UPGro Hidden Crisis Research Consortium

Unravelling past failures for future success in Rural Water Supply

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Survey 1 Country Report – Uganda

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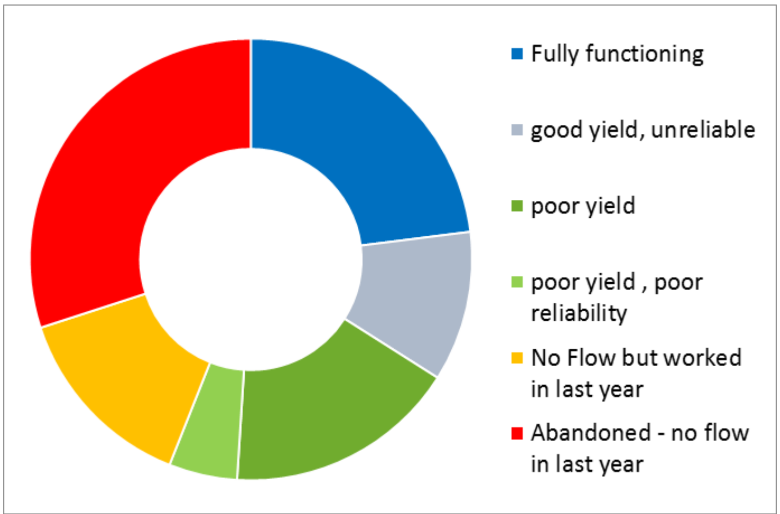
Executive Summary

Statistics on the functionality of water points from the Hidden Crisis project in Uganda are presented. The survey, undertaken in 2016, was focussed on boreholes equipped with handpumps (HPBs) within the 112 districts of Uganda. A stratified two stage random sampling approach was adopted and 10 districts identified to sample. A tiered definition of functionality was applied, and all which enabled more nuanced definitions to be reported: The results from the survey indicate:

- 55% of HPBs were working on the day of the survey (compared to national figure of 86% for rural water supply [1])
- 34% of HPBs passed the design yield of 10 litres per minute
- 23% passed the design yield and also experienced < 1 month downtime within a year.
- 18% passed the design yield and reliability criteria and also water quality criteria

The results of the survey indicate the utility of carrying out more detailed assessments of functionality to help unpack national statistics. A linked survey of the performance of the water management arrangements at water points showed that for 70% of the sites water management arrangements were judged to be weak.



Functionality assessed for boreholes equipped with hand pumps within Uganda. The functionality criteria used were: sufficient yield (>10 L/min) on day of survey; and less than 1 month downtime reported for the past year.

The *Hidden Crisis* project is a 4 year (2015-19) research project aimed at developing a robust evidence base and understanding of the complex and multi-faceted causes which underlie the current high failure rates of many new groundwater supplies in Africa, so that future WASH investments can be more sustainable. The project is being undertaken by an interdisciplinary team of established researchers in physical and social sciences from the UK, Ethiopia, Uganda, Malawi and Australia, led by the British Geological Survey.

Acknowledgements

[1] Water and Environment sector performance report, 2016

Whilst the authors of this report reflect the team directly responsible for undertaking and facilitating the Survey 1 field programme in Uganda, the design of the field research programme, and the definitions of functionality presented are the joint work of the whole *Hidden Crisis* project team.

This report was compiled with full involvement and participation of the Ministry of Water and Environment of the Government of Uganda.

The project team involves an interdisciplinary consortium of established researchers in physical and social sciences from:

- British Geological Survey
- Sheffield University
- Overseas Development Institute
- Flinders University, Australia
- Addis Ababa University, Ethiopia
- Makerere University, Uganda
- University of Malawi
- WaterAid UK and country programmes (Ethiopia, Uganda and Malawi)

Contents

1. Introduction

The *Hidden Crisis* project is a 4 year (2015-19) research project aimed at developing a robust evidence base and understanding of the complex and multi-faceted causes which underlie the current high failure rates of many new groundwater supplies in Africa, so that future WASH investments can be more sustainable. The project is being undertaken by an interdisciplinary team of established researchers in physical and social sciences from the UK, Ethiopia, Uganda, Malawi and Australia, led by the British Geological Survey. The research is focused on three countries – Ethiopia, Uganda and Malawi – to examine functionality and performance of groundwater supplies in a range of hydrogeological, climatic and social, institutional and governance environments.

