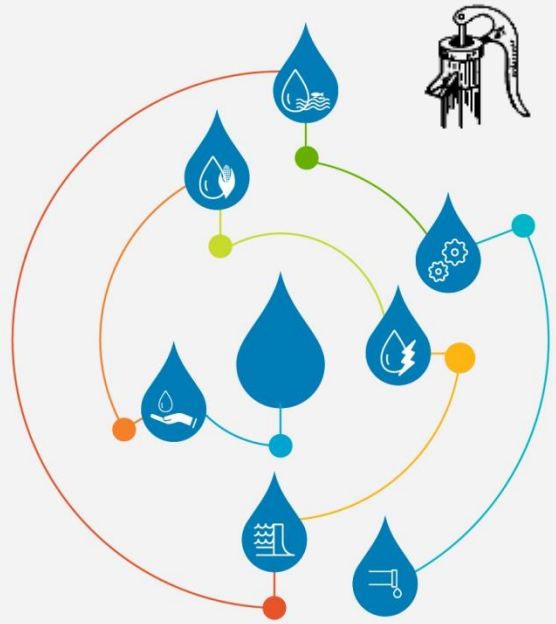
Safe Pani |
Real-time monitoring of handpumps for safely managed drinking water services in rural Bangladesh



Alex Fischer, University of Oxford
Adnan Hakim, UNICEF
Md. Shafiqur Rahman, Government of Bangladesh

October 2018

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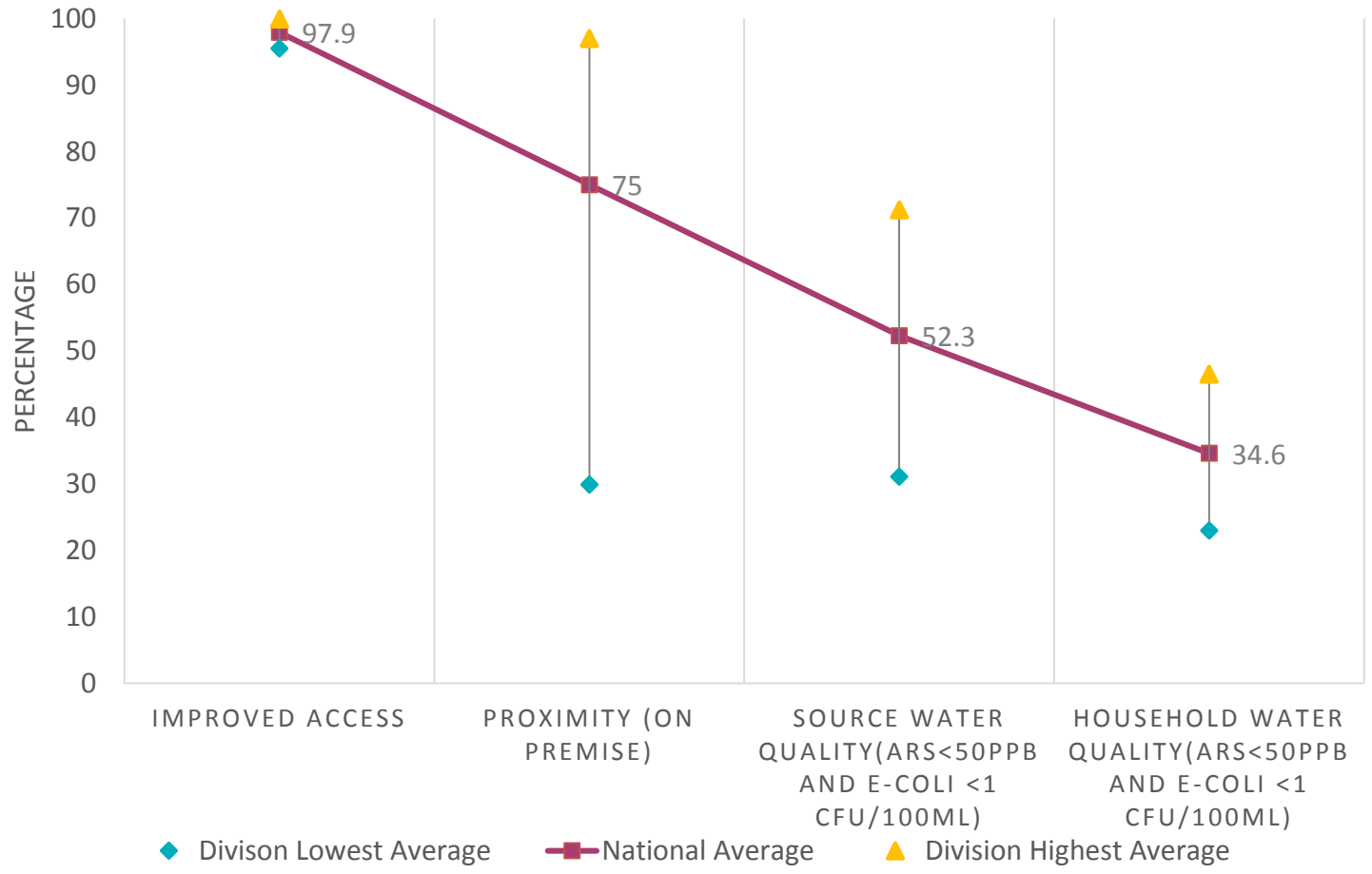
Key concerns for rural drinking water security in Bangladesh



