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TRANSFORMATION TOWARDS SUSTAINABLE
AND RESILIENT WASH SERVICES

ASSESSMENT OF THE FUNCTIONALITY OF ROPE PUMPS FOR SUSTAINABLE WATER SUPPLY IN RURAL AREAS OF MALAWI

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The sustainable provision of adequate and safe drinking water is the most important of all public services. A high share of the population in Malawi lives in rural areas where access to safe water and access to sanitation is very low. However, non-functionality of water facilities in rural areas continues to affect the availability of potable water further compromising the access. This paper reports on the functionality assessment on one type of hand pumps, the Rope pump, in rural areas which were installed since 2012. Of the 127 Rope pumps that were visited in six districts, 73% of the Rope pumps were functioning and 27% were non-functional as a results of rope breakage, breaking of the handle, dry wells and water quality issues (turbidity and odour). To increase functionality there should be trainings on O&M of the Rope pumps to the users, Self-supply approach should be encouraged to ensure private ownership of the Rope pump and proper sitting of the Rope pump should be emphasised.

Introduction

Water is fundamental for life and health, it is the most crucial element for human survival. Lack of access to water affects the entire community, so anything that disturbs the supply of water tends to disturb the survival of humanity. There is low access to safe water and sanitation in rural areas of Malawi. This is unlike urban areas where most residents have access to treated piped water. There are several hand pumps which are used in rural areas to provide safe water like the Afridev pump, the Canzee pump, the Mark V and the Rope pump. The Rope pump is also known as rope and washer pump, which is a low cost option for water supply, it is simple, cheap, easy to maintain and can be produced with materials that are locally available in Malawi (Haanen, Rik and Holtslag Henk, 2016).

The Rope pump consists of a wheel and a continuous rope with pistons, made of rubbers or plastics that are attached to the rope at equal intervals of one meter. The pistons fit in the raising pipe with a clearance of 1 mm. At the bottom, the rope is guided by a turning point (called guide box) into the raising pipe (WASHtech, 2013). The wheel and the handle are attached to a rotating shaft mounted on the support structure on top of the well. The water is lifted up by the pistons and discharged at the surface as the rope and pistons are moved by turning the wheel (Albert, 2004). Rope pumps can be installed on hand dug wells as well as tube wells, up to the depth of 35 meters.

Although large numbers of these pumps have been installed in rural areas, there is a high percentage of non-functionality which affects the availability of potable water in rural areas. It was therefore the aim of this study to assess the functionality of the Rope pump for sustainable water supply in rural areas and to come up with recommendations to increase the functionality rates.

Methods

The study targeted six districts in Malawi being: Kasungu, Mzimba, Mzuzu city, Nkhata-Bay, Rumphi and Karonga. A total of 127 pumps were randomly but purposefully selected from the districts and visited by the research team between January and September 2017. The mWater mobile app was used to collect data. At

each water point five questionnaires were administered to users of the Rope pump on the functionality of the Rope pump while implementing NGOs and the government officials were involved in key informant interviews. The data was exported from mWater app to Microsoft Excel for analysis.

Figure 1. Showing study area *(source: compiled by author using google.maps)*

Results

Functionality is one of the critical areas to look upon as far as management and sustainability of water facility is concerned. Within the research a functional pump was defined as a pump that pumps water of required volume at the time of the visit. The research examined a total of 127 Rope pumps, and it was observed that 93 pumps were functioning while 34 pumps were non-functional representing 73% and 27% respectively. It was also found that out of 127 Rope pumps 52 pumps were private owned pumps while 75 pumps were communal pumps. A total of 45 private pumps were functioning while (87%) 48 communal pumps were working during the time of visit (64%).

