Research Brief

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Sustainable WASH Systems Learning Partnership

Factor Mapping to Understand Water Source Functionality in Kamuli District, Uganda

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Whave and University of Colorado Boulder

Between April and October 2018, Whave conducted five factor mapping workshops in Kamuli District, Uganda to learn about factors that affect the functionality of rural water services in the area. Factor mapping is a stakeholder-driven activity that seeks to create an understanding of local systems and system leverage points by sharing, challenging, and making explicit stakeholders' assumptions of how issues arise from a complex interaction of unique factors. During the activity, stakeholders describe the specific factors they believe influence the functionality of local water services and the interdependencies of those factors. In five separate workshops, Whave actively engaged 57 participants from the district government (15), sub-county government (12), water user committees (12), the Hand Pump Mechanics Association (9), and Whave staff (9), each representing a different perspective on the factors that influence reliable water service functionality in Kamuli District.

As part of the workshop, participants brainstormed a list of the most influential factors affecting water services and then ranked the factors in order of importance. The five groups collectively identified 63 factors they thought were important to sustain water services. Thirteen common factors (shown in Table 1) emerged, of which *Preventive Maintenance*, *Water User Committees*, *Water Source Bylaws*, and *mechanics* ranked the highest on average.[1] However, there were interesting differences in factor ranking across the groups. For example, while both the district government and Whave staff ranked *Spare Parts* high (first and second), the sub-county government ranked it seventh, and water users and the Hand Pump Mechanics Association ranked it last.

Using the lists developed by each group, Whave added the most influential factors to a cross-impact matrix as column

[1] Core factors discussed within the workshops are identified with proper names in italics in the report. E.g., *Coordination* vs. coordination (in general).

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and row headings, including the factor *Reliable Water Source Functionality*, which represented the outcome of interest (see Figure 1). Whave displayed these matrices on large sheets of paper at the front of the room for all participants to view throughout the activity. They then asked the group, "Based on current conditions, how does [factor A] influence [factor B]?"

If the group determined that a connection existed, they assigned a value ranging from 1 to 3 to represent the strength of the influence from the factor in the row to the factor in the column and recorded it in that cell. Over the next few hours, the group gave a score to the strength of each possible connection. This process of rating connections encouraged a lively conversation about how participants thought each part of the system was connected to the others.

Table 1. Ranking of Factors Affecting Water Services

Common Factor	Rank
Preventive Maintenance	1
Water User Committee	2
Mechanics	3
Water Source Bylaws	4
Spare Parts	5
Coordination	6
Role of Water Users	7
Supervision and Monitoring	8
Water User Attitudes	9
Water User Fees	10
Political Involvement and Government Support	11
Hygiene and Sanitation	12
Vandalism	13

At the end of the workshop, each group had a table with approximately 80 different connections. The participants could see how the ratings they assigned demonstrated the relative influence (how that factor affects other factors)

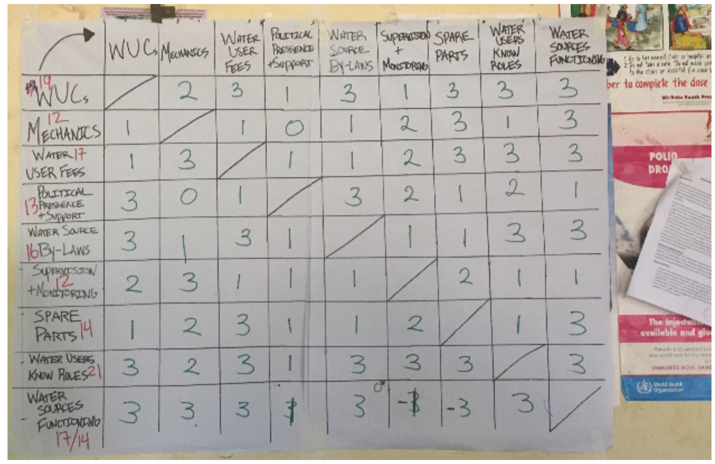

Figure 1. Example of a Cross-Impact Matrix

and dependence (how that factor is affected by the others) of each factor by adding up the values in the columns and the rows for each group's cross-impact matrix. Influence & Dependence scores give a systems-level analysis of factor importance and susceptibility to influence as a function of their interconnections. Interestingly, while the different groups mostly agreed on the factors, the interactions between factors varied significantly, as shown by the variance in the rank of factor influence scores for each stakeholder group. For example, stakeholders were likely to see the factors that they could influence as less dependent. Whave staff felt that *Spare Parts* was an easy factor to influence, which is something they can affect because they are a major buyer of spare parts. The differences surfaced by the groups highlights the importance of promoting a systems mindset among local stakeholders that assesses service delivery based on interactions between factors in the system and reveals the local understanding and context-specific nature of local systems.

After the workshops were complete, the University of Colorado Boulder performed additional analyses on the cross-impact matrix to gain a better understanding of how all the factors are connected. This analysis produced several insights that can help identify key leverage points to focus efforts to promote the functionality of water services. One such analysis, causal loop analysis, systematically evaluates how factors influence and then "feedback" on one another over time. Figure 2 presents a visual representation of a feedback loop on *Reliable Water Service Functionality* from the water user group's factor map.

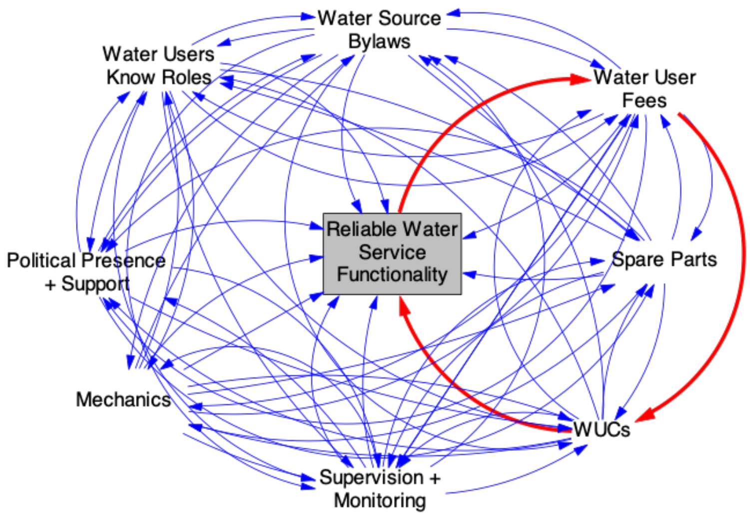

Figure 2. Factor Map from the Water Users Group (the example feedback loop is shown in red)

A key to understanding feedback loops is to read each sequence as a sentence. For example, the feedback loop highlighted in Figure 2 suggests that as more water user fees are collected, this will improve the operation of the water user committees, which will in turn improve the overall reliability of water service functionality, which would then motivate water users to pay their water user fees, and so on. Conversely, the loop can also be read such that if less water user fees are collected, this will diminish the work of the water user committees, which would then reduce overall water service functionality, and then potentially demotivate water users from paying their water user fees, and so on. Analysis of feedback loops within stakeholder-derived factor maps offers process-based insight into the potential dynamic drivers of a particular outcome within the local system, in this case reliable water service functionality.

As part of the workshops, Whave asked participants to rate the value of the activity and the actions they or their organizations may take as a result of learning more about the interconnections of factors within their local system. Overall, the participants shared positive feedback about the workshop with 100 percent indicating the meeting was valuable and improved their understanding of factors that support the sustainability of water services. One participant expressed the intent to take the activity to another group of government officials in a local sub-county. In another meeting, a resident district commissioner encouraged the participants to engage communities in a similar