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## **Financial sustainability of rural water supplies in Western Kenya: comparing technology types and management models**

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

**Financial sustainability of rural water supplies in Western  
Kenya: comparing technology types and management models**

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**REFEREED PAPER 1706**

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*This case study is an evaluation of the financial sustainability of 52 rural water supplies in Western Kenya, including both handpumps and motorized pumps used for pumping groundwater. The four included management models are community management, government management, combined community and government management and private management. The water supplies are evaluated in terms of service level, operation and maintenance, financial management and cost recovery. At the handpumps, the community or combined management scores bad and the private management good. At the motorized pumps the private management scores again high, but here also the community management scores better than the ones with government involvement. In general, the management is better at the motorized pumps, but still the cost recovery is better at the handpumps because of the low costs. Evaluating the management models, the private management got in total the best results.*

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## **Introduction**

Kenya is in the top ten of countries with the largest population without access to safe drinking water (UNICEF and WHO, 2012). Because most of these people live in rural areas, large investments are done in the Kenyan rural water supply. But recent studies show that many of the new water supplies stop functioning within a few years after implementation (MWI Kenya, 2007 and RWSN, 2007). Causes for this low 'post-construction sustainability' can be technical, institutional, financial, social or environmental. One of the most critical factors mentioned in literature is an adequate financing of operation and maintenance (Lockwood et al, 2010; Parry-Jones, et al, 2001; Carter, et al, 2010; Lockwood and Smits, 2011). The current study, conducted in cooperation with SNV Kenya, is about the post-construction sustainability of rural water supplies in Western Kenya, with a specific focus on the financial part of it (or financial sustainability)<sup>1</sup>.

In the rural water supply practice in Western Kenya, several water supply technologies exist. Some of these technologies require hardly any operation and maintenance (O&M), like springs, surface water catchment, rain water catchment and a well without a pump. These technologies are not included in the current research. Remaining technologies are a handpump and a motorized pump, both used for groundwater pumping. Apart from the differences in technologies, several management models for rural water supply exist within Western Kenya: community management, government management, private management and institutional management. The latter one is not included in the current research because at these locations serving the community is in general not the main purpose. As the access to clean and safe water in adequate quantities is recognised as a human rights issue in Kenya (Constitution of Kenya, 2010), mechanisms for finding sustainable service delivery is a key national priority. As different management models are likely to result into different levels of sustainability, government of Kenya is in search of a most sustainable model for Kenyan context.

The objective of this study is to compare the financial sustainability of rural water supplies in Western Kenya. Within this comparison the aim is to compare different technology types, different management models and different combinations of these two. The final goal is that this comparison can be used by the

Government of Kenya and other supporting entities in the development of policies and projects for the rural water supplies.

## Methodology

The methodology is based on a literature review about rural water supply management and sustainability. This review includes case studies which have functioned as examples for the current study (WSP, 2010; Lockwood et al, 2010; SNV, 2012). Data for this study is collected during interviews with the responsible persons for the water supplies. Data is collected about service level, O&M, financial management, cost recovery and finances. Service level includes system functioning, water quantity, walking distances and water quality. O&M includes who is responsible for the daily operation and pump check and for the maintenance arrangements and the days it takes between a breakdown and a repair. Financial management includes: responsibility for the finances, water tariff, tariff structure, bank account, bookkeeping and service cut-off for non-payment. Cost recovery includes the practice of the payments, the extent in which the income covers the O&M costs and whether replacement is expected to be a problem on the long term. The finances include the yearly income, costs and costs per user. To all above mentioned factors scores are assigned (see table 1). These scores are divided by 2, in order to get final scores between 0 and 1. The scores are also given a weighing factor. In this way, for every water supply a weighted score can be determined for all the four sustainability categories. In total 27 handpumps and 25 motorized pumps were evaluated, within eleven districts in Western and Nyanza Province.

