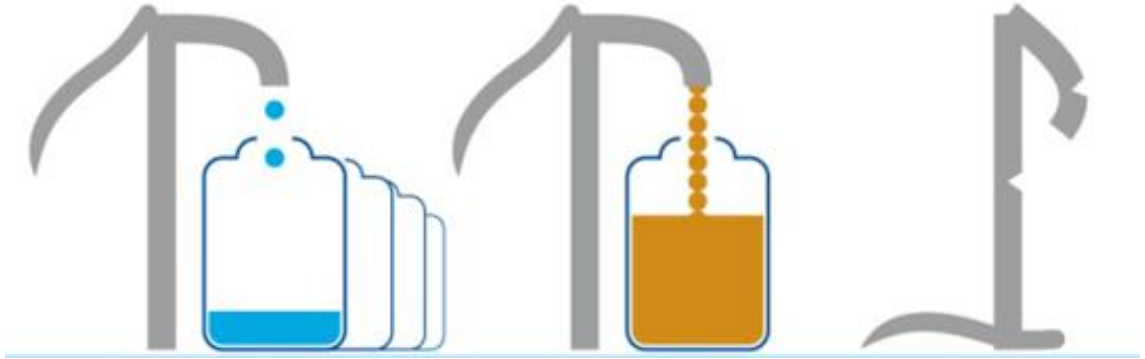
Determinants of hand-pumped borehole functionality:
preliminary evidence from Ethiopia, Malawi and Uganda



Presented by:

Donald John MacAllister

British Geological Survey

The Hidden Crisis project

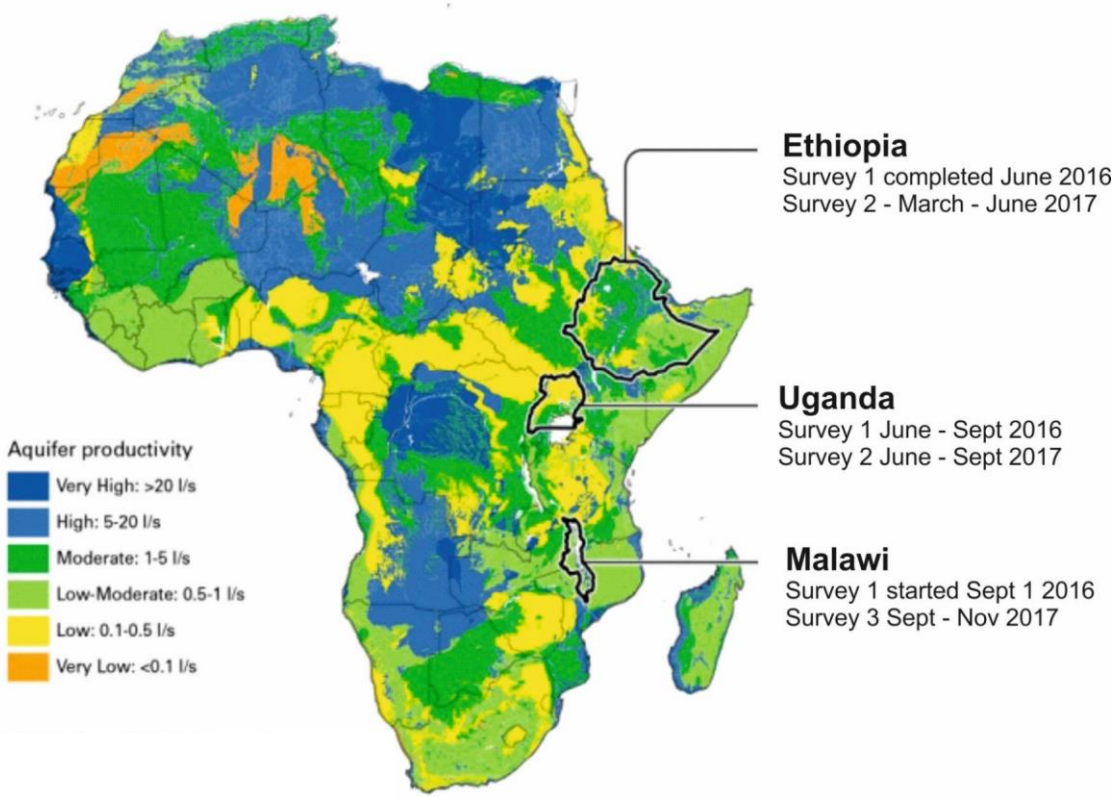
Unravelling current failures for future success in rural groundwater supply

Objectives:

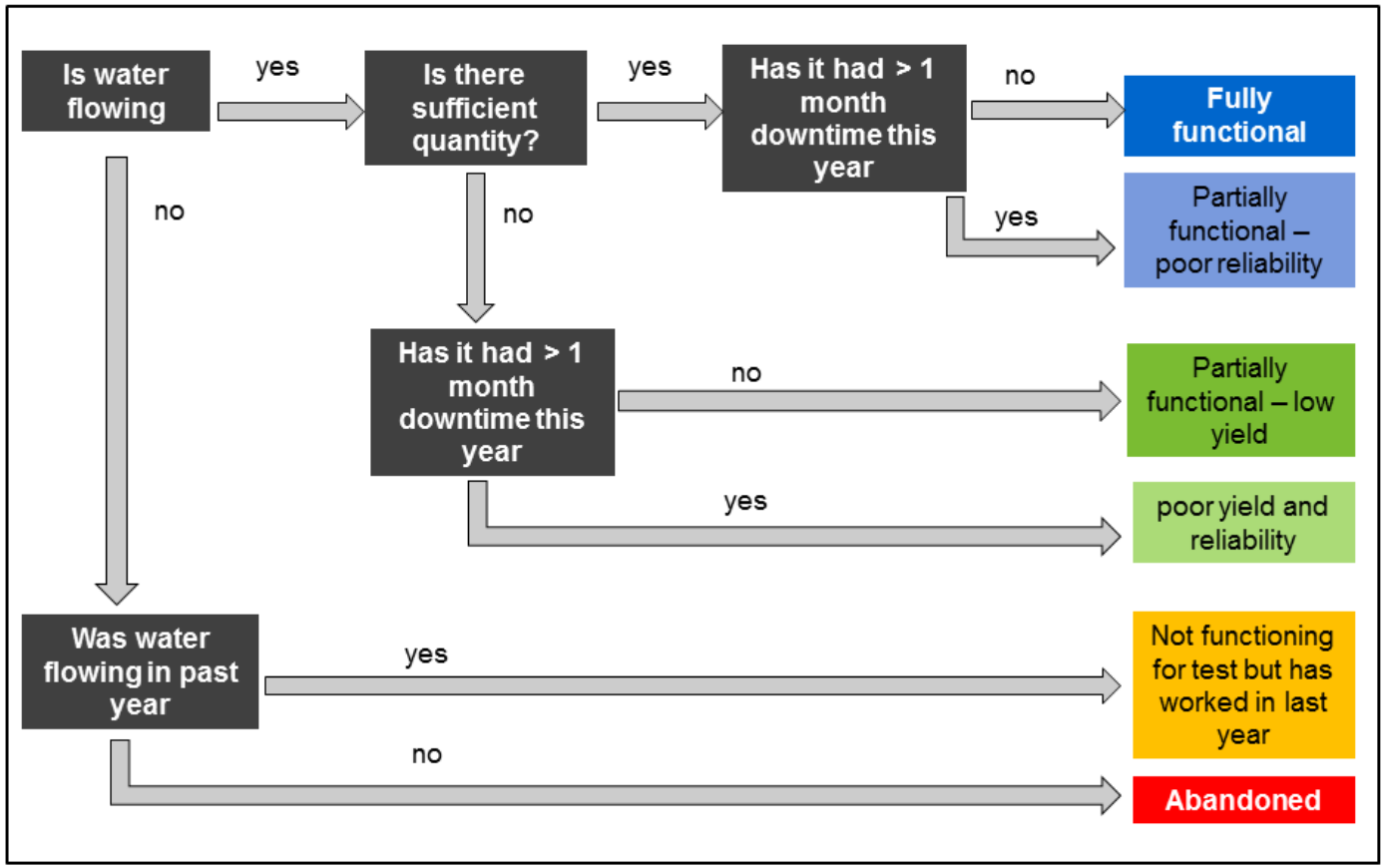
1. Define functionality of boreholes and water committees

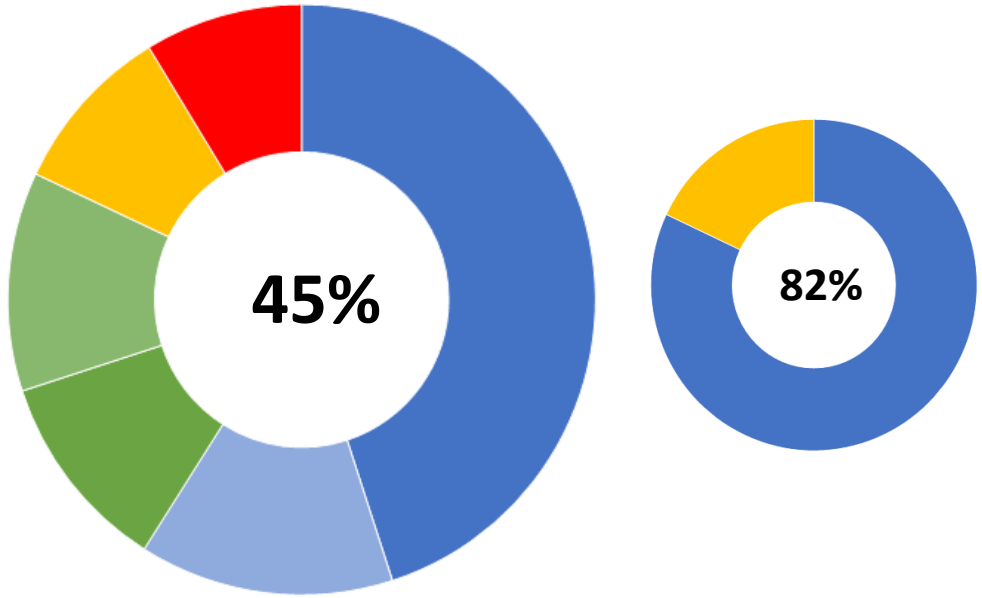
2. Apply to Uganda, Ethiopia and Malawi to explore current status – SURVEY 1