The results indicate that rope breakage, breaking of the handle (3%), a dry well (14%) and water quality (12%) issue in these wells (there was high turbidity, odour of water for users abandoned the pump), were some of the reasons why pumps were not functioning. Of the 34 pumps that were not functioning, 62% of the pumps had a problem of the rope. It was further observed that the frequently breaking of the rope was greatly influenced by the tension of the rope, size of the rope washer and raising pipe, over- use of the rope and wear and tear of guide box. About 70% of the respondents mentioned about frequent breaking of the rope as being the main problem experienced in the use of the Rope pump technology

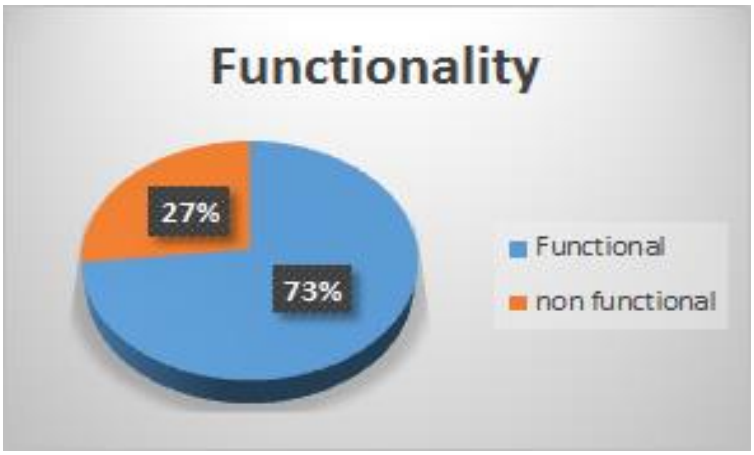


Figure 2. Functionality of the visited pumps

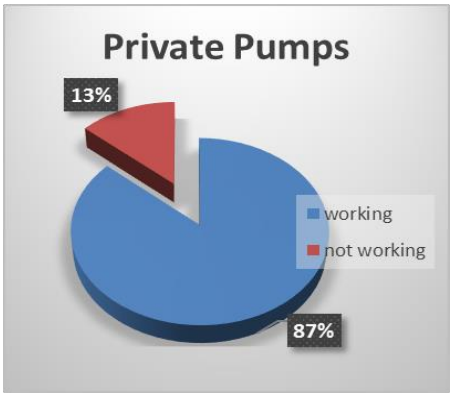


Figure 3. Functionality in private pumps

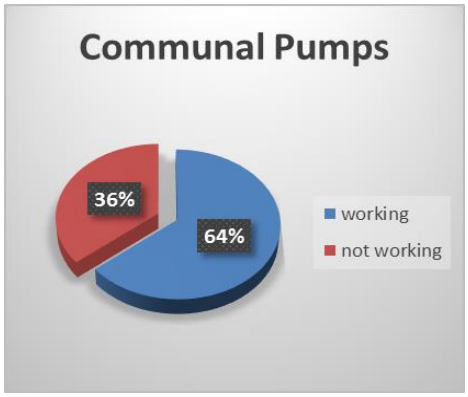


Figure 4. Functionality in communal pumps

Factors affecting the functionality of Rope pump

1. Number of users

   The functionality of the Rope pumps was compared to the number of users. It was found that the breakdown of the Rope pump, such as breaking of the rope, increases with an increase of the number of people accessing water from a single water point. The private pumps had an average of 5 households with 34 people using the pump and had an overall 87% of pumps which were functioning. The communal pumps had an average of 25 households with 154 users and 64% pumps were functioning

Table 1. Showing number of users and functionality

Category	Average number of households	Average number of users	Functionality (%)
Private pumps	5	34	87
Communal pumps	25	154	64

2. Installation and quality of material used
   Observation were also made on some cases of poor installation of the Rope pumps, compromised civil works and the use of low quality materials which compromised the functionality of the pumps. Lower class (thinner) PVC pipes easily break creating a possibility for the entry of the objects into the well which also possibly affect the quality of water as well as creating sharp edges which affect the durability of the rope.

