

Examining functionality and sustainability of groundwater supplies equipped with hand pumps
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Improving access to water, and helping to achieve new Sustainable Development Goals of universal access to safe water, will depend to a large extent on accelerated development of groundwater resources, usually through drilling boreholes and equipping them with handpumps. However, emphasis on new infrastructure has obscured a hidden crisis of failure, with an estimated 30% of new sources non-functional within 5 years. This problem has remained stubbornly persistent over the last four decades, with little sign of sustained progress despite various interventions. The accumulated costs to governments, donors and above all rural people are enormous. The lack of systematic investigation and understanding into the complex multifaceted reasons for failure has given limited opportunity to learn. Preliminary results of a collaborative research programme across Ethiopia, Uganda and Malawi are presented where we - (1) bring clarity to the definition of the functionality of hand pump equipped boreholes, and the functionality and performance of water governance arrangements - essential for developing shared data and knowledge base+ and (2) develop a survey methodology for measuring functionality and performance. We have found it useful to divide objective measures of functionality (based on meeting design criteria) from user experience and demands put on the system. Here we present result from the initial surveys in the project, in Uganda, Ethiopia and Malawi. The results show the utility of detailed survey design and undertaking an interdisciplinary survey. The primary reasons for poor performance and failure are low yield, poor quality or mechanical failure. However, behind these initial symptoms of failure are many secondary reasons and underlying conditions. By examining these deeper factors to poor performance using an interdisciplinary approach the underlying causes of the rapid failure of approximately 30% of Africa's hand pump equipped boreholes can be understood, diagnosed and ultimately mitigated.

