The handpump choice is yours: a pilot study in Rumphi District, Malawi

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In sub-Saharan Africa, moving towards the Sustainable Development Goals will require an approach to water and sanitation service delivery for many rural communities where handpumps still dominate infrastructure. This paper reviews a case study of allowing users (local government and communities) in Rumphi District, Malawi, to choose a handpump model based on information about the life-cycle costs. The results indicate that there is some awareness within communities and within the local government of several handpump options for the rural water supply in the study area. Given a choice of different handpump models in the treatment communities, each community chose the rope pump. Allowing communities to choose the type of handpump model, with input from both local government and donors on low cost borehole drilling, should be considered as an innovative approach to rural water service delivery.

Keywords: developing countries, groundwater, handpump, private sector, rural

Goal 6 of the sustainable development goals (SDG) is to 'Ensure availability and sustainable management of water and sanitation for all'. This can be linked to SDG 9, which is to 'Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation' (United Nations, 2016). In sub-Saharan Africa, moving towards these SDGs will require an approach to water service delivery where handpumps still dominate infrastructure for many rural communities. However, the functionality of handpumps in rural areas requires addressing operational, technical, institutional, financial, and environmental factors (Foster, 2013). In Malawi, improved water sources remain inaccessible for 10 per cent of the population, despite technologies available across a range of costs, in both urban and rural areas (WHO/UNICEF, 2015; Holm et al., 2016).

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Chowns (2015) noted that in Malawi, the rural community water management model has worked well for the government and donors, but not for the actual communities. Soublière and Cloutier (2015) pointed to the strong dynamics of power and control in Malawi, particularly how communities, local governments, and development partners link in regards to water service delivery. One approach hypothesized to increase the sustainability of safe water in rural areas is through the transition from a donor-driven water supply infrastructure to allowing users (local government and customers) to choose, based on an informed life-cycle choice.

In 2015, the non-governmental organization, Water For People, undertook an intervention with the Rumphi District Council where handpumps were installed on manually drilled boreholes (well depth roughly 11 to 20 m). The focus was on four handpump model choices, common in Malawi: Afridev, rope pump, Malda pump, and the Elephant pump. Water For People led community sensitizations in order to:

- raise community awareness and gauge acceptance on the four handpump model choices;
- mobilize local raw materials for construction works; and
- educate the community on the life-cycle costs of each of the four handpump models, including capital cost, maintenance cost per year, and the replacement after 10 years.

To support the life-cycle cost objective, Water For People and the Rumphi District Council undertook a life-cycle cost analysis for the product-life of each handpump model. A brochure was developed in the local vernacular language in the area of Chitumbuka. This was used to lead a community discussion on choosing a technology that the community could afford. Each community was given an independent choice. The chosen handpump model was then provided by Water For People. The life-cycle costs did not include training local installers or training communities in preventive maintenance and repairs. These costs were covered by Water For People.

This paper reviews a case study of allowing users (local government and communities) in Rumphi District, Malawi, to choose a handpump model, based on information provided about the life-cycle cost. The study specifically considered 1) awareness of rural water supply options, 2) willingness of communities to pay for water supply system maintenance, and 3) satisfaction with their chosen handpump. Recommendations are made to promote rural water supply in Malawi.

Methods

Our study was conducted in Rumphi District, Malawi, in 2016. The district covers an area of 4,769 km^2 and the 2008 Census indicated a population of 170,000 (Malawi Government, 2009). The Rumphi District Council selected

36 communities, based on a need for communal water supply. Some of the communities were within a few kilometres of piped water.

The study involved two arms. In the treatment communities, after the community sensitization process, community members were allowed to choose a handpump model. The three intervention objectives were conducted within a 16-month timeframe. Our study was conducted a few months following the handpump installation. Interviews with 81 household users in 19 communities, including some water user association members, were completed. Respondents were asked to indicate level of awareness of water supply choices, level of satisfaction with their chosen handpump, attributes they liked most about the technology, and major problems with the technology since installation. Handpump functionality was also checked by interviewers.

