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Sustainability of hand-dug wells in Tanzania: results from a post-evaluation

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A recent post-evaluation conducted in the Kagera region, Tanzania assessed the sustainability of 17 representative water points up to 9 years post-installation by Concern Worldwide. This found that nearly all the hand dug wells were still functioning which validated the pump technology chosen for the programme. However, it also highlighted the importance of considering a service delivery approach as 3 water supplies, although still functioning, were not used by the population due to concerns about water taste and colour. The importance of ownership was also suggested by the fact that despite the failure of the cost-recovery scheme put in place, WASH committees seemed to be able to collect enough money reactively for any required maintenance. For longer term sustainability, more work is required to strengthen both the spare part supply chain as well the local back stopping agencies.

Background

It is widely reported that a substantial proportion of water supply facilities across sub-Saharan Africa are either no longer working or functioning sub-optimally, with statistics showing that the non-functionality of rural water points is somewhere between 30 and 40% (IRC, 2012). The sustainability of water points is measured through different methods which all, more or less, revolve around the following three dimensions: the characteristics of the installed infrastructure (is it robust, appropriate, sited well etc.), the motivation and skills of the local community for managing it, and the backstopping support available (RWSN, 2009).

Concern Worldwide has implemented various WASH projects in Tanzania since 2003, modifying their approach over time to draw on the lessons learned from evaluations (for example, considering both the domestic and productive use of water). In the Kagera region of north-west Tanzania, Concern has been carrying out WASH activities with local partners in over the past 9 years with 3 sequentially funded programmes. This involved constructing water points with hand pumps, protected springs, sanitation in schools with rainwater harvesting, some household supply of sanitation slabs, as well some solar pumping projects. In November 2014, an independent post-evaluation review of the water points installed was carry out, measuring sustainability over a short term, (<2 years) medium term (2-5 years) and long term (>5 years) period.

Methodology

Water point selection

Concern's WASH programme activities in the Kagera region have involved the installation of 775 water points (WPs) including hand-dug wells, protected springs, gravity distribution schemes and solar pumping schemes, across three Districts - Ngara, Kibondo and Biharamulo. Given the time available for the post-evaluation, it was decided to focus on the shallow hand-dug wells (of which 480 have been installed or rehabilitated) due to the relatively low number of WPs that could be visited during the assessment. Hence, a representative sample of 17 wells was randomly chosen for the field assessment according to the District and age distribution since installation / rehabilitation (<2 years, 2-5 years and >5 years) of the 480 hand-dug wells.

Field assessment

Water point infrastructure

At each water point as assessment of the infrastructure was carried out including measurement of pump yield, assessment of the integrity of the apron, protection of the well from surface runoff and animals, and proximity of potential polluting activities (agriculture, houses etc.)

Water point committee and users questionnaire

Each WP committee (normally consisting of 8 people) were asked a series of questions concerning the management and structure of the committee, financing, maintenance and repairs and other factors such a population served by water point, maximum distance travelled. A separate questionnaire was also carried out with a selection of WP users covering the quantity of water collected per day, perceived quality of the water, frequency of pump breakdowns, typical queuing times and alternative sources.

Other backstopping support

Meetings were arranged with the Local Government District Water Engineers in Ngara and Biharamulo. Some interviews were also held with hardware shop suppliers in the Districts in order to assess whether pump spare parts could be sourced locally.

Sustainability

The overall sustainability of the different WPs has been characterised according to three fundamental criteria: the sustainability of the physical infrastructure, the sustainability of the water point committee and the sustainability of the backstopping support. It should be noted that the backstopping support criteria do not include access to any ongoing support from Concern or its partners, who are not considered as long term backstopping support options. The results from the WP physical assessments and questionnaires have thus been summarised and distributed according to the 3 sustainability criteria, as listed in Table 1. For example, the infrastructure criteria include factors that are related to the initial location of the well, the design of the technology, the quality of installation etc. Whilst the weighting between the different categories could be considered to be fairly subjective, all of these factors can be directly linked to the quality of the water source, the robustness of the technology and the perception of its value by the local users.