Limited data available for functionality and performance of rural services

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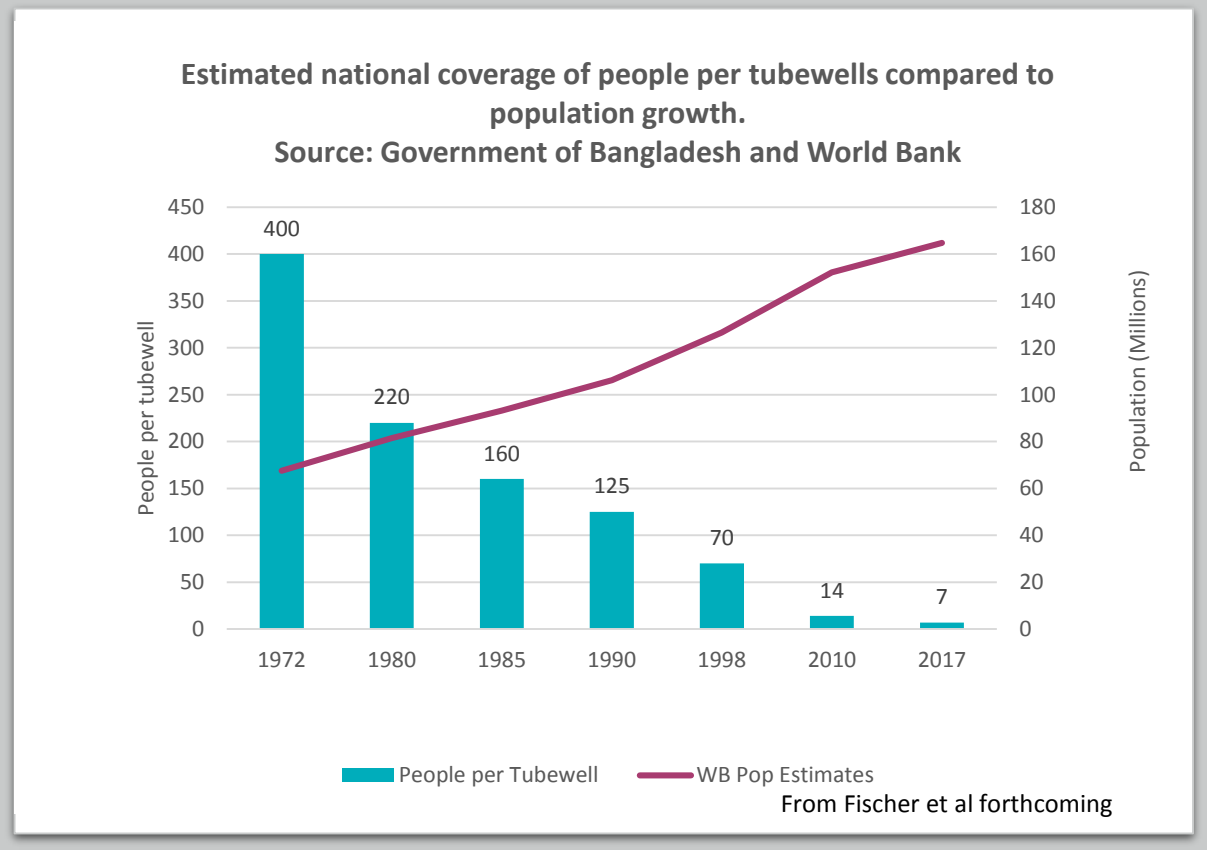