Three different survey phases are being conducted over two years (2016-18) to collect a significant evidence base, which can be used to develop a more detailed understanding of the causes of poor functionality within the three countries.

1. **Survey 1** – A rapid survey of 200 handpumped borehole supplies within each country to establish data on the different levels of functionality performance of these boreholes and the performance of the local water management committee.
2. **Survey 2** – A detailed survey of 40-50 handpump-equipped boreholes within each country, designed to provide detailed physical and social science datasets to better understand the underlying causes of poor functionality. Data collated by detailed community discussions, as well as deconstructing the water point to examine the construction and hydrogeological properties.
3. **Longitudinal Studies** –conducted at a small number of water points (6 -12) in Uganda and Malawi for at least 12 months to monitor temporal changes in: the use and performance of hand-pump boreholes; user perceptions; the capacity of community management; community livelihoods and dynamics; groundwater levels; and rainfall.

2. Assessing Functionality – different levels of performance

The new Sustainable Development Goals (SDGs) set a much stronger focus on sustainability and performance of water services, and have highly ambitious goals to achieve universal access to safe and reliable water for all by 2030 (UN 2013[2]). Poor functionality of water points threatens to undermine progress, and a lack of knowledge for the reasons behind this makes it difficult to recommend improvements and take corrective action. As a first step it is necessary to be able to reliably monitor current rates of functionality and to have a clear benchmark as to what constitutes a functional water point. Currently, there is no single accepted definition for functionality, although organisations are working towards this as a means of tracking progress towards the SDGs.

Guidelines for assessing functionality

Within Hidden Crisis Project we suggest the following guidelines for assessing functionality[3]:

- Functionality should be measured against an explicitly stated standard and population of water points
- It should be measured separately from the users experience of the service it provides.
- The assessments should be tiered, allowing for further information, but always being able to be reduced to a simple measure.
- A distinction can be made between surveying functionality as a snapshot (e.g. for national metrics) and monitoring individual water point performance (including a temporal aspect).

Defining functionality

Survey 1 of the Hidden Crisis project uses the guidelines above to assess functionality in terms of different levels of performance. This starts with a basic 'yes/no' definition of whether a water point is working, and moves to a more detailed understanding of the reliability and yield of supply (Figure 1). The final level introduces water quality to the performance assessment. The project is using the following definitions of functionality:

1. **Basic** – is the water point working on day of survey(yes/no)?
2. **Snapshot** – does the water point work and provide sufficient yield (10 L/min) on the day of survey?
3. **Functionality performance** – does the water point provide sufficient yield (10 L/min) on the day of survey, and is it reliable (<30 days downtime in last year)? Or is the water point abandoned (not worked in past year)?

[2] UN Water 2013 A Post-2025 Global Goal on Water. 2013.
[3] Wilson et al. 2016. British Geological Survey (BGS) Open Report, OR/16/044,

4. **Functionality including water quality** as 3 above, and also passes WHO inorganic parameters, and thermotolerant coliform (TTC) standards.

Each of these definitions requires different amounts of data to be collected, and a requisite duration of survey. The 'Basic' and 'Snapshot' assessments reflect the requirements of a widespread national survey assessments, whilst the more performance-focused definitions of 3 and 4 are more relevant to local or regional surveys looking to track the functionality of individual water points or programmes through time.

Standard approaches were used within Survey 1 to collect relevant data to each of these definitions (Appendix 1).

The Survey 1 data provide:

- a more nuanced understanding of the current functionality in each country in terms of performance levels; and
- an insight to the impact of using different definitions of functionality.

