better decisions about the next improvements. Fontes Foundation also uses the extensions as a motivation for the communities to perform well; if the management is good the community is rewarded with an extension. The exercise therefore shows that CapEx can be continous, and does not necessarily need to be a one time cost, depending on the local conditions and the approach chosen by the implementing agency.

The curve of **CapManEx** stays low during the first years of operation and then shows peaks as the system gets older. In Katunguru the main peak came after five years of operation, when funding was raised for new pumps, new tanks and the refurbishing of a tap. This shows that the system could run with minimum CapManEx for the first 5 years. Due to the lack of funds in local government (both Sub-County and District), the NGO covered the required cost to keep the system running, however always with contributions from the community. This shows that the will to cover CapManEx was there, but it was simply not possible for the community to raise enough money, and the existing support structures also did not have access to enough funds. This underlines the need for CapManEx, but it also shows that if a project is continously followed up and supported, five years can pass without the need for substantial CapManEx.

OpEx is relatively flat. In Kisenyi, there is a decline after solar panels were installed in 2009. In Kazinga there is also a decline after the generator was replaced in early 2010. The previous generator had a production defect and the community spent a lot of money repairing it. In Kazinga OpEx amounts to more than 4800 USD in 2009. This shows that it is possible to raise a substantial amount of money even in a relatively poor rural community.

ExpDS covers direct support to the projects, reflected by the cost of travels, seminars, salaries and administration. The curves show an increasing trend. This is because the software carried out during the implementation phase is covered in CapEx, and the real support starts only after the implementation phase has been completely finished. Every time the project is improved, the capacity building and sensitisation does not only include issues related to the new infrastructure (for example how to sign service contracts with the school and the health centre) but also general follow up of the project. In addition, during implementation follow up is also carried out in the other villages in the area. It is therefore difficult to differenciate between the cost of direct suport and initial software, and here it is all covered in CapEx. This shows that the categorisation becomes tricky when the projects are implemented over time, like in the approach used by Fontes Foundation. It raises the question whether the initial training of the community should be part of CapEx in the WASHCost categorisation, or if it should rather be integrated in ExpDS as an ongoing cost. It is still important to note that the expenditures on direct support are always below 8000 USD which is still extremely low taking into account salary levels in Norway. This is due to voluntary work and the increased use of local employees in Uganda including coordination from the office in Kampala.

Sub-categories

For some categories, sub-categories were created in order to go into detail, both in terms of spending and sources of funds. The graph below gives us a better picture of what the committees spend money on in Kazinga. Fuel, chemicals and salaries (allowances) to local technicians and

caretakers revolve around the same amount when all costs are aggregated from 2007 to 2010; between 2000 and 2500 USD. The maintenance cost is high because, as mentioned before, Kazinga had a troublesome generator that required frequent repair. When the generator was not operational, the generator from Katunguru was shipped back and forth in order to still provide water, and the committee had to cover the transportation costs. This shows the will of the committee to continue to provide water, and also the ability to raise funds for it. It also shows that communities are able and willing to cover all costs necessary to keep the system running, as long as they are motivated and capacitated to do so.

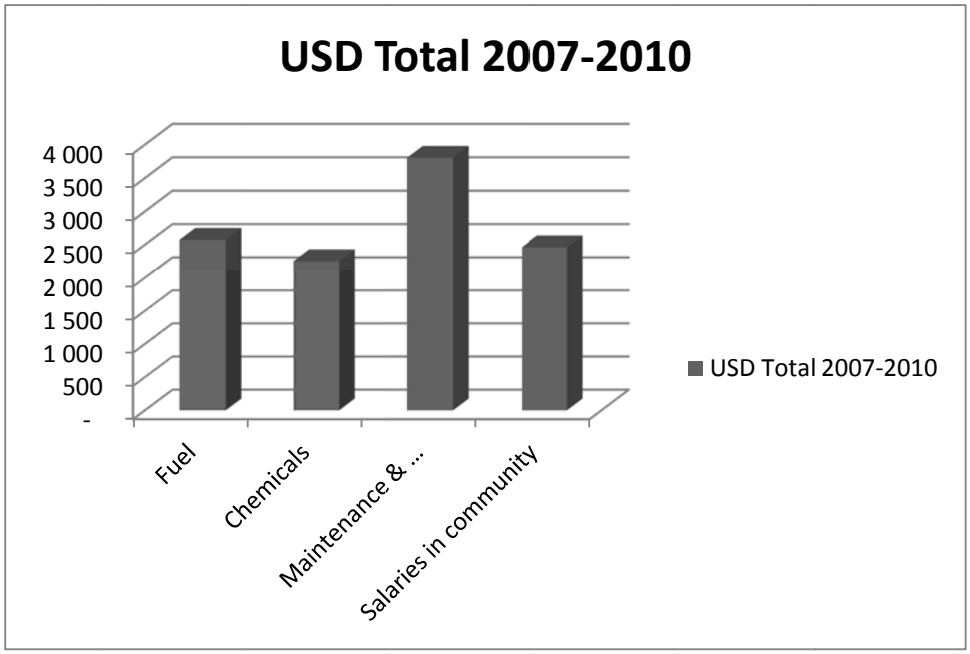

Figure 6: Distribution of OpEx by categories for Kazinga

Since ExpDS is a substantial expense running over all years, it is interesting to take a look at the sub-categories shown by the figure below. The highest expenditure are the salaries in Norway, which can be explained by the high salary levels. Fontes Foundation recognises the benefits of more coordination taking place in Uganda, and has therefore established an office with a local coordinator. It has to be noted that around USD 4800 in salaries in Norway is extremely low (this is less than approximately 1200 USD per year) taking into account the time spent to plan, implement and follow up this project. If all the work was remunerated, ExpDS would probably be significantly higher, and it is important to take this characteristic of Fontes Foundation into account when comparing with other NGOs and other water projects. The administration costs cover expenses such as office rent in Kampala, bank charges, marketing for fund raising and the cost of accountants and auditors both in Norway and in Uganda. The administration cost is less than 5% of the total cost of implementing and running the project over three years, which is low compared to similar NGOs.