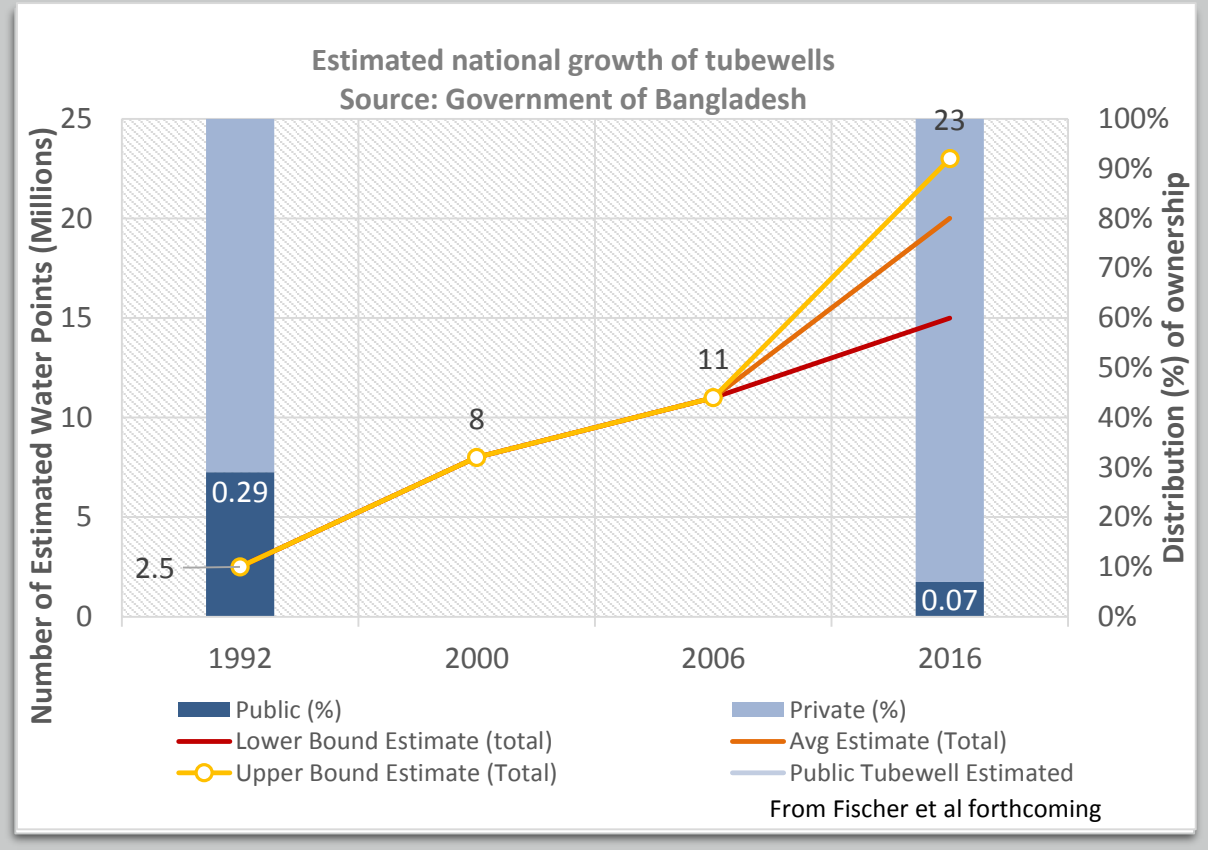

Growing rural sector dependence on groundwater

Limited data on handpump performance (functionality and reliability)