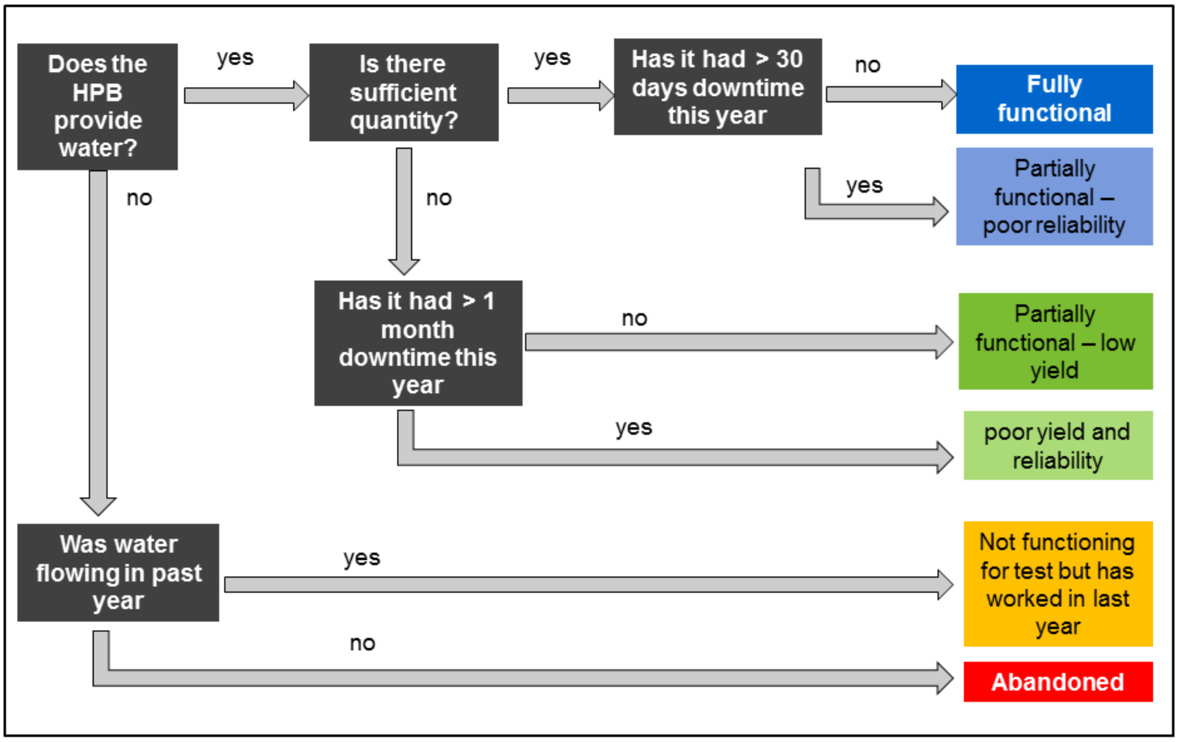


Figure 1 – A schematic diagram showing the different categories of functionality used in the Survey 1 analysis.

3. Survey 1, Uganda

Survey 1 in Uganda was conducted from 4th to June 15th September 2016. A total of 200 boreholes across ten districts were surveyed: three of the districts were in Central Region (Luwero, Mityana, Rakai), two in the Western Region (Mbarara, Rukungiru), three in the Northern Region (Dokolo, Lira, Oyam) and two in the Eastern Region of the country (Budaka, Kumi) – Figure 2. Physical characteristics of the districts included in Survey 1 are summarised in Table 1.

Site selection. The water points in Survey 1 were chosen by a stratified two-stage random sampling design. The domain to be sampled comprised those Districts across Uganda where sampling was deemed practicable by WaterAid. There are 112 Districts in Uganda and 25 were were regarded as feasible to sample, and these constitute the sampling domain. Districts were used as primary sample units and were randomly chosen from within each of four strata defined with respect to hydrogeology (sedimentary or basement rocks) and poverty (above or below Uganda median). Twenty villages were then randomly chosen from within each District. At each village, the community made a list of all the hand pump boreholes they had access to as a community and then one of these was randomly chosen to sample.

The relative size of each stratum was computed from the numbers of shallow water points recorded in the national water supply database. To account for differences between the 25 Districts in the sampling domain and all 112 Districts within Uganda, the results presented below are computed from stratum sample means and the relative size of the strata over all villages in Uganda. Treating these as an estimate for this entire domain, as opposed to the original domain of Districts available for sampling, assumes that the Districts in the sample domain are a random sample drawn from all districts.

Survey methods. HPB's were surveyed for water quality, microbiology, pumping test, users perception of the HPB functionality performance and the experience and capacity of community management arrangements.

Survey team. The Survey Team in Uganda was led by Makerere University, and was supported by: WaterAid Uganda, who played a key part in facilitating the fieldwork; and, the ten District Water Bureau's, which helped facilitate access to communities, and assisted the survey team. Training and guidance throughout the Survey was provided by BGS and Sheffield University, UK.