Table 1. Sustainability criteria [with respective scores in brackets]

Water point infrastructure	Water point committees	Backstopping support
Do the community trust / value the water source [no (0), few (2-5), most (6-9), all (10)]	Age of committee [<1 yr (0), 1-2yrs (1), 2-3 yrs (2), 3-4 yrs (3), 4-6 yrs (4), >6 yrs (5)]	Response from District Engineer to problems [no response (0), n/a but know who to contact (2), less than 1 week (5)]
Measured pump yield (l/min) [<5 (0), 5-10 (1), 10-15 (2), 15-20 (3), 20-25 (4) >25 (5)]	No. of active members [0 (0), 2(1), 4(2), 5(3), 6-7(4), 8 (5)]	Local Government supplies spare parts [no (0), never asked but know who to ask (2), always (5)]
Yield / recharge reduces in dry season [completely (0) to no difference (5)]	Frequency of meetings [none (0), verbal but no evidence (1-2), once per year (3), once per quarter (4), once per month (5)]	Availability of spare parts in shops [>500 km away (0), > 200 km away (1), maybe in District village (2), in District village (4), in village (5)]
Protection of pump [no fence (0), fence with openings (2-3), fence with gate (5)]	Cash saved (in TSh) [none (0), <5000 (1), <15 000 (2), <30 000 (3), <50 000 (4), >50 000 (5)]	Other private mechanic available locally [none (0), yes but never used (2), yes and used (5)]
Changes colour after rain [yes (0), no (5)]	Regular contributions [none (0), at formation (1), once per 2 yrs (2), annually (3), monthly (4), every day (5)]	Organised water committee at higher level than local water points [none (0), village facilitator actively involved (2), water vendors group (4), village water points organisation (5)]

Condition of slab & drain [damaged (0) to perfect (5)]	BNK – money saved in bank [none (0), none (but receipts) (1-2), loans provided (3), in village communal bank (4), their own bank account (5)]	Financial infrastructure available [none (0), private loans (1-2), contribution by Local government (3), access to group bank account (4), own bank account (5)]
No. of people served by WP [>600 (0), <501 (1), <401 (2), <301 (3), <201 (4), <101 (5)]	Extra activities to raise money [none (0), reactive payment if it breaks down (1), loan scheme proposed (but no contributions) (2), loan scheme (already operating) (4)]	
Max. distance to users (return trip) [>2 hrs (0), 1 hr (2), 45 mins (3), <30 mins (5)]	Local caretaker fixes pump [no (0), just at training (1), minor maintenance (3), full dismantling (5)]	
Gradient / steepness to source [level (5) to >300 m drop (0)]	Contributions have covered maintenance in past [no (0), n/a (2), yes (5)]	
Length of queues [peak times> 2 hr (0), peak times >1 hr (1), dry season >2 hrs (2), dry season >1 hr (3), peak <30 mins, none (5)]	Knowledge of cost of spare parts [no (0), full knowledge (5)]	
Breakdown frequency (ave. months between breakdowns) [<1/5 yrs (5), 1/3 yrs (4), 1/2 yrs (3), 1 per yr (2), 1 per 6 months (1), < 1 per 6 months) (0)]	Sourced spare parts in past [no (0), n/a (1), from NGO (2), from District Engineer (3), from local supplier (4), from manufacturer (5)]	
Fraction of time not working [>0.5 (0), <0.35 (1), <0.25 (2), <0.1 (3), <0.05 (4), 0 (5)]	Hygiene promotion organised by committee [(never (0), > 2 yrs ago (1), > 1 yr ago (2), every 3 months (3), household visits & at water point > once per year (4), household visits every month (5)]	
Contamination source nearby [houses v. close (0), agriculture (3), none (5)]	Do the community trust committee [no(0), some (2-3), yes (5)]	
	Is the pump working [no (0), yes (10)]	

Results

Water point physical indicators

A summary of all of the results of the survey of the 17 WPs is given in Table 2. From the 17 hand pumps only one was not functioning at the time of the survey (PE2). However, three other water points (PE 6, 9 and 11), although still functioning, were not being used at all by the local population due to complaints about the water smelling, not tasting good and also running dry during the dry season. In addition, PE14 was not trusted during the rainy season, again due to the smell of the water and only used in times of water shortage during the dry season. In these cases the local population preferred to use nearby traditional unprotected sources. The hand-dug wells using Nira pumps were all 6 m deep with yields varying from 15 to 48 litres per minute. The average amount of water collected per household based on the responses from 101 users across the Districts was 14.9 Lcd (litres per capita per day).