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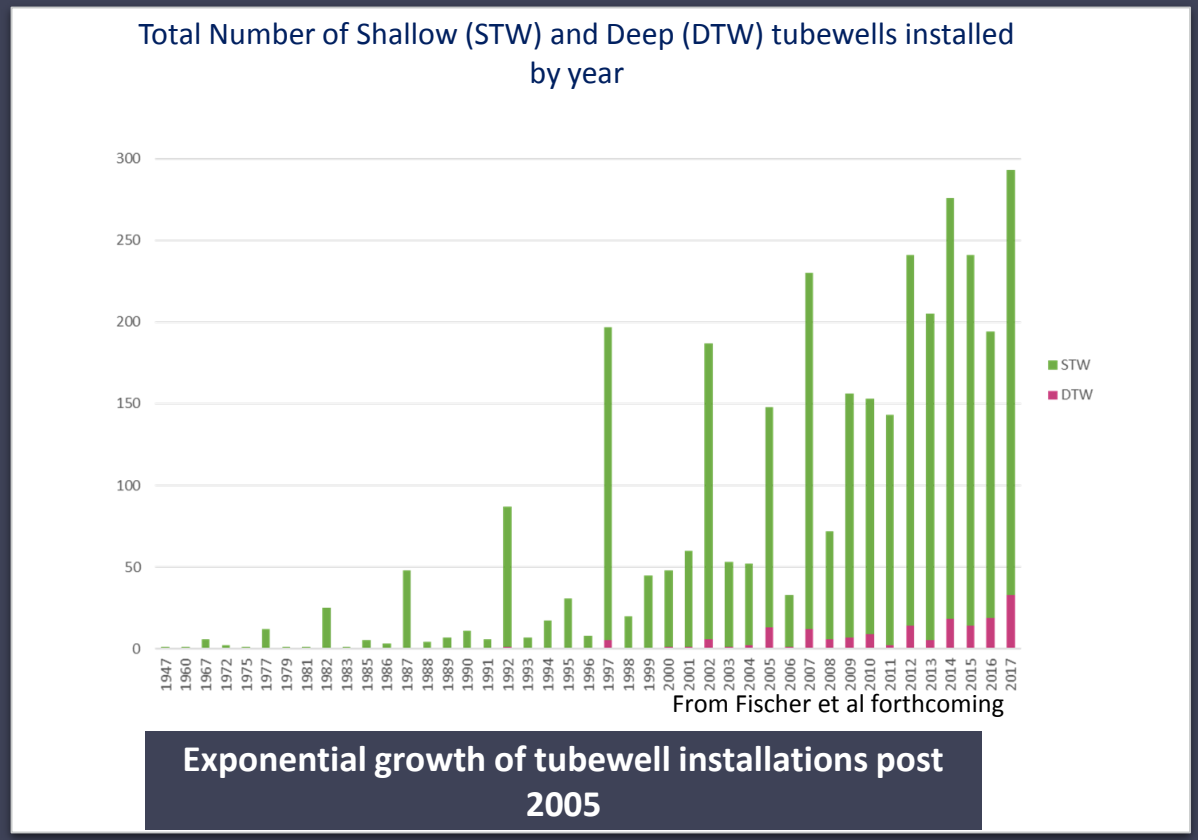
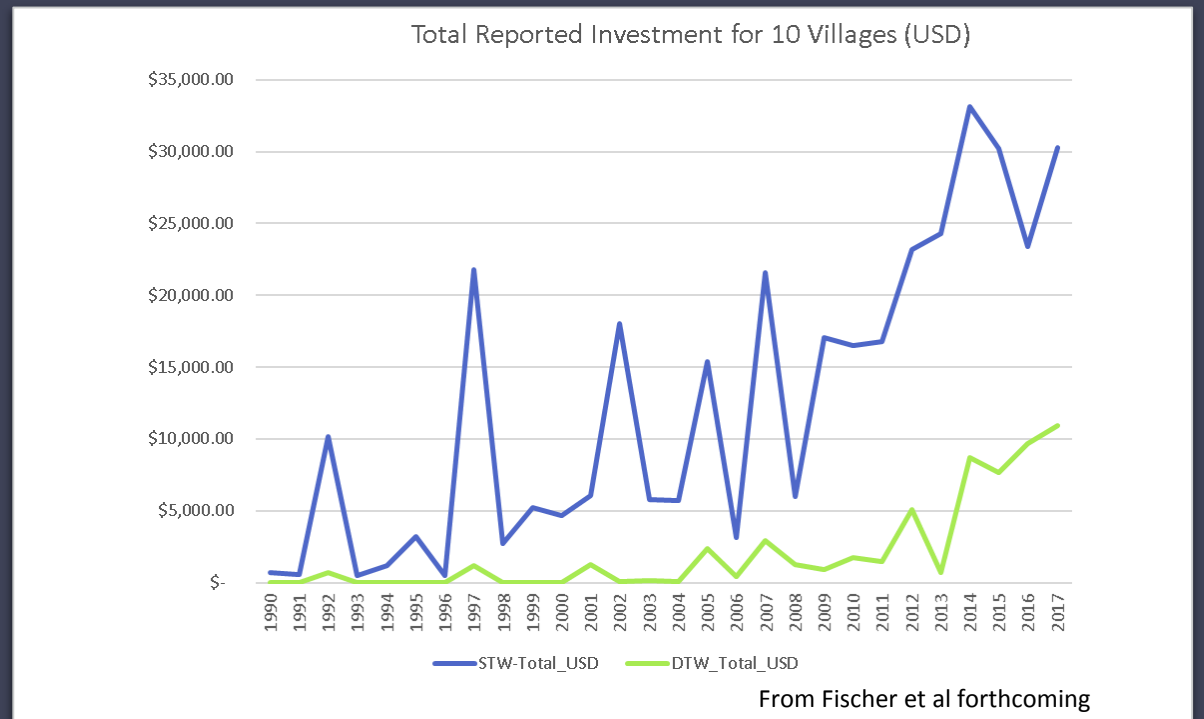


From Fischer et al forthcoming

Exponential growth of tubewell installations post 2005



From Fischer et al forthcoming

94% privately financed.
64% of TW are single users/individual households