3. **Detailed interdisciplinary analysis to understand underlying reasons for functionality status – SURVEY 2**



Handpump borehole functionality – example from Ethiopia





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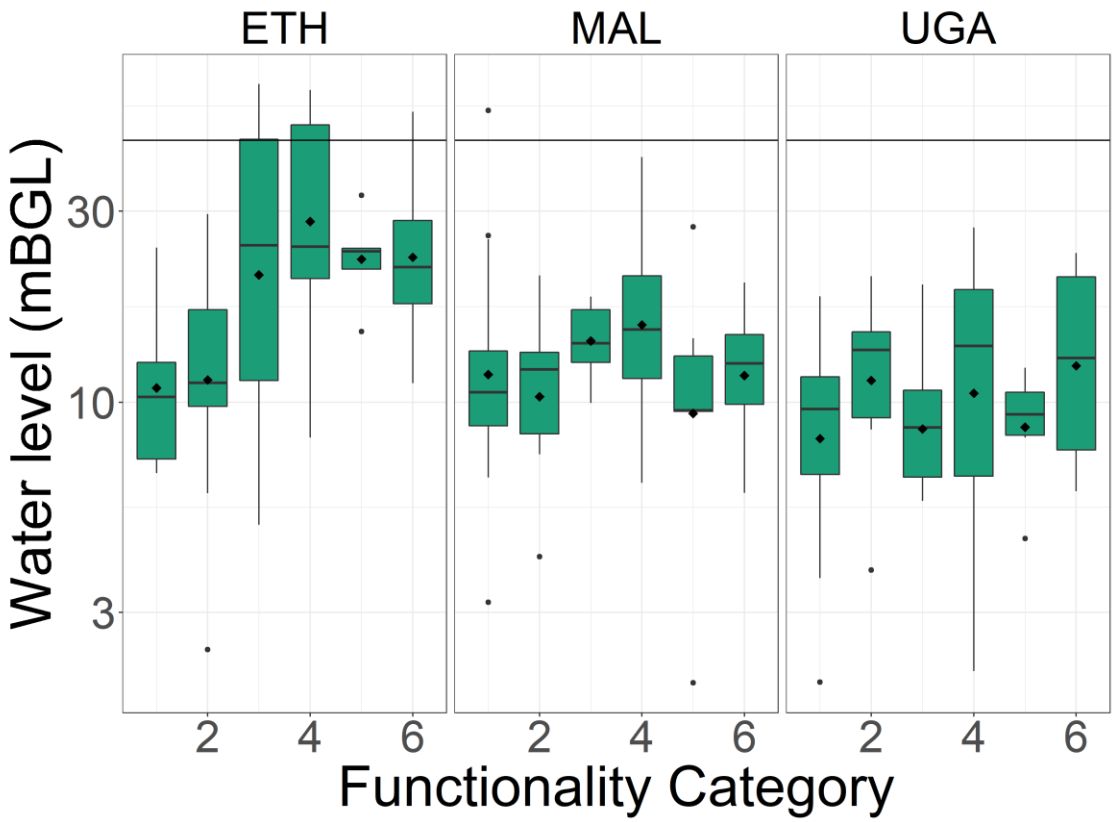
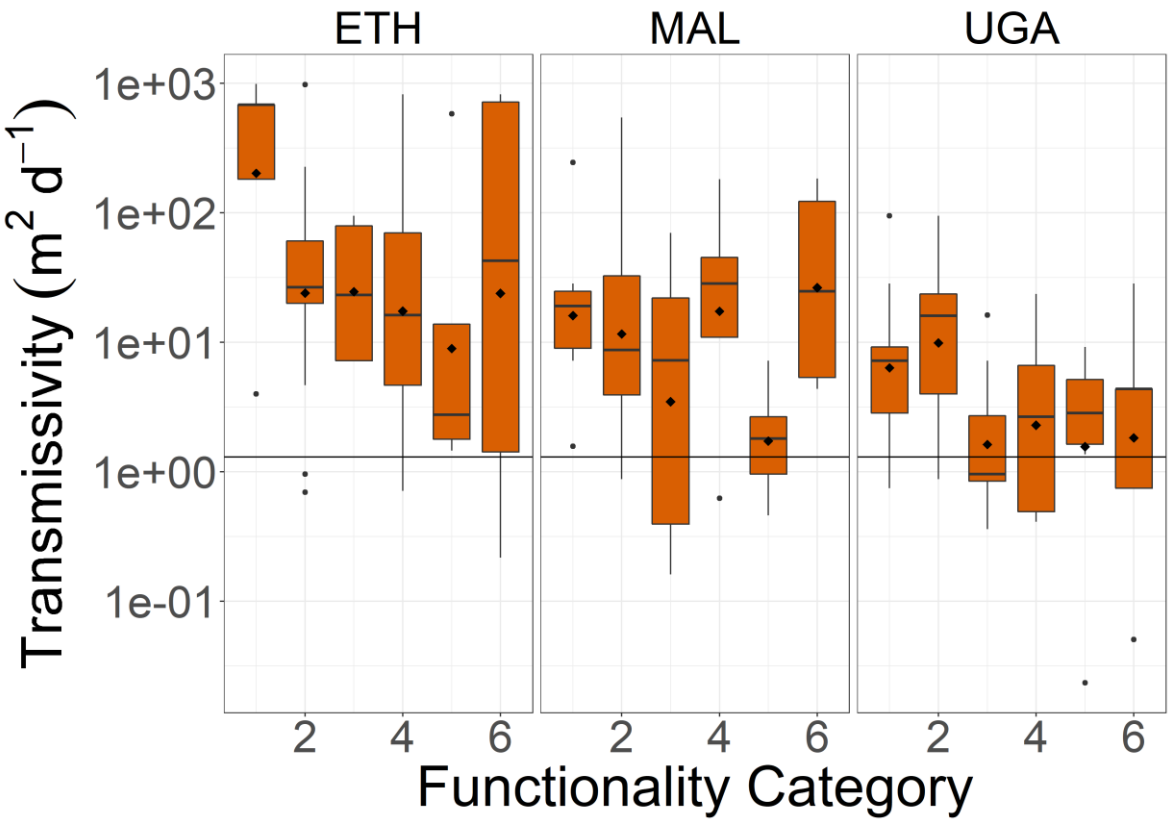
Survey methodology