As a control, 79 households in 17 communities within the Rumphi District who were not provided with the community sensitization process were also interviewed. These households were outside the area within which Water For People was working at the time of our study. Respondents were asked to indicate level of awareness of water supply choices, in addition to the cost, management, and level of satisfaction of their current water supply. Following the present study, the 17 control communities were reached by Water For People with community sensitizations, but these results are outside the scope of this evaluation.

The study also completed interviews with two key informants from the Rumphi District Council.

All interviews were conducted face-to-face in the local vernacular language of the area, Chichewa or Chitumbuka, or English.

Data analysis was completed using Microsoft Excel. Qualitative results were coded to identify themes and representative respondent quotations selected. At times, respondents contradicted other users within the same community, which indicates the individual nature and limitations of study findings. Ethical clearance for this study was obtained from the Republic of Malawi, National Commission for Science and Technology (PO6/16/111). Participation was on the basis of informed, written, consent.

Results and discussion

Choice of rural water supply options

Magoya and Nhlema (2016) have shown the importance of human dimensions between water service delivery and the customer, not only technical or financial management, as essential for a sustainable water supply in other areas of Malawi. Our results also show rural users (local government and customers) want a choice. When the control group was asked an open-ended question about water supply technology that they were aware of (some respondents listed more than one reply), 44 per cent (35/79) listed Afridev, 38 per cent (30/79) listed rope pump, and only 3 per cent (2/79) of the respondents listed the Elephant pump. No control group respondents indicated the Malda pump. In addition to handpump models of interest, 38 per cent (30/79) indicated awareness of piped water supply. Control group respondents were also asked to indicate the water supply technology that they would choose if given an opportunity, as an open-ended question. Responses were categorized, as some respondents listed more than one reply. Most respondents (84 per cent; 66/79) could clearly list a stated technology preference. The results revealed that 48 per cent (38/79) wanted an Afridev pump and 20 per cent (16/79) would choose a rope pump. No respondents indicated wanting a Malda or Elephant pump. 18 per cent of respondents (14/79) would choose piped water either solely or in addition to handpumps. For the control group that wanted Afridev pumps, they reported reasons such as, 'It's easy to manage and find repair parts', or, 'It's durable, from experience it provides large quantities', or, 'Children cannot break it easily'. For the rope pump, respondents stated they wanted one because, 'It will be the first in our area so it will make us happy to have one', or, 'It seems durable as we have seen from other areas', or, 'Because it's lighter to use'. Some respondents that wanted piped water explained that the geology in their area is challenging for drilling and groundwater is too deep for handpumps. Overall, our results show that in the control area, there is limited awareness about handpump options for rural water supply.

In the treatment communities, after the community sensitization process, each community chose the installation of the rope pump. The rope pump is typically manufactured in the geographic area of use. It works with a pulley system to lift water up with a rope tied with washers at regular intervals within a plastic pipe (of slightly larger diameter than the washers). At the base of the pipe there is a guide box for the rope system (Sutton and Gomme, 2009). The one-handle rope pump produced and installed in Malawi typically has a maximum pumping depth of 35 m. In our study, the rope pump hardware was manufactured in Mzuzu city, the capital of the northern region, by a single fabrication shop. In 35 per cent (28/81) of respondents, there was an awareness of other water supply options available beyond the rope pump. This likely indicates that, although the rope pump was selected and installed, not all users necessarily participated in the community sensitization process nor did the information flow from those who selected the handpump model to others within the community.

During interviews with the local government, it was indicated that there was a robust awareness of handpump options for rural water supply and management structures and that customer satisfaction is perceived to be important for functionality, as well as the sustainability of handpump models. However, due to water scarcity in some areas of the district, the council further expressed concern that the rope pump may not be suitable for communal supply because of the high number of users. In some cases, this would be up to 155 households. This also indicates the local government understands the technical limitations of handpump models.