Majority of handpump growth is privately financed

Source: 10 villages, 24,858 people and 3,831 tubewells from Matlab, Chandpur

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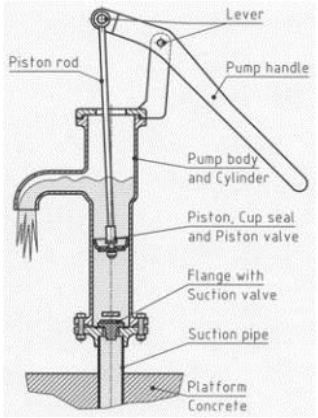
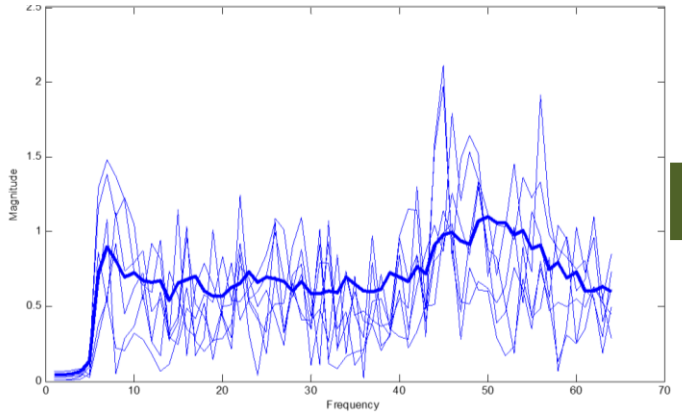
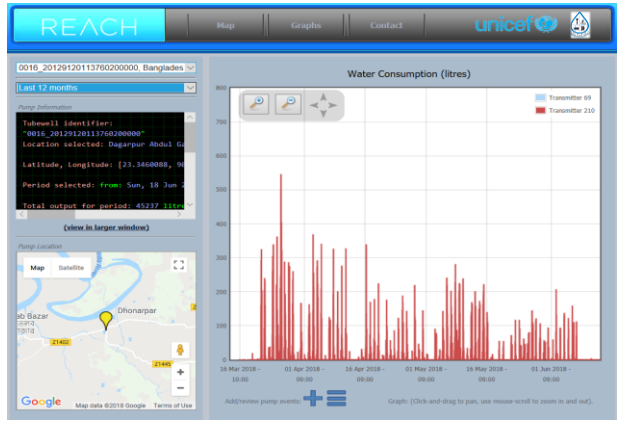
How can sensors support rural drinking water service models?