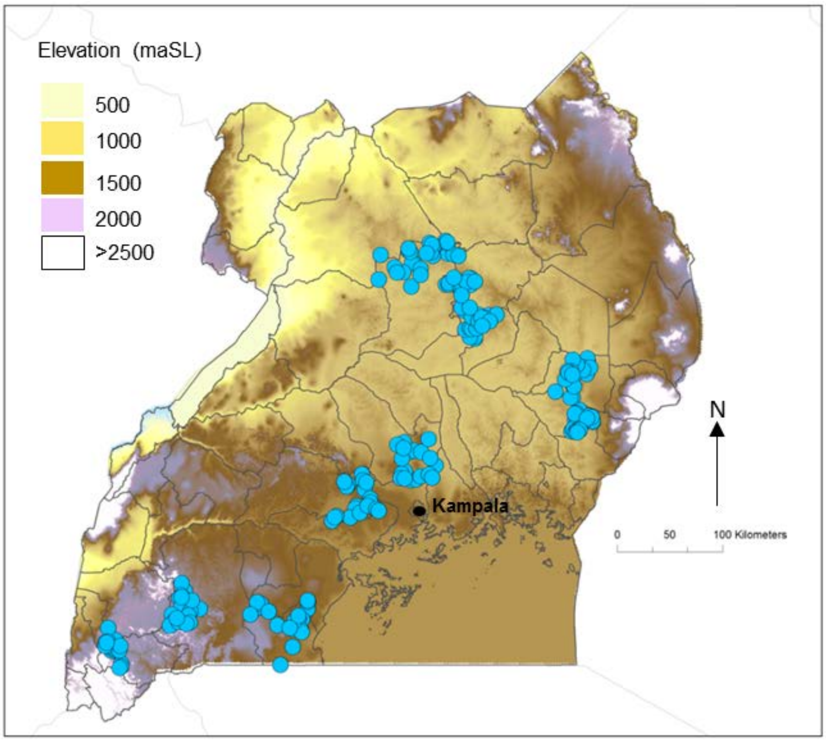


Figure 2 – Location map of sampling sites of Survey 1 Uganda

District	Regional state	Distance from Kampala (km)	Av. Elevation (mamsl)	Mean annual rainfall (mm)	Mean annual temp. (°C)	Dry months
Budaka	Eastern	185	1152	1010	22.3	None
Dokolo	Northern	195	1000	1050	22.5	None
Kumi	Eastern	195	1050	1150	22.5	None
Lira	Northern	210	1090	1434	23.3	None
Luwero	Central	50	1100	1157		None
Mbarara	Western	250	1400	905	22.7	None
Mityana	Central	60	1220	1100	21.5	None
Oyam	Northern	240	1080	1150	22.7	One
Rakai	Central	160	1200	1117	22.8	None
Rukungiru	Western	320	1550	850	23	None

Table 1 – Physical characteristics of the Survey 1 areas.

4. Survey 1 Results, Uganda

The results of Survey 1 in Uganda are summarised below.

Functionality performance level	% pass
Basic – working (yes/no)	55
Snapshot – provides sufficient yield (10 L/min)	34
Functionality performance – sufficient yield and reliability (<30 days downtime in last year)	23
Functionality including water quality - passes WHO TTC and inorganic parameters	18

The 'Basic' and 'Snapshot' assessments reflect the requirements of national survey assessments, whilst the more performance-focused definitions are more relevant to local or regional surveys looking to track the functionality of individual water points or programmes through time.

The results of the basic survey (55%) are lower than the National functionality of rural water supply (86%). The difference is likely to be due to our different sampling methodology, where we randomly sample from *all* boreholes equipped with a handpump. The more comprehensive assessments of functionality performance which include yield and reliability are considerably lower.

Water quality is generally considered a service issue rather than strictly water point functionality.

A breakdown of district results is shown in Appendix 3.