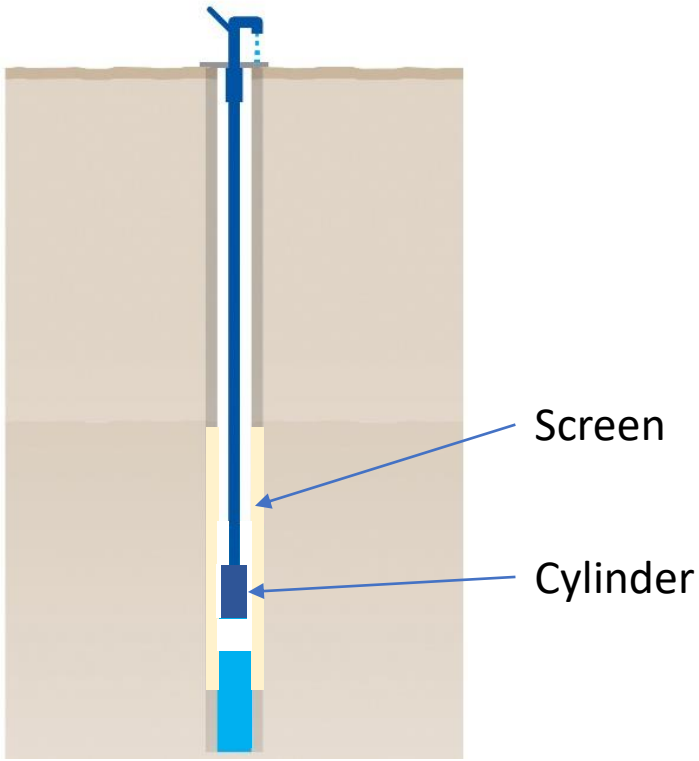
- Physical survey:
  - sanitary & engineering survey,
  - pumping test,
  - water chemistry,
  - CCTV survey,
  - questionnaires (reliability, downtime, quantity, quality).
- Social science: focus groups, transect walks.