Accountability	Public investments and service delivery can be independently verified using performance data on functionality and reliability
Planning and Investment	User demand and investment can be quantified across a network to estimate future infrastructure needs
Sustainable Finance	New streams of funding (public and private) are de-risked through improved performance data

Data loggers
Monitoring of rural handpumps







How they works:

- Accelerometer measures handle movement and vibration.
- Machine learning interprets behavior and provides use estimates based on field calibrations.

Outputs

1. Use monitoring (temporal demand and flow estimates)
2. Condition monitoring (Observed and predicted)
3. Service accountability (repair, supply and reliability)

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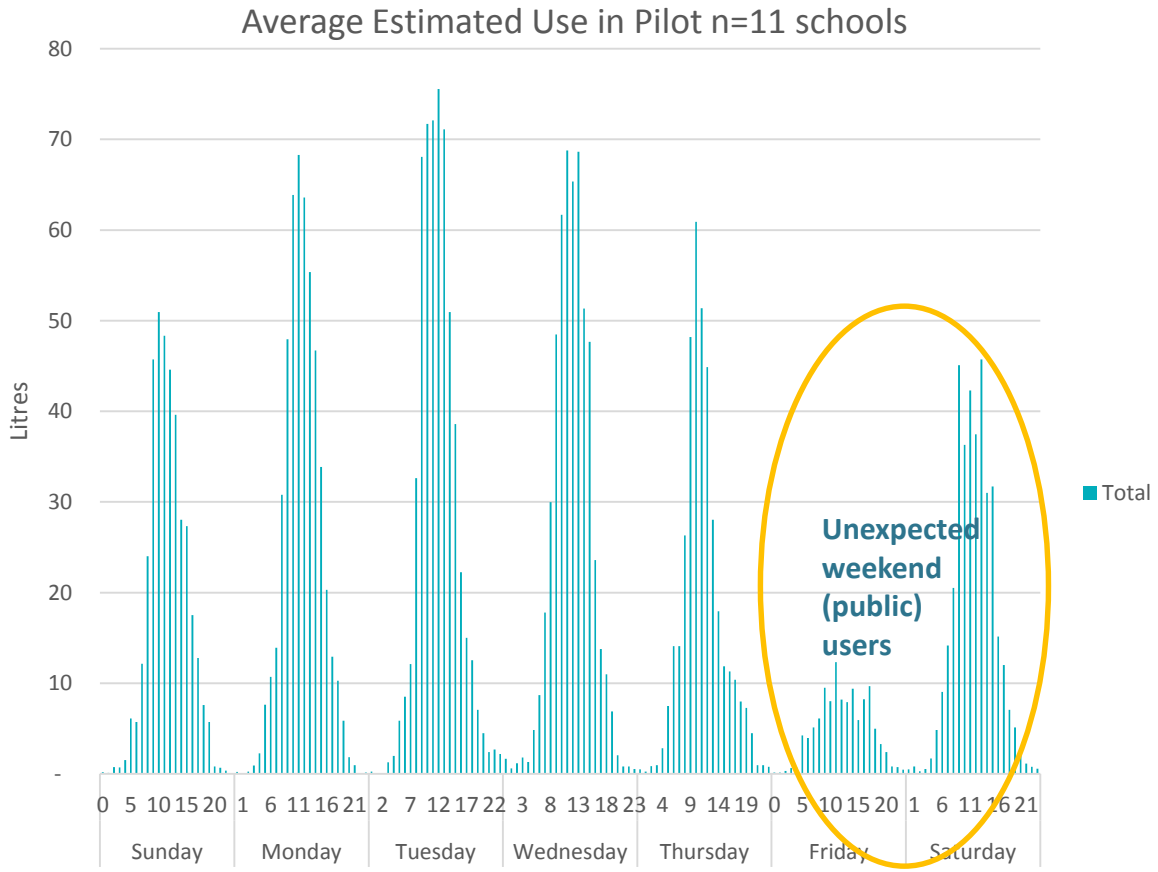
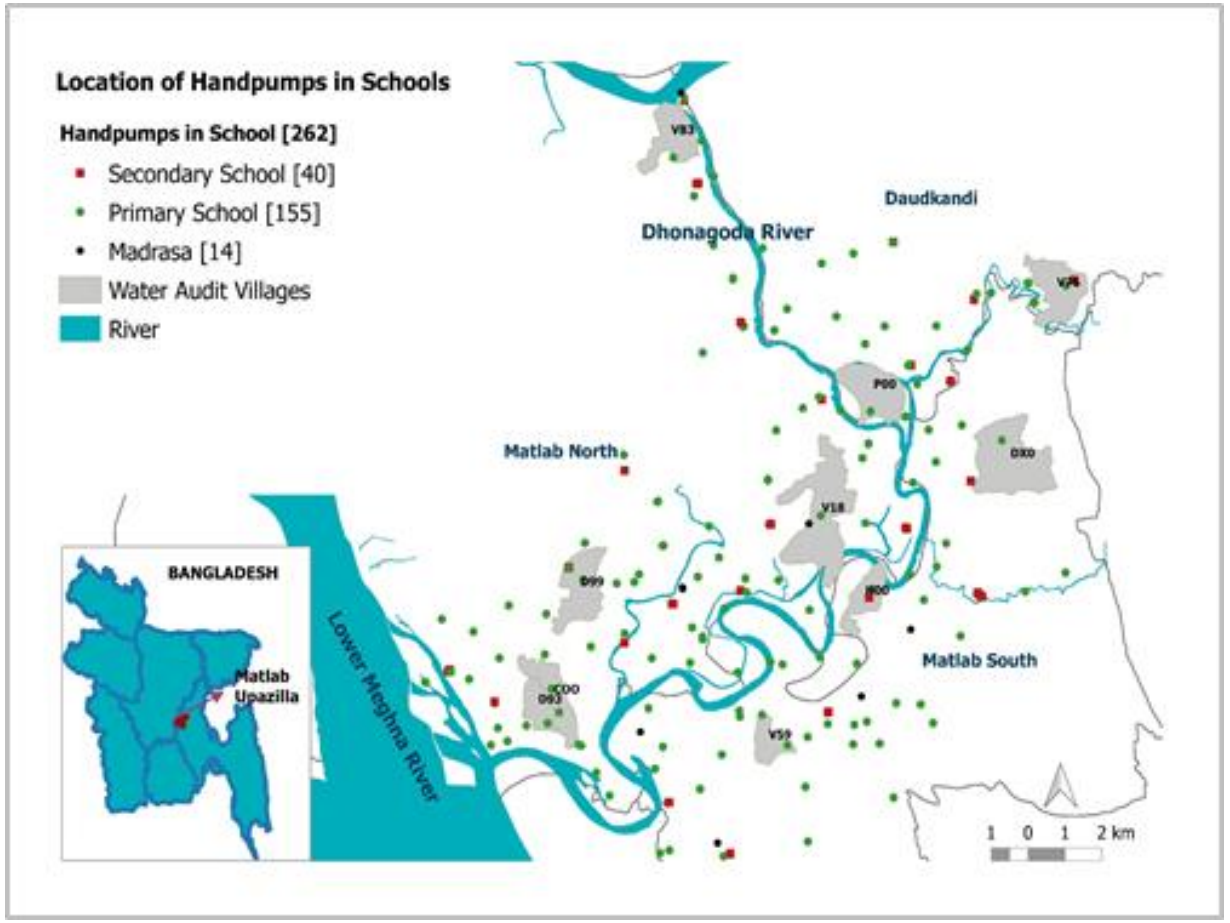
Estimating use patterns