Basic functionality

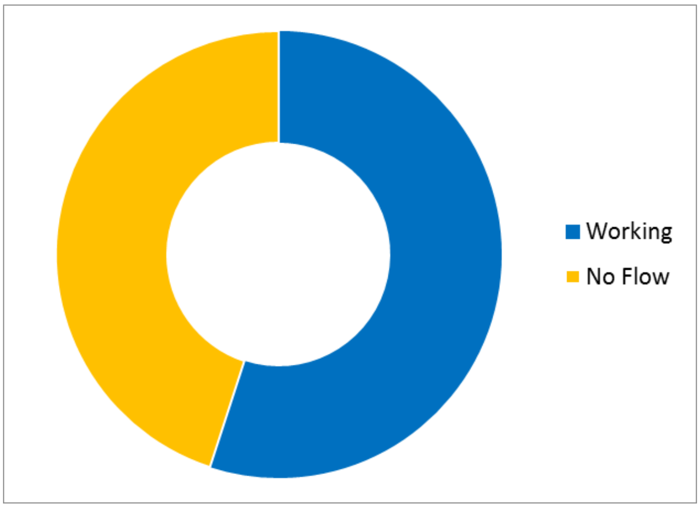


Figure 3 – Functionality assessed as working or not working (no flow)

Snapshot functionality

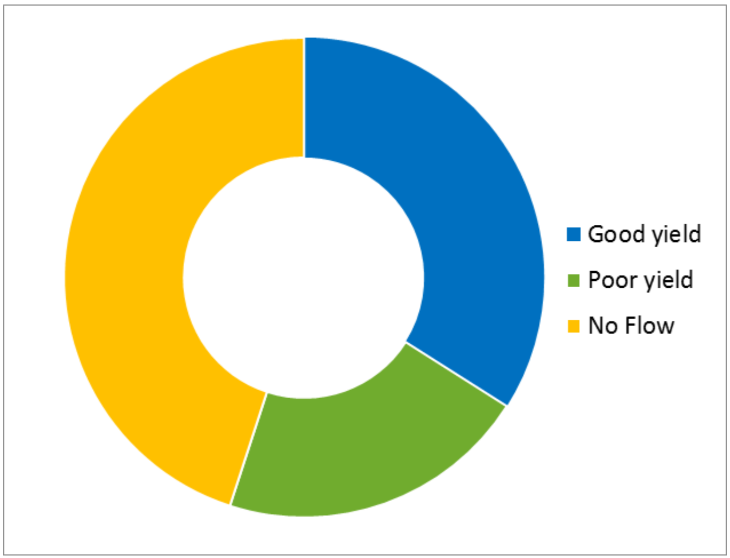


Figure 4 –Functionality assessed as working with sufficient yield (10 L/min)

Functionality performance

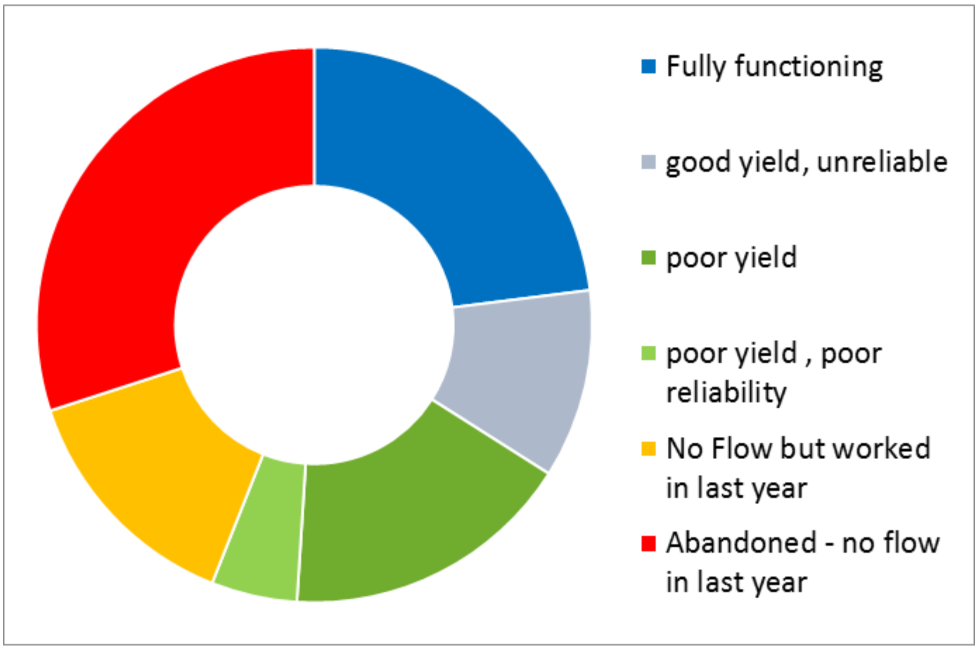


Figure 5 – Functionality performance – functionality assessed as working with sufficient yield (>10 L/min) and reliability (<30 days downtime [days not working] in the last year).