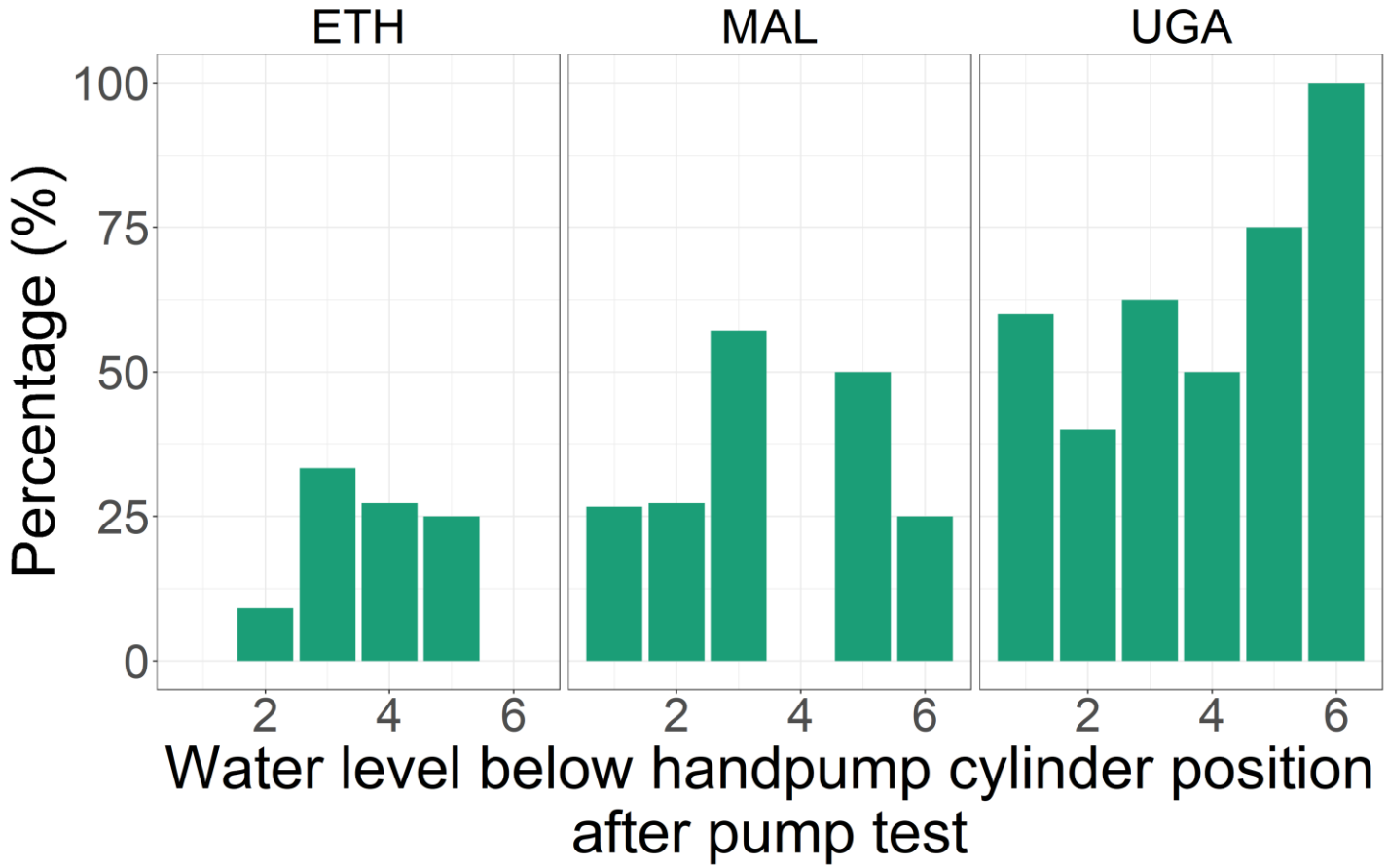
Hydrogeology





Cylinder position and dynamic water level





Handpump – India Mark II

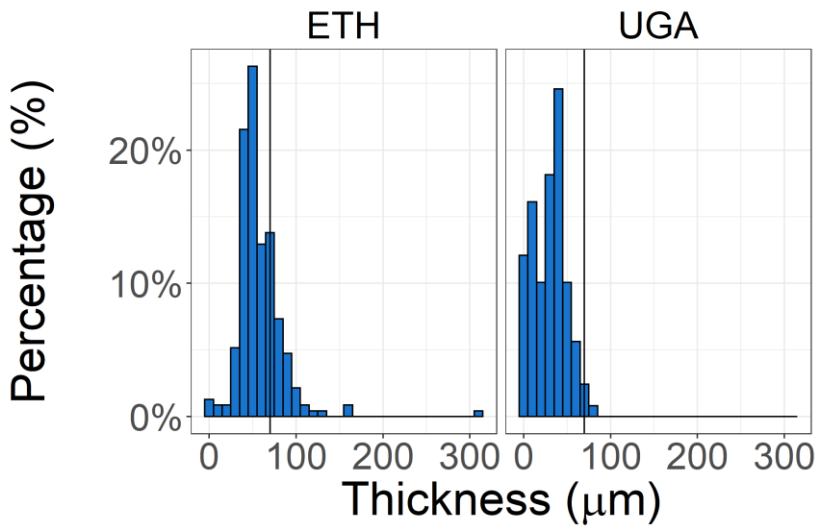


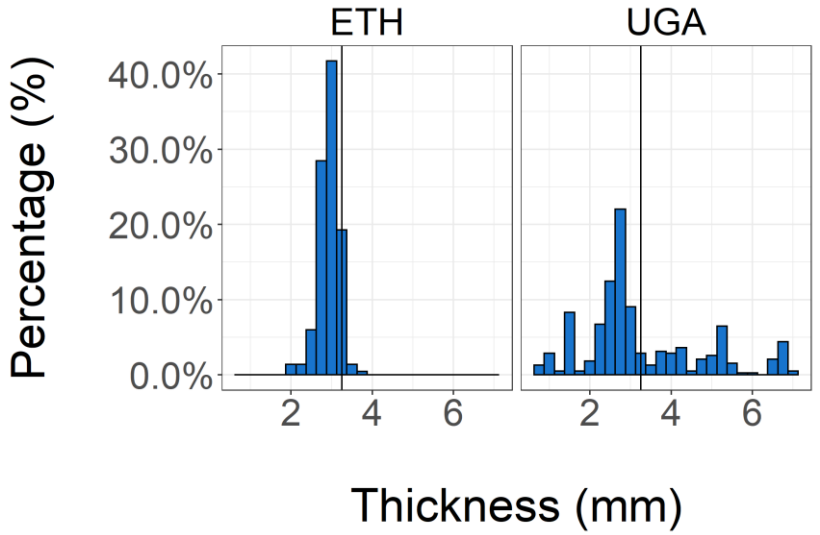




Handpump – IMII rising main and rods