Willingness of communities to pay for water supply system maintenance

In the control arm communities, 29 per cent (23/79) of respondents were actually paying cash towards the repair work of the water supply system they were currently using, including the maintenance of shallow wells (median per household, per month was MK200 [US$0.29]).

There are smaller and more frequent breakdowns with a rope pump compared with other handpump models. After community sensitizations, 96 per cent (78/81) of the treatment respondents were willing to pay per household, per month for maintenance of the rope pump (median was MK500 [US$0.71]). Willingness to pay compares to actual payments for repairs, which were reported for five different pumps. Some repairs to the rope pump, such as rope adjustments, may not require any financial contribution. Of the repairs that had cost the community cash (purchase of oil and a new rope were the only reported repairs), the median paid was MK125 (US$0.18). The reported repairs indicate payments are sufficient to carry out the necessary repairs, and the median payments could even be lowered to still cover the life-cycle costs of the pumps. However, the median payment for both control and treatment communities may reflect a user's historical experience, rather than a full understanding of the life-cycle cost. Willingness to pay may also be a study limitation and a reflection of the common practice in the rural water sector, where capital infrastructure and repair of non-functional water points is subsidized or provided freely by donors. Additionally, the results show it is unlikely that the study communities would be able to handle a sudden, larger replacement cost shortly after installation.

When asked what communities would be willing to pay for maintenance services in the long term, the Rumphi District Council said 'In most cases, the amount people give is around MK500 per month. As a Council, we do not impose the amount, the people decide for themselves how much each will contribute. They [the communities] should be able to maintain it over time'. In Ethiopia, the national government has set minimum quality standards for rope pumps (JICA, 2016) needed to reduce community repairs. However, there is a gap in the government standards specific to rope pumps in Malawi.

Customer satisfaction with their handpump choice (community sensitization process)

Each of the 19 rope pumps was producing water at the time of the site visit, though with a few challenges. Overall, a high level (96 per cent; 78/81) of treatment respondents were satisfied with their choice of the rope pump. However, it is difficult to control this variable in our study as to how much of this is really about satisfaction with the choice of the handpump model versus the satisfaction of having a water source, as opposed to having no water source at all. In Tanzania, Coloru et al. (2012) also found a high level of satisfaction (74 per cent) by users of rope pumps.

The rope pump has a successful history in Nicaragua, dating back to the early 1990s (Alberts et al., 1993; Alberts, 2004). In Ghana, the rope pump was perceived by rural water supply users as an advanced water supply technology when compared with their previous technologies (Harvey and Drouin, 2006). Additionally, there are 10,000 rope pumps in each of Tanzania (Maltha and Veldman, 2016) and Ethiopia (JICA, 2016).

The 19 rope pumps were installed by six local private enterprises. For five of the six enterprises, no respondent indicated any complaints. However, of respondents' dissatisfied with the rope pump technology (3/81), they were attributed to a sole installation provider. However, this same installer also had satisfied respondents (17 out of 20 respondents were positive). Thus, only one installer had three unsatisfactory users in two communities. One of the respondents who indicated dissatisfaction noted, 'The water is still dirty even though months have passed. The pump only yields a few liters (less than 25 liters) per moment of use'. However, dirty water, or too little water, in general depends on the quality of the borehole, not on the pump. Another unsatisfied respondent noted 'When you pump for some time it stops instantly and it is hard when pumping'. Sutton and Gomme (2009) report more than a two-year period is needed to support local private enterprises in rope pump technology.

In the treatment area, respondents were asked about attributes they liked about rope pumps and responses were categorized (Table 1).

Despite a high level of customer satisfaction with the rope pumps, some (43 per cent; 35/81) respondents had problems with their pump. Problems reported were thematically categorized as being a result of the local private enterprise not conducting proper well development, well siting, or a repair that required minimal effort or funds (Table 2).