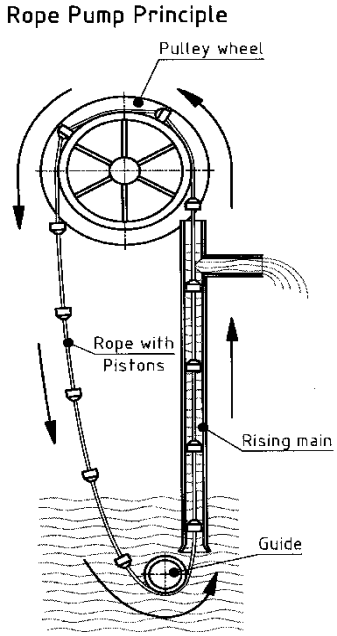
3. Availability of finances for the cost of operation and maintenance of the Rope pumps
   In all cases the users were responsible for the cost of operation and maintenance (O&M) of the Rope pump. The researchers discovered that the users had put in place different strategies which were used to collect funds for the maintenance in the communal pumps. In the case of communal pumps, the water point committee (WPC) generally collects funds from users through contributions whenever there is a problem to repair the pump. Secondly, users will sometimes jointly participate in piece work to raise money for maintenance and lastly in some cases the users will agree to pay a certain amount of fee on monthly basis. Despite having such systems, it was observed that not all members from the communities were willing to pay or participate in any activity aimed to raise funds for O&M of the Rope pump, as some were not satisfied with the technology and others complained that the required contributions were too high (MK200.00 or $0.27/month), such that poor people could not afford to pay. Also there are issues related to lack of trust in the committee members.
   The results indicated that there was more willingness to pay for O&M in privately-owned pumps (Self-supply pumps) which increases the functionality of the pumps, which also leads to a shorter down time of the pump in case of a breakage.

4. Ownership of the pump
   Functionality of the Rope pump was seen to be a function related to the ownership of the pump. Survey results indicated that privatly owned pumps were better maintained than the communal pumps in which users leave the responsibility of maintenance to the WPC. Also faults on privately- owned pumps were fixed in shorter time than communal pumps. It was observed that out of 52 private owned pumps, 45 were working representing 87% while out of 75 communal pumps, 48 pumps were working representing 64%. Over 75% of the communal pumps visited were donated by churches, not-profit organizations or political leaders and there had been no financial contributions from the beneficiaries. Users of some of the water points had the view that the one who donated the water point was also responsible to pay for its maintenance which led to a lack of willingness to contribute to maintenance.

5. Preference to other technologies
   The presence of other water hand pump options in the areas had an effect on the functionality of the Rope pumps. Communities which prefer other types of technologies such as the Afridev pump over the Rope pumps seem to have ignored the Rope pump once it has developed a fault. It was noted that communities which were willing to maintain the Rope pumps were those that primarily rely on the Rope pump as their main source of water.

Conclusion and recommendations

The study concluded that there are several factors influencing the functionality of Rope pumps which can be improved in order to improve the functionality. Firstly, before handing the Rope pump over to the users there should be a user training on operation and maintenance of the pump to ensure sustainability of the pump. There should be a local supply of spare parts that is readily available. As well, local mechanics should be trained to have the skills required for more complicated repairs. Secondly, the Self-supply approach should be encouraged to increase and ensure private ownership of the Rope pump as it is convincingly shown that private ownership ensures a high functionality as compared to communal ownership. Thirdly, proper sitting of the Rope pump should be considered to avoid having many pumps in one area. This can be achieved by involving other implementing organizations who implement similar projects in that area. Lastly, organizations involved in the placement and installation of the Rope pumps should monitor installations and maintenance to ensure that the pump are installed to high standards in terms of use of quality materials and quality workmanships.



Photograph 1. Schematic drawing of a Rope pump
Source: Albert, 2004

Photograph 2. Maintenance of Rope pump

Photograph 2. Worn out guide box

Acknowledgements

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