- Ethiopia:
  - **60%** RM thickness below spec. (3.25 mm ±0.2 mm).
  - **55%** galvanising thickness below spec. (70- 80 µm).
- Uganda:
  - **65%**
  - **90%**





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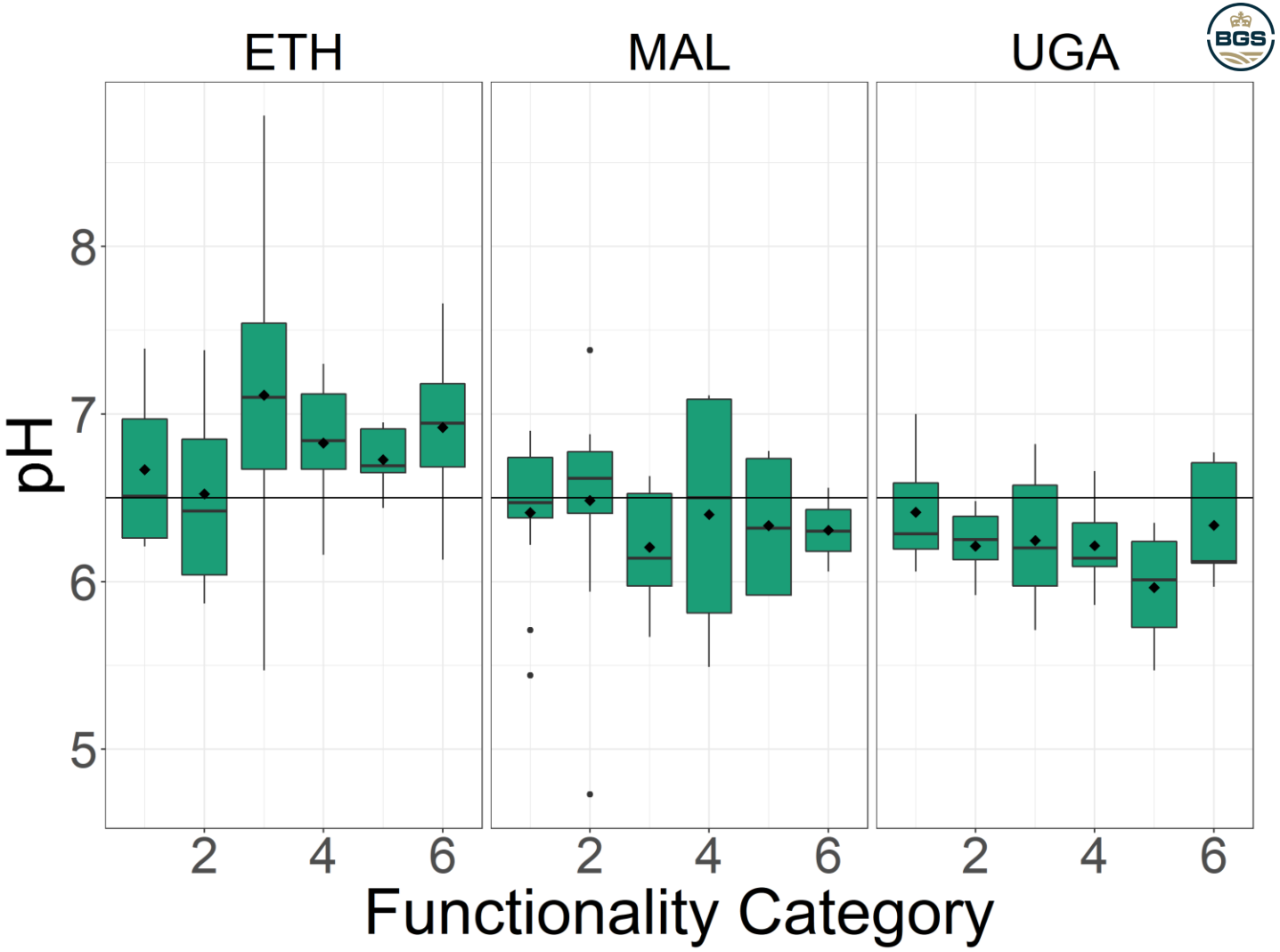
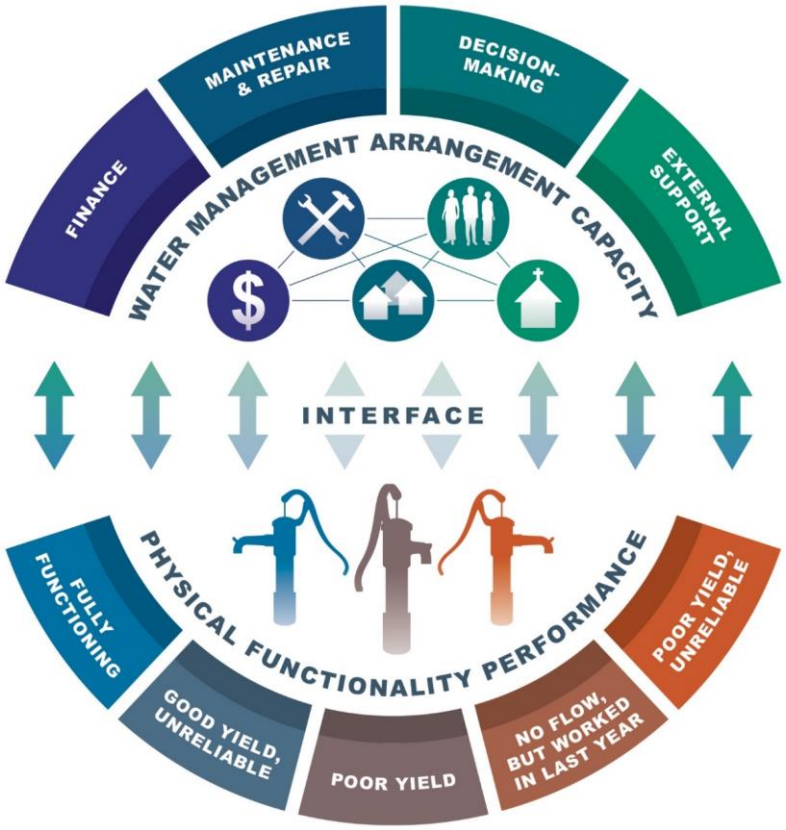
Kebede, S., et al. (2019). "Physical factors contributing to rural water supply functionality performance in Ethiopia." http://nora.nerc.ac.uk/id/eprint/527020/