At 10 out of the 17 of the wells the users reported that the water changed colour after heavy rainfall events which indicates potential rapid pollution pathways. An example of this is shown in Photograph 1 which shows the difference in water clarity from water drawn in the morning following a couple of days without rain (the red bucket) compared to water pumped just after a rainfall event (the white buckets). This is of some concern from both a water quality perspective as well as the local community's perception. In addition, at two of the wells, users reported that worms sometimes appeared in the pumped water during the rainy season. The siting of some of the wells was very close (<30 m) to surface water (rivers or other traditional wells) which provides a contamination source and potential for very rapid pollutant transport into these shallow wells (see Photograph 2). In addition, many users reported significant problems with reduced yields in the dry season.

Table 2. Water point physical indicators

Water point no. (District)	Age (yrs)	Population (households)	Pump make	Yield (l/min)	Ave. water use (Lcd)
PE1 (Ngara)	2.0	120 (24)	Nira	28	12.4
PE2 (Ngara)	9.6	233 (57)	Nira	n/a	13.2
PE3 (Ngara)	2.3	390 (83)	Nira	20	11.4
PE4 (Ngara)	6.0	215 (51)	India MkII	9	9.3
PE5 (Ngara)	6.0	100 (18)	India MkII	13	14.4
PE6 (Ngara)	3.1	200 (48)	Nira	20	17.9
PE7 (Kibondo)	1.5	715 (152)	Nira	19	15.2
PE8 (Kibondo)	1.2	450 (100)	Nira	48	17.9
PE9 (Kibondo)	1.0	380 (65)	Nira	18	13.1
PE10 (Kibondo)	2.2	309 (52)	Nira	20	16.1
PE11 (Biharamulo)	1.1	226 (24)	Nira	31	12.8
PE12 (Biharamulo)	5.5	826 (200)	Nira	24	24.1
PE13 (Biharamulo)	1.3	137 (18)	Nira	15	18.3
PE14 (Biharamulo)	5.1	180 (22)	Nira	24	19.2
PE15 (Biharamulo)	6.5	250 (40)	Nira	38	14.0
PE16 (Biharamulo)	6.4	900 (250)	Nira	23	6.0
PE17 (Biharamulo)	6.5	1000 (175)	Nira	22	21.4

Photograph 1. Change in turbidity of water following a rain event

Photograph 2. Proximity of PE17 hand pump to traditional open water source

Functioning of water point committees

The WP Committee members were all elected initially during a public meeting and popular vote. However, very few committees had replaced members who had left or had organised a second round of elections since the installation of the water point. Although 42% of the WP committees were female, only 27% of four key roles (chairperson, treasurer, secretary, caretaker) were occupied by women. For most committees (14 / 17) there was evidence of regular meetings being held with minutes kept for ~1 year post committee formation but the frequency of meetings generally started to fade for older water points.

Most committees had collected some money just after the pump installation (500 to 2000 Tsh per family), but this practice had generally shifted to just collecting money reactively from the users if problems with the pump developed; this appeared to be successful for those WPs which had required maintenance in the past, reporting maintenance costs of 15 000 to 85 000 Tsh per visit. In general the committee members had very little knowledge of cost of spare parts and only one committee (PE12) saved money in bank account.

6/17 committees had successfully maintained their WPs and were happy to pay their caretaker for service. However, no caretakers appeared to carry out any routine preventative maintenance. In general, access to a good mechanic, whether the WP committee caretaker, local private operator or local government technician, seemed to be a key element for long term sustainability.

Backstopping support

Whilst the WASH programme had implemented an impressive number on new water points into the region, there had been no direct commitment from Concern or their local partners to develop the supply chain aspect (pump spare parts, trained mechanics etc.) in parallel. It has been assumed that the Local Government Water Department will provide the main link in the supply chain, but the interviews revealed that it was not clear that they are resourced adequately to take on such an additional responsibility. It should also be noted that 8/17 WPs had required no maintenance since installation being relatively new and so the committees and supply chain are still relatively untested.