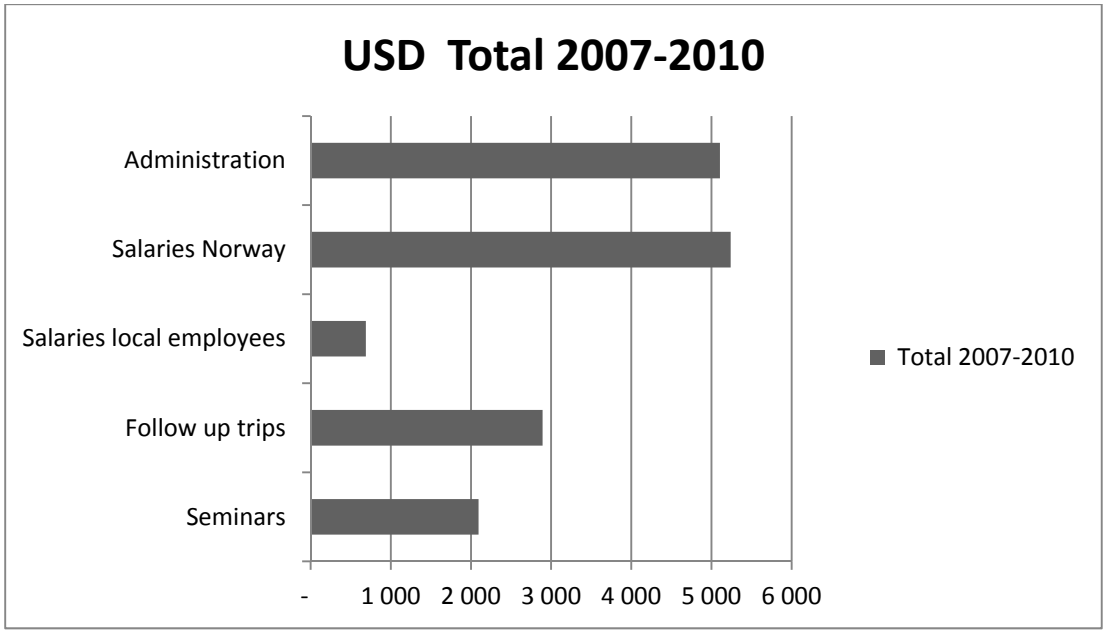

Figure 7: Distribution of ExpDS by category for Kisenyi

Conclusion

The main conclusion from the cost-tracking exercise is that a constant cash flow is needed (between 5000 and 15,000 USD per year) to run a rural water project over the years, and only a small part of it (24%) is paid for by the community. It has to be noted that the management of many water systems is subsidised, especially in developed countries. In developing countries, however, it has for the last decades been assumed that communities can take on this responsibility through the community management model. However, even with a strong initial mobilisation, communities are not able to take on the responsibility of running a water system without continuous training and follow up, due to lack of human and financial resources. The highest costs are therefore the costs of supporting the communities through capacity building and support, categorised as ExpDS. In addition, there are some occasional costs to cover rehabilitations or replacement of assets that communities are not able to cover, and that are also necessary to keep the project running. These costs are reflected in the CapManEx category.

At the same time, the operations and maintenance costs are all covered by the community, including some local salaries. This shows that communities are willing and able to cover some costs if they are motivated and capacitated to do so. It also has to be noted that ExpDS shows and increasing trend not because the cost of mobilising the community and training the water committees is increasing, but because part of this cost is initially included in CapEx and only reflected in ExpDS when the construction phase is over. This makes it difficult to tell how much was used on community support at any time. The ExpDS costs are also relatively low in the Fontes Foundation example because a lot of work is done on a voluntary basis, and this has to be taken into account when comparing the costs to other projects and NGOs.

What does this mean for the rural water and sanitation sector? With the current community management model, it shows that a substantial effort is necessary to enable and empower the communities to manage their own projects. This means that the cost of a support mechanism should be taken into account whenever designing or funding a rural water project. It also raises questions whether the decentralised community management model is cost-effective, or if a more centralised system could be developed for O&M. If the follow up or CapManEx support was taken over by a private company or the government, the total cash flow to keep the project

running could probably be reduced. However, few local governments have the means or human resources to continuously support projects, and contracting out post-construction services to private companies is only in its early stages. In addition, in rural areas where transport infrastructure is poor and the distances long, a centralised system would involve high transaction costs. The community management model also has a number of benefits other than providing safe drinking water that are until now poorly understood and measured. For example, by managing their water system in a committee, members get important skills about basic accounting, project management and community mobilisation. In addition, the project generates salaries in the community, that in turn can contribute to the economic development of the village. Only when these benefits can also be included in the cost analysis, the effectiveness of community management, not only in terms of running the water system but also in terms of development generally, can be assessed.

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