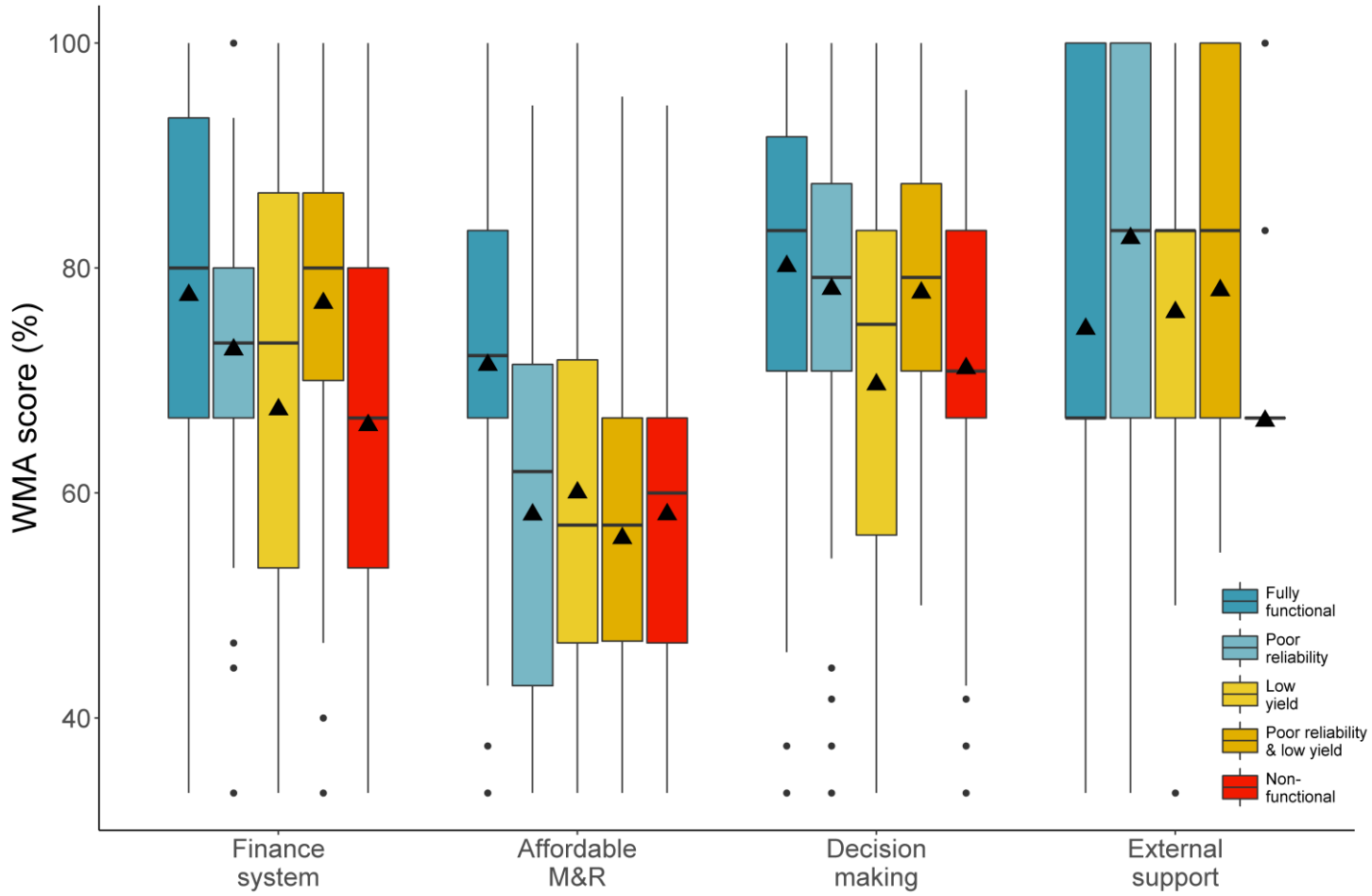
Water chemistry

- pH as an indicator of corrosion:
  - Low risk > 7
  - Intermediate risk: 6.5 - 7
  - High risk: 6 - 6.5
  - Severe risk < 6



Management





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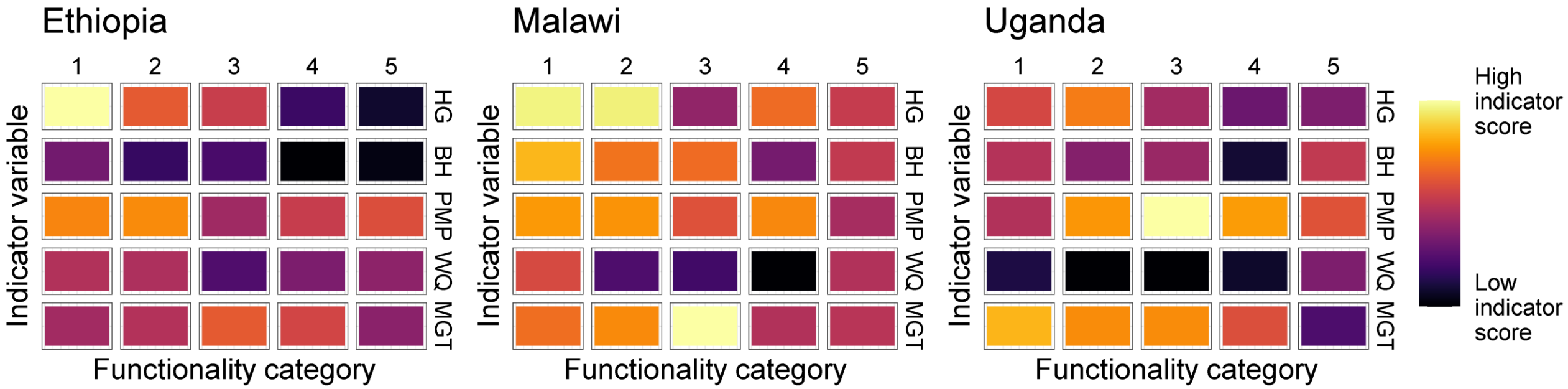
Integrated analysis



Conclusions

- Nuanced definition of functionality used to determine causal factors.
- Preliminary analysis suggests physical factors which impact functionality outcomes, include:
  - Hydrogeology (transmissivity and water level)
  - Rising main condition
  - BH design and configuration (screen and pump cylinder placement)
  - Poor quality materials and corrosion (especially IMII handpumps)
- Sociotechnical interface is nuanced and complex, overly simplistic and reductive approaches are not adequate to fully understand functionality.
- Future work:
  - statistical analysis of physical factors that affect functionality, breakdown and failure rates.
  - further interdisciplinary analysis of the dataset.