	<b>Criterion</b>	<b>Score 2</b>	<b>Score 1</b>	<b>Score 0</b>	<b>Weighing</b>	<b>Comments</b>
<b>Service level</b>	System functioning	Good	Small problems	No	0.2	Examples 'small problems': heavy pumping, leakages, almost breaking parts.
	Water quantity	Yes	Rationing required	No	0.4	'Rationing required' is about the dry season.
	Maximum walking distance (km)	<0.5	>0.5-1	>1	0.3	-
	Water quality	Good	Some problems	Bad	0.1	Problems include turbidity, salinity, rust, germs.
<b>O&amp;M</b>	Responsible person for daily operation and pump check	Yes	-	No	0.2	Examples of tasks: checking the pump, fuel and chemicals
	Responsible person for maintenance arrangements	Yes	-	No	0.3	Examples of tasks: contacting technician and buying spare parts.
	Days to repair	1-2	3-7	>7	0.5	-
<b>Financial management</b>	Responsible person for financial management	Yes	-	No	0.2	Examples of tasks: collecting money and keeping records.
	Water tariff	Yes	-	No	0.2	-
	Differential tariff structure	Yes	-	No	0.1	Meaning that water is paid per quantity.
	Bank account	Yes	-	No	0.1	-
	Bookkeeping	Yes	Incomplete	No	0.2	-
	Service cut-off for non-payment	Yes	-	No	0.2	-
<b>Cost recovery</b>	% current in payment	>90%	50-90%	<50%	0.3	-
	Tariff covers O&M	Yes	-	No	0.5	Based on income, required expenditures and use of external funding sources.
	Can community replace the system	Yes	Doubtful	No	0.2	Based on income, expenditures and expectation of interviewees.

## Results and discussion

General information on the visited water supplies can be found in table 2. Table 3 gives the assigned character and the included amount of locations per combination of technology type and management model. Table 4 gives the average output per sustainability criterion and per combination. Per category a weighted

score is given, using the weighing factors as given in table 1. Table 5 gives an overview of the averages of total yearly income and total yearly recurrent costs.

	Handpumps	Motorized pumps
Total number	27	25
Depth of water source	8-75 m, average 24 m	18-130 m, average 76 m
Installation year	1985-2011, average 2000	1979-2010, average 2000
Population served	150-1200, average 321	100-10000, average 1872
Costs per user per year	1-89, average 26 KSh	24-628, average 242 KSh
Maximum walking distance	0.5-5 km, average 1.6 km	0.2-5 km, average 2.4
In function	26, 7 with problems	23, 1 with problems
Water quality	12 no data / 10 good / 5 problems	6 no data / 14 good / 5 problems
Water quantity sufficient	19	21

	Community	Community – Government	Government	Private
Handpump	A (16)	B (5)	- (0)	C (6)
Motorized pump	D (23)	E (8)	F (7)	G (14)