Neither in the positive or negative comments mentioned by rope pump respondents was the life-cycle cost a major response. The problems reported in our study compare to results in Tanzania, where Coloru et al. (2012) reported non-satisfied users having complained mostly about the physical effort required to operate the pumps. This was not as evident in our study, possibly due to the shallower depth. Hydrogeological conditions and well siting are possible causes for the reports of limited and not enough water. These are the hardest problems to fix. Whether manual drilling is an appropriate option in all locations of this district is outside the scope of this study and needs further research. However, that the local private enterprise did not always conduct proper well development is indicated in that some rope pump users reported their water had traces of debris and mud. Additionally, three respondents in three different communities reported earthworms coming out of the pump water.

In some communities, households had problems where the rope kept slipping off the wheel. This is an easy fix for either the local private enterprise or user and begs the question, why was the user not trained or confident enough to undertake this repair themselves when they had chosen their handpump option? Although the handpumps were installed by local private enterprises, respondents in the treatment group indicated they were not necessarily willing to just call the provider back for repairs. Respondents also wanted choices for self-repair. One respondent noted 'We need training on how to fix technical problems' and further went on to say they wanted 'knowledge of possible shops where to buy repair materials'. Further, another respondent indicated 'We depend only on a person [the local private enterprises] who is not a village member for repairs'. A one-day, site-specific, community-based training on maintenance was provided by the Rumphi District water monitoring assistants; however the council has also noted that this training was not adequate. Further community-based training on maintenance was not organized, as the local government lacked financial resources.

Table 1 Positive attributes of the rope pump reported by respondents

Pump satisfaction category		
Technical	*Water quality/quantity*	*Social*
Easy to operate/user friendly	Clean or safe water	'It's lovely to the eye. It was artistically done'
'Part of my body exercise'	Water is always available	
Repair parts are affordable	Good water flow	
People who can repair it are available in the area		
Near household		
It can be locked to prevent children from playing with it		
Durable		
Water source is covered		

Table 2 Problems with the rope pump reported by respondents

Pump problem category		
Local private enterprise did not conduct proper well development	*Well siting*	*Easy repair for local private enterprise or user*
Earthworms in the water	Limited water quantity	Loose rope falling off the wheel
Dirty water	No water	Tight rope resulting in hard-to-rotate pump wheel (difficult to draw water)
Smells like oil		Loose bolts and no tools available
		Lack of oil
		Worn rope
		Untied rope

How to promote rural water supply by promoting greater user involvement

In this study, the local government was willing to try an approach to let the community make an informed choice of their handpump model. Eventually, this approach may form a transition model away from donor handouts and towards a future of self-supply. In Malawi, the local and national government currently have no role in self-supply. The results indicate that not all users choose the handpump model; it is usually the local government and a few community members who choose. Donor handouts in the study area are deeply rooted and any transition to self-supply will not be easy.

In Ethiopia, rope pumps were promoted in a three-year plan through design standardization, strict quality control and human resources development, involvement of national and local governmental organizations, extension services, and a handbook for rope pump promotion (JICA, 2016). In contrast, our approach differs from Ethiopia in that users had more choice, through a one-page life-cycle cost brochure and the involvement of local (rather than national) government over a much shorter time frame. Our results show that approaches to promoting handpump choice by users need to consider life-cycle cost, as well as more strongly promote to the local government and customers the technical benefits of the local availability of spare parts and trained technicians in their area. This should also address the human dimension components of being visually appealing and the technology should be able to be secured with a lock.

Conclusions

Allowing communities to choose the type of handpump model, with input from both local government and donors on low-cost borehole drilling, should be considered as an innovative approach to rural water service delivery. Developing countries need to do something different to get away from the subsidy and power mindset and to meet the SDGs in new service delivery approaches. Our study was a lesson learned for practitioners on the option of giving users a choice, as well as a donor being open to a range of handpump models in their intervention area. In Malawi, supporting informed user choices for rural water supply infrastructure has proven to be a technical solution with human dimensions.

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