Functionality performance – including water quality

Table 2 – Functionality performance, including water quality.

		Water quality issues (%)			
		None	TTC only	Inorganic only	both
Fully functioning		17.6	2.6	1.6	1.0
Good yield, unreliable		6.2	3.1	0	1.6
Poor yield		12.8	3.1	0	0.9
Poor yield, poor reliability		3.5	1.4	0	0
No flow but worked in last year	14				
No flow abandoned	30.6				

Some HPB's are shown to have Thermo-tolerant coliforms (TTC) in excess of the WHO drinking water standard. TTC's are a bacterial indicator of sanitary quality of water. We used the strict WHO standard of a failure being any measured TTC in the water, rather than a risk based approach which would prioritise higher concentrations of TTCs.

A few other HPB's are shown to have inorganic water quality parameters in excess of the WHO drinking water standards. Inorganic water quality parameters found to be in excess were: Manganese, Zinc, Aluminium, and Boron. With the exception of one HPB which failed on two parameters, HPB typically fail on a single inorganic parameter.

5. Water Management Arrangements

During Survey 1 in Uganda a social survey of the village-level water management arrangements was also carried out at each water point. A core aspect of the social-science component of the Hidden Crisis project is to not assume that all local management functions are performed solely by the formally appointed water point committee. Instead, the focus of the research has been broadened to include all local actors and institutions who may play a part in managing HPBs. This is why we use the term water management arrangement (WMA), which includes the water point committee but is not limited to it.

The project developed a definition of a WMA (see Appendix 2). This definition lists 8 different attributes that need to be present to a greater or lesser extent if the WMA is to be considered 'functioning'. A structured social survey was designed with a total of 23 questions that addressed the 8 attributes of a WMA, where each question could be ranked between 1 (lowest) and 3 (highest). The survey was divided into 4 categories of questions: (1) Finance; (2) Maintenance and Repair; (3) Decision making, rules, and leadership; and (4) External Support. The quality of the WMAs has then been assessed by placing them into 4 categories depending on distribution of scores.

Scores	Functionality of WMA
Scores mostly 1s	Non existent
Scores 1s and 2s	Weak
Scores mostly 2s and 3s	Functional
Scores mainly 3s	Highly Functional

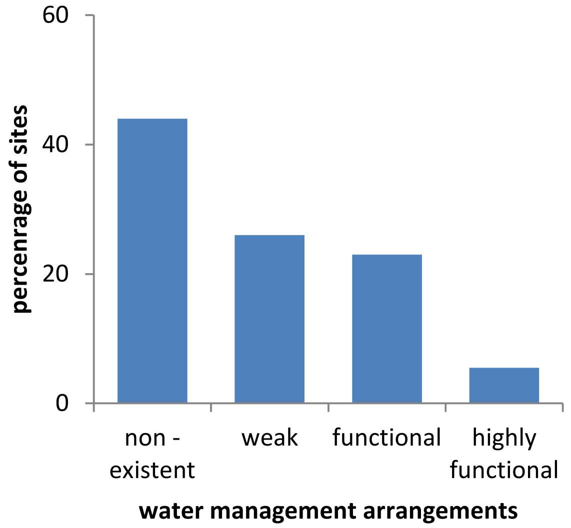


Figure 7 – Percentage of sites assessed to have non-existent, weak, functional or highly functional water management arrangements.