	Criterion	Factor	A	B	C	D	E	F	G
Service level	1. System functioning	0,2	0,81	1,00	0,75	0,86	1,00	0,93	0,94
	2. Water quantity	0,4	0,84	0,80	0,75	0,79	1,00	0,79	0,81
	3. Maximum walking distance	0,3	0,31	0,00	0,83	0,00	0,33	0,20	0,38
	4. Water quality	0,1	0,67		1,00	0,80	1,00	1,00	0,79
	<b>Weighted service level score</b>		<b>0,66</b>	<b>0,58</b>	<b>0,80</b>	<b>0,57</b>	<b>0,80</b>	<b>0,66</b>	<b>0,70</b>
O&M	6. Responsible person for daily operation and pump check	0,2	0,44	0,20	0,67	1,00	0,67	1,00	1,00
	7. Responsible person for maintenance arrangements	0,3	0,69	0,80	0,83	1,00	0,67	1,00	0,88
	8. Days to repair	0,5	0,31	0,00	0,67	0,50	0,00	0,30	0,25
	<b>Weighted O&amp;M score</b>		<b>0,45</b>	<b>0,28</b>	<b>0,72</b>	<b>0,75</b>	<b>0,33</b>	<b>0,65</b>	<b>0,59</b>
Financial management	9. Responsible person for financial management	0,2	0,81	1,00	0,50	1,00	0,67	0,86	0,63
	10. Water tariff	0,2	0,63	1,00	1,00	1,00	1,00	0,86	1,00
	11. Differential tariff structure	0,1	0,00	0,60	1,00	1,00	1,00	0,86	1,00
	12. Bank account	0,1	0,40	1,00	0,17	1,00	0,50	0,86	0,38
	13. Existence of bookkeeping	0,2	0,44	0,80	0,33	0,86	0,50	0,79	0,50
	14. Service cut-off for non-payment	0,2	0,25	0,40	0,83	0,57	1,00	0,86	0,63
	<b>Weighted financ. management score</b>		<b>0,47</b>	<b>0,80</b>	<b>0,65</b>	<b>0,89</b>	<b>0,78</b>	<b>0,84</b>	<b>0,69</b>
Cost recovery	15. % current in payment	0,3	0,20	0,60	0,75	0,50	0,75	0,57	0,75
	16. Tariff covers O&M	0,5	1,00	0,00	1,00	0,71	0,00	0,14	0,75
	17. Can community replace the system	0,2	0,25	0,10	0,92	0,42	0,00	0,43	0,69
	<b>Weighted cost recovery score</b>		<b>0,61</b>	<b>0,20</b>	<b>0,91</b>	<b>0,59</b>	<b>0,23</b>	<b>0,33</b>	<b>0,74</b>

Table 5. Average income, recurrent costs and costs per user in KSh per year (85 KSh = 1 USD)				
	Income	Recurrent costs	Income – costs	Costs per user
A	6400	6200	200	17
B	8000	9700	-1700	15
C	47500	11000	36500	53
D	243000	169000	74000	243
E	No data	No data	-	-
F	531000	729000	-198000	272
G	170000	88300	81700	209

### Management models for handpumps

Out of all handpumps, the locations with community management and the locations with combined community and government management scored low. The private managed handpumps scored good, especially in terms of cost recovery and quick response to breakdowns.

The most striking matter at the community managed handpumps was the trouble with the payments. The users were not willing to pay for the water and the communities did really have difficulties with making people pay. Several factors which contribute to a low willingness to pay for water are (Merret, 2002):

- where economic life is hard so that households need to take the greatest care over their domestic expenditure;
- where there is a widely held view that certain public services should be free;
- where persons or parties in political life give their support to non-payment;
- where the quality of the public service is poor;
- where the government is so manifestly corrupt that payments for public services are known to line the pockets of the power elite; and
- where neither the government nor the public water utility is willing to exercise sanctions against non-payment because of the likely political and/or public health consequences.

Especially the first two of these reasons were mentioned in the interviews as reasons for people not to pay. The fifth reason was not given in this way, but in the way that the money collector was using the money for personal purposes. The last reason was not given by the interviewees but from the collected data it is clear that at locations without consequences for non-payment the payments were also worse. On top of these six reasons, there is the fact that people are not willing to pay because of other options of taking water from free (unprotected) water sources. Although the first two reasons remain in the cases of handpumps with private management, the payments were better in these cases. People were not allowed to take water if they did not pay, so there was simply no option of non-payment. People who were not willing to pay did not use the water source.

### Management models for motorized pumps

The motorized pumps scored low at the locations with combined community and government management and at the locations with government management. At the combined managed motorized pumps the responsibilities for O&M and financial management were not clear. At the government managed motorized pumps the payments were not good enough to cover the costs. At the community managed motorized pumps, the committees were well organized but they did not manage to make all users pay. At the privately managed motorized pumps, the responsibilities for O&M and financial management were not clearly defined but the financial situation was good. There was enough money for the O&M and for replacement on the long term.