Sustainability indicators

The results from the three different sustainability indices (infrastructure, committee and backstopping) have been normalised (i.e. expressed on a scale of 0 to 1.0) for each WP and then added together for an overall comparison, as showed in Figure 1. These final cumulative sustainability scores do match the same general feeling as to comparative sustainability's between WPs from the site visits and WP point committee interviews: i.e. PE12, PE17 and PE8 were the best whilst PE2, PE6 and PE11 were clearly failing. The scores have then been used to correlate overall sustainability of WPs (out of 3.0) with respect to their age (Figure 2) which interestingly shows no significant difference. Another finding, however, is that the sustainability of the water points seems to increase with the higher number of users per well (Figure 3) which is perhaps an indication that the more highly used WPs are more valued by the community.

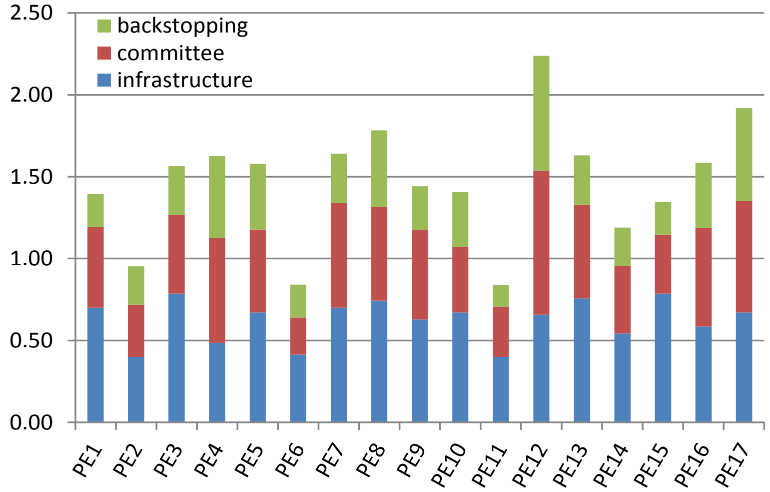

Figure 1. Cumulative sustainability indices (out of max. 3.0) for the 17 water points

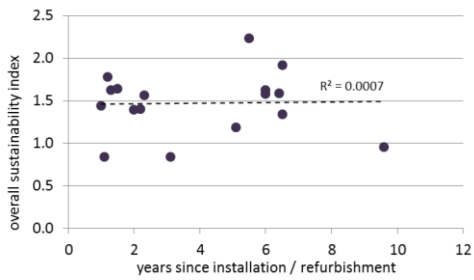

Figure 2. Sustainability indices for the 17 WPs versus their age

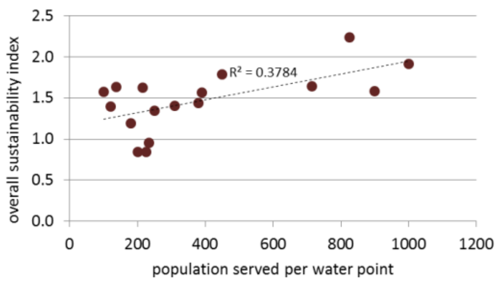

Figure 3. Sustainability indices for the 17 WPs versus their user population

Conclusions

The post-evaluation showed that, whilst a lot of effort had been made to choose a robust pump technology for the programme (which seemed to have been validated given that only one pump was not functioning), there were issues with the siting of several of the WPs which, although still functioning, were not used by the population due to concerns about water taste and colour. This highlights the importance of considering a service delivery approach with respect to WP sustainability and also the need to develop WASH programmes at the proposal stage with some flexibility to allow the best technology to be chosen depending on local site conditions i.e. not be pinned down to an exact number of WPs of a specific technology. The importance of ownership with regards WP sustainability has also been suggested through the fact that each time a repair was needed and despite the failure of the cost-recovery scheme put in place, WASH committees were able to collect enough money to perform the needed repairs. From a longer term perspective, the lack of specific activities and budget in the programme targeted towards analysis and development of the supply chain and maintenance capacity and the weakness of some of the local back stopping agencies can cause a threat to the long term sustainability. Finally, it should be remembered that only 17 water points were formally assessed and, although the water points were randomly selected, the results as representative of the sustainability of a programme of 480 hand dug wells do need to be viewed with the appropriate level of confidence.

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