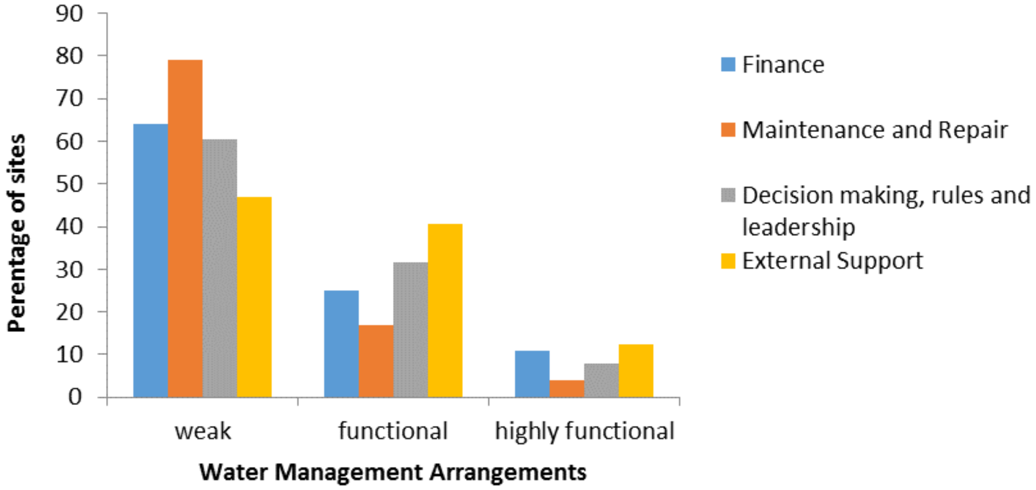


Figure 8 Water management arrangement scores disaggregated by category.

The survey indicates the majority of the Water Management Arrangements (70%) are weak or non-existent. Initial exploration of the data show no simple relationship between the physical functionality and water management arrangements although more sophisticated analysis is yet to be undertaken. These initial findings are consistent with the hypothesis that the relationship between WMAs and HPBs is complex and multifaceted. These complexities and inter-relationships are being investigated in more detail within the second project survey.

Appendix 1 – Survey 1 assessing physical functionality

The project used standard methods to assess the following definitions of functionality for a handpump borehole.

1. **Basic** – is the water point working (yes/no)
    - Handpump physically working and proving some water at time of survey visit.

2. **Snapshot** – does the water point work and provide sufficient yield (10 L/min)
    - Basic functionality assessment, plus:
    - Yield assessed from standard 30 minute stroke test conducted at the handpump borehole. The water point was assessed to pass the functionality test if the yield provided in the final 3 minutes was >10 L/min.
3. **Functionality performance** – (provides sufficient and reliability (<30 days downtime in last year))
    - Basic and Snapshot functionality assessment methods, plus:
    - Water point user survey used to assess the number of breakdowns and repairs in the last year, and number of days of downtime. The handpump borehole was assessed to be of sufficient reliability if the total downtime is <30 days in the last year.
    - If the waterpoint had not functioned in the past year it was classified as abandoned
4. **Functionality including water quality** (passes WHO inorganic parameters, and TTC)
    - Basic, Snapshot and Functionality performance assessments, plus:
    - Inorganic water sample analysis for major and minor ions – the water sample chemistry must meet WHO standards for inorganic parameters.
    - Thermo-tolerant coliform (TTC) water sample analysis – the TTC concentrations must meet WHO standard (<1 TTC)

Appendix 2 – A Functioning Water Management Arrangement

A functioning water management arrangement is comprised of the following eight attributes:

1) Authoritative leadership exists
2) Has the capacity to make and enforce decisions, including on rules-in-use
3) Collects or sources, manages, and accounts for funds
4) Undertakes and secures maintenance work
5) Represents all users in a way that ensures equitable access to the water supply
6) Recognised as legitimate by both users and the local governance structure
7) Is aware of its own role and responsibilities and the roles and responsibilities of others
8) Is linked to other relevant stakeholders and institutions

Appendix 3 – Individual district results

Functionality performance level	Budaka (%)	Dokolo (%)	Kumi (%)	Lira (%)	Luwero (%)	Mbarara (%)	Mityana (%)	Oyam (%)	Rakai (%)	Rukungiri (%)
Basic – working (yes/no)	60	80	75	60	75	50	50	60	35	40
Snapshot – provides sufficient yield (10 L/min)	10	35	35	35	60	40	30	45	25	10
Functionality performance – sufficient yield and reliability (<30 days downtime in last year)	5	25	25	30	35	30	15	30	15	10
Functionality including water quality (passes WHO inorganic parameters, and TTC)	5	25	10	20	35	15	15	30	10	5

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