lifecycles, as this indicates problems in site selection, installation, and commissioning. These problems can be rectified through better planning, improved contracting, and building of capacity of well-drillers.

Governments should require all agencies providing drinking water through handpumps to use standard definitions and methods to measure functionality so that a national picture can be drawn. Data collected should include the age of each installation in order to be able to develop a better picture of trends in functionality. A complete picture will include all water points, including those that have been abandoned. The Sustainable Development Goals, adopted by the Member States of the United Nations in September 2015, challenge governments to ensure that everyone has access to drinking water by 2030. One of the proposed parameters to track success is that water is "available when needed." For countries where handpumps are used, a standardized system to monitor, analyze, and respond to functionality concerns will be required to ensure that this aim is met.

Reviewed by Jeffrey Goldberg, Water and Sanitation Advisor, USAID and Clarissa Brocklehurst, UNC Water Institute affiliated adjunct faculty member in Environmental Sciences and Engineering.

Literature review: handpump functionality monitoring

This section provides a review of literature on handpump functionality monitoring. It seeks to highlight some of the functionality measurements used in the literature and describe the challenges that emerge from inconsistencies in the way the results of functionality studies are presented by authors.

The earliest surveys of handpump functionality date back to 1974, but their use for analytical purposes in the literature do not seem to occur until some years later. For example, McPherson and McGarry (1987) cite a 1974 World Health Organisation survey that found that 50% of handpumps installed on tube wells in Bangladesh and Thailand were inoperative at the time of assessment. Mudgal (1997) cites a 1974 UNICEF survey in India that found that 75% of handpumps were inoperative at the time of assessment. These early surveys expressed functionality in terms of a simple binary "working/not working at time of assessment" measurement. This binary assessment standard spans the literature; for instance Cairncross et al. (1980) estimated that 30% of water systems throughout the developing world were not working at any one time and a USAID study in Ethiopia (Schweitzer, et al. 2015) found that 43% of 21 handpumps surveyed were not working at the time of visit.

Other measures have evolved which use additional parameters designed to capture greater nuances in handpump and waterpoint performance. This unfortunately makes cross comparison of results from different functionality studies highly problematic. The challenge of cross comparison is illustrated in a useful compilation of water service failure statistics maintained by Improve International (2015). A total of 125 studies are referenced, drawing upon an array of different survey methodologies, expressing functionality results using a range of different indicators.

Varying measurements of functionality are the focus of a recent literature review covering 117 handpump functionality studies (Wilson et al., forthcoming). This review groups studies into six classes depending upon how they define and measure functionality.

Studies falling into the first class--for example, van der Linde (2015) and Deneke and Hawassa (2008)--do not define functionality but use a binary "working/not working" measure by default. Studies in the second class, including MWE (2010) and UNICEF (2014), define functionality but still use a "working/not working" measure. Studies featured in the third class present a more complex interpretation of functionality, using descriptions such as "needs repairs," "semi-functional," "minimally functional," "broken," "missing parts," and "seasonal," for example, SNV (2014) and Truelove (2013). The fourth class, including the study by Carter and Ross (2016) reviewed in the first part of this Digest, and one by Tincani et al. (2015), feature detailed tiered definitions of functionality, but use a simple binary measurement if more detail is not present.

More than three-quarters of the studies reviewed by Wilson et al. were carried out since 2008, illustrating a growing interest in measurement of functionality and water supply sustainability. Most studies were unpublished grey literature (sixty items), and twenty-four were published in peer-reviewed journals. The review resulted in the following findings:

1. There is no single widely-accepted definition of functionality;
2. Even within individual studies, functionality is often not explicitly defined;

3. It is difficult to compare the results of different functionality surveys due to the lack of clarity on definitions, survey domains and survey methods;

4. A simple binary (functioning/non-functioning) approach is the most common method used in both national surveys and local studies; and,

5. The limitations of a binary approach to defining functionality have led some to define multiple categories, such as partial functionality, but this has made cross comparison of surveys even more difficult.

Although handpump functionality monitoring has been a sporadic feature of rural water supply programmes since the early 1970s, literature on the issue reveals that no consistent monitoring standards have evolved and no widely-agreed indicators yet exist. The lack of a sector-wide standard incorporating multiple parameters jeopardizes the usefulness of many surveys as they may oversimplify the problem of handpump/borehole failure.