Initial deployment for school facilities in Matlab, Bangladesh



From Fischer et al forthcoming



Estimate average peak daily use patterns
Identified public use of school water points on weekends and after hours
Initial deployment to cover ~250 schools by October 2018

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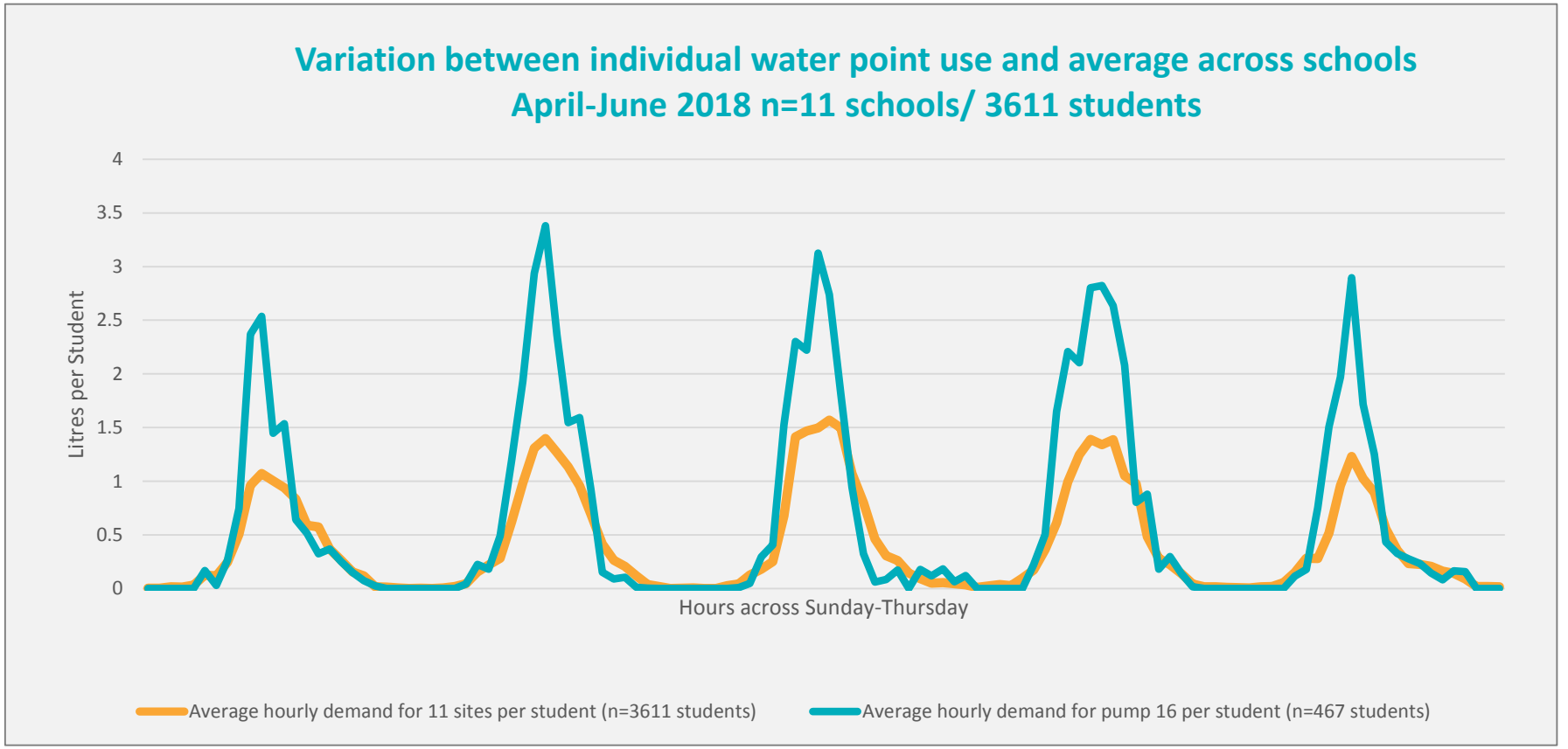
Estimating risk factors
Reliability and demand by water point



From Fischer et al forthcoming

Estimate hourly and daily demand patterns by user numbers
Link use patterns to water quality analysis (arsenic, microbiological, salinity, iron)
Observe declining demand later in week, possibly related to attendance

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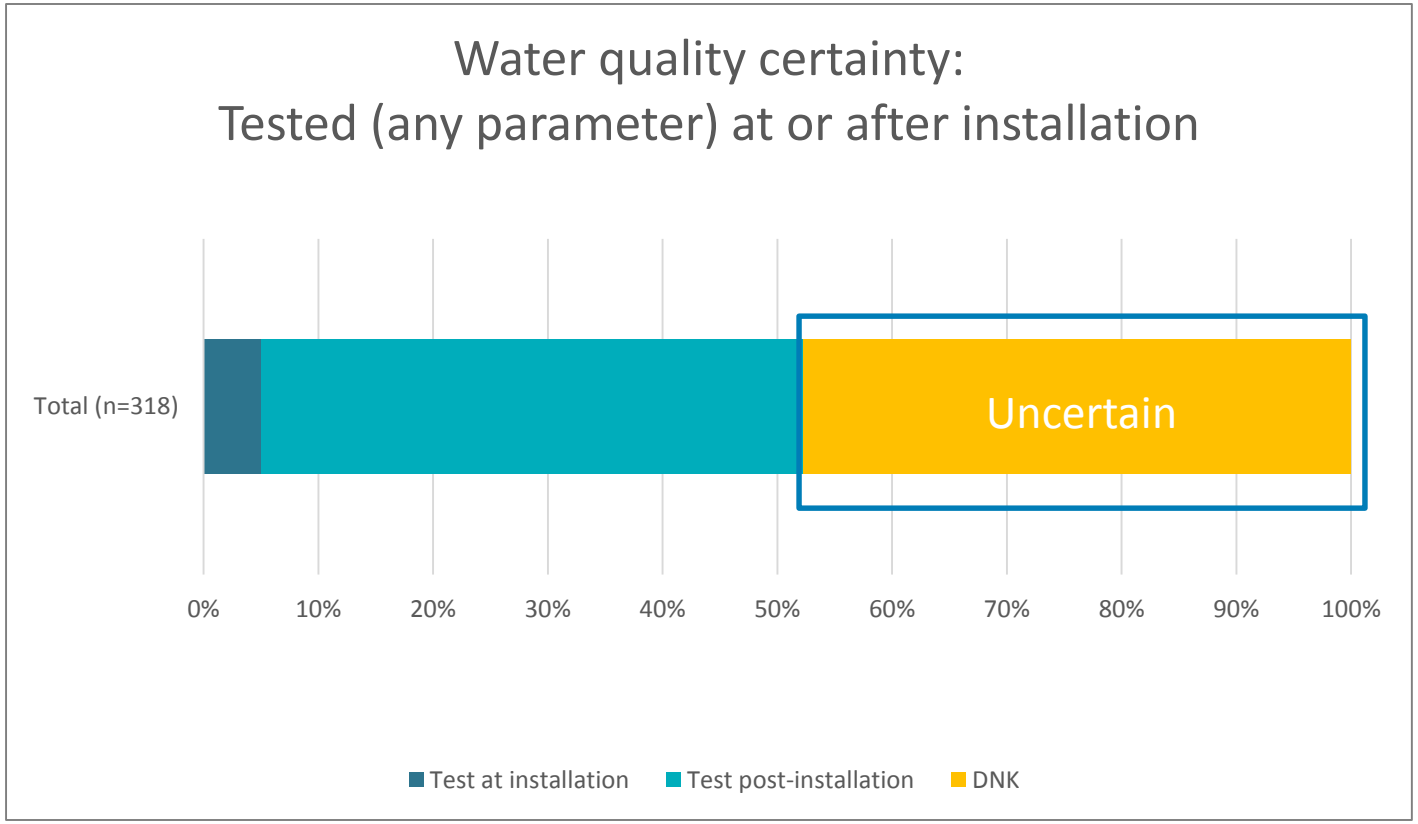
Addressing uncertainty
Safety and observed functionality