In terms of cost recovery it is notable that the combined managed and the government managed motorized pumps have low scores of respectively 0.23 and 0.33. At the government managed pumps the payments were bad, but also at the combined managed handpumps, the income did not cover the costs. This situation is understandable because the government wanted to hand over all water supplies and remained only with the systems which were not profitable enough to hand over to a company or community. At these water supplies there were problems with the payments, high costs for O&M (including staff salaries) and too few users to covers the costs. On top of that there were large delays in maintenance due to the bureaucratic government system.

Comparing the other two management options for motorized pumps, community management and private management, the financial situation is better at the privately managed water supplies. There are many problems with the payments at the community managed motorized pumps. At the privately managed motorized pumps, the absence of proper bookkeeping and a bank account for the income from the water resulted in the lower score for the financial management. In terms of possibilities for replacement the privately managed systems score higher than the community managed ones. At the community managed motorized pumps there were not enough savings for a replacement. At the privately managed motorized pump, only at two of the eight locations financing a replacement is not expected to be possible.

In literature it is found that community management is more suitable for small water supplies than for bigger water supplies (Kleemeier, 2000). But in the current study, community management scores higher here at the motorized pumps than at the handpumps. Apparently the communities take more initiative in organizing themselves in case of a motorized pump, compared to the situation with a handpump.

### **Comparing technologies**

Comparing the two technologies, the handpumps score higher on cost recovery and the motorized pumps score higher on O&M and financial management. At the handpumps it happens more often that the regular money collection is neglected. The responsible entities at the motorized pumps have more need to be organized because of the daily need for staff and money for e.g. fuel refilling. A negative side of the motorized pumps are the high costs per user per year, about nine times higher than at the handpumps.

### **Comparing management models**

Comparing the four management models, the differences were not big. The community managed locations have difficulties with making people pay. At the combined managed systems the responsibilities for O&M and financial management are not clear. At the government systems the costs (including high salaries of government staff) are too high for the amount of users. The privately managed systems score slightly higher, especially in terms of cost recovery.

### **Conclusions and recommendations**

Looking at the handpumps, the privately managed locations score better than the others. At locations with community committees, the responsible persons were not able to collect enough money to maintain the pump. At the motorized pumps the privately managed locations scored again high, but also the community managed locations scored good compared to the ones with government involvement. In general, the management is better at the motorized pumps, but still the cost recovery is better at the handpumps because of the low costs. Evaluating the management models, the private management got in total the best results.

Based on the results, four recommendations are given:

1. Because of the fact that the water quantity is not sufficient at many locations and the walking distances are large, more water supplies are needed in the research area. It is recommended to focus more on handpumps than on motorized pumps for new water supplies. The reason for that are the high yearly costs at the motorized pumps. These costs make the motorized pumps less suitable for the rural areas of Western Kenya, where domestic income is low and people are not open to pay for their water. In some situations, with low water tables or high population density, a handpump is not feasible and than a motorized pump can be a good option for rural water supply.
2. Action needs to be taken in order to improve users' willingness to pay. Examples are activities for economic development like job creation and microfinance projects, training in communities about the importance of clean water which is not free and training for responsible entities about dealing with sanctions against non-payment and about making finances more transparent.
3. In order to improve community management it is recommended that costs and responsibilities are shared within communities, local authorities and the central government. In the current situation especially the tasks of the local authorities are not fully recognized. They should be more present for co-financing major repairs, performance monitoring and retraining of committees and mechanics.
4. Since the private management model scores high on financial sustainability, it is recommended that the Government of Kenya and development partners pay more attention to this option. In order to create a situation where private management is a serious option, several aspects need to be considered:

- The government needs to contribute in investment costs or facilitate microfinance options.
- Community sensitization is required about the option of a private handpump. People need to know about this option. And they need insight in the costs and possible revenue.
- Training is required for private owners of a water supply about water supply technologies, maintenance and dealing with financial management.
- Formal recognition and regulation of such private investors is necessary as they will be running water systems as businesses.

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### Note

1. The full report can be found at <http://repository.tudelft.nl/view/ir/uuid%3Ad55b4e80-1a38-4979-a61f-603f9ad969b0/>

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