A sector-wide standard could include temporal aspects (frequency and duration of downtime), as suggested in Carter and Ross (2016). In this case, challenges associated with user recall would have to be addressed. Fisher (2013) found user recall is best within a two-week timeframe; beyond two weeks there is the risk that recall bias creeps into survey responses. Despite this risk, Fisher recommends looking at failure rates over a year to capture seasonality.

The literature suggests that a useful place to start in order to harmonise functionality monitoring would be, at the very least, to encourage all those tracking functionality to state the definition of functionality used, the domain in which they are sampling, and the methods used to survey functionality. Agreement on a detailed, sector-wide standard for measuring functionality would allow more light to be shed on the true level of service that users receive, contribute to understanding of the determinants of functionality, and help to align policy and programmatic responses.

This literature review was prepared by Vincent Casey of WaterAid, and Alan Macdonald and Paul Wilson of the British Geological Society.

Reviewed by Jeffrey Goldberg, Water and Sanitation Advisor, USAID and Clarissa Brocklehurst, UNC Water Institute affiliated adjunct faculty member in Environmental Sciences and Engineering.

References

Cairncross S., et al., (1980). Evaluation for Village Water Supply Planning. International Reference Center for Community Water Supply and Sanitation, The Hague, Technical Paper 15

Deneke, I. and Hawassa, H. A. (2008). The Sustainability of Water Supply Schemes: A case study inMirab Abaya woreda. Ripple Working Paper 4

Fisher, M.B. (2013). Proposed Core WaSH MEL Indicators: Monitoring for Continuous Program Quality Improvement. The Water Institute at UNC, Chapel Hill, NC, USA https://waterinstitute.unc.edu/publication/proposed-core-wash-mel-indicators-monitoring-continuous-program-quality-improvement/

Improve International (2015). Statistics on Water Point Failures https://improveinternational.wordpress.com/handy-resources/sad-stats/

McPherson H. J., McGarry M.G. (1987). User participation-and implementation strategies in water and sanitation projects. Water Resources Development Vol 3 No 1. http://www.ircwash.org/sites/default/files/205.1-3969.pdf

Moriarty, P., Smits, S., Butterworth, J. and Franceys, R. (2013). Trends in rural water supply: Towardsa service delivery approach. Water Alternatives 6(3): 329-349

Mudgal. A. K. (1997). India Handpump Revolution: Challenge and Change. Handpump Technology Network Working Paper: WP 01/97 http://www.watersanitationhygiene.org/References/EH_KEY_REFERENCES/WATER/Handpumps/Handpump%20General/India%20Handpump%20Revolution%20(HTN%20SKAT).pdf

MWE. (2010). The Water Supply Atlas, Ministry of Water and Environment, Uganda

Schweitzer, R., Ward, R., Lockwood, H. (2015). Wash Sustainability Index Tool Assessment: Ethiopia. Report prepared for USAID SNV (2014). Results are in: mapping the water supply in Chum Kiri http://www.snvworld.org/en/cambodia/news/results-are-in-mapping-the-water-supply-in-chum-kiri

Tincani, L., Ross, I., Zaman, R., Burr, P., Mujica, A. And Evans, B. (2015). Regional assessment of the operational sustainability of water and sanitation services in Sub-Saharan Africa. Report by VFMWASH

Truelove, J. (2013). Sustainability of Community Managed Rural Water Supply in Post-Conflict Regions of Northern Uganda. MSc thesis Loughborough University

UNICEF. (2014). Madagascar WASH Sector Sustainability Check, Final Report (draft)

van der Linde (2015). Over one million surveys collected with Akvo FLOW http://akvo.org/blog/over-one-million-surveys-collected-with-akvo-flow/

Wilson. P. et al. A Hidden Crisis – Defining Functionality. UPGRO A Hidden Crisis – unravelling past failures for future success in Rural Water Supply. Forthcoming.

Written by Vincent Casey – Senior WASH Advisor – WaterAid, Alan MacDonald – Principle Researcher Hydrogeologist – British Geological Survey, Paul Wilson – Hydrogeologist – British Geological Survey

THE WATER INSTITUTE AT UNC • GILLINGS SCHOOL OF GLOBAL PUBLIC HEALTH • THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

4114 MCGAVRAN-GREENBERG HALL, CB #7431 • CHAPEL HILL, NC 27599 • WATERINSTITUTE@UNC.EDU • @UNC_WATER_INST • 1.919.966.2480