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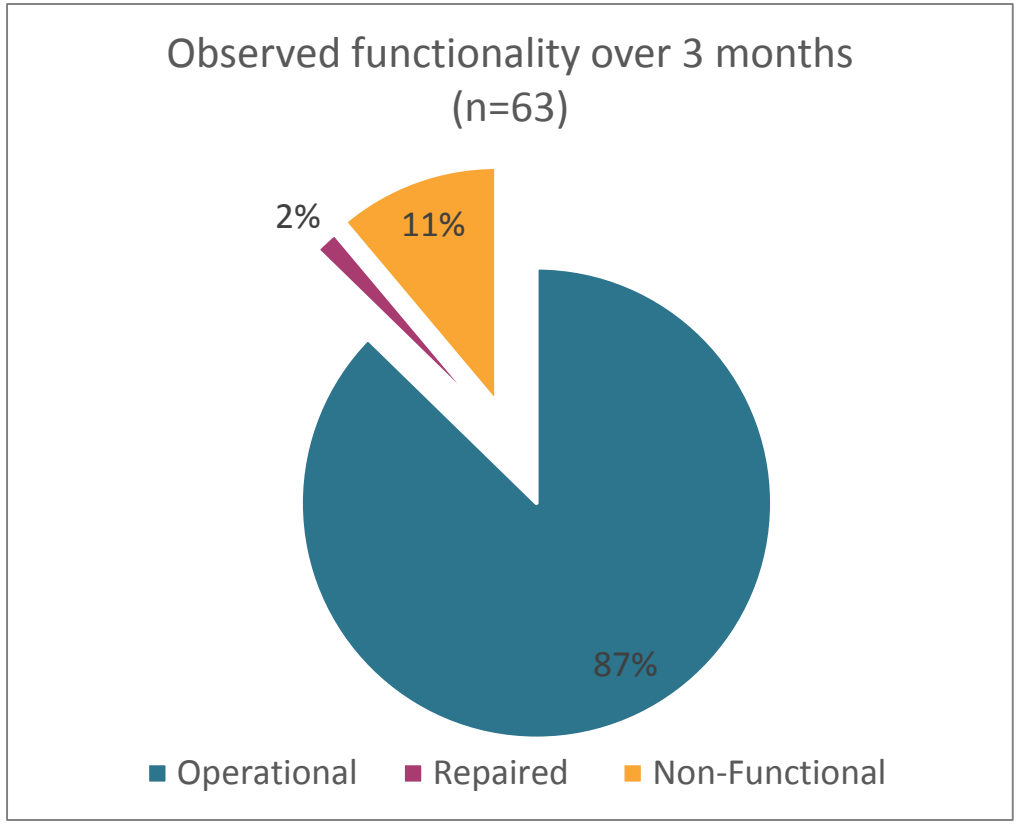

From Fischer et al forthcoming

Link water quality to use type (drinking/bathing/washing) and seasonal demand patterns
Quantify rate of non-function or deviation from average
Quantify repair and down-time and link to service provision

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Findings: Monitoring enables performance based rural service models

Technology relevant for other Asian rural systems dependent on handpumps

Data loggers in Kenya linked to local service entrepreneurs reduced handpump downtime from >30 days to <3 days.

REGULATED PROCUREMENT, INSTALLATION

SMART MONITORING OF FUNCTIONALITY, RELIABILITY AND WATER QUALITY

PERFORMANCE-BASED CONTRACTS AND BLENDED FINANCE

PROFESSIONAL MAINTENANCE SERVICE TO SCHOOLS AND MULTI-USER WATER POINTS

Components for service company

Model design components

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Improving water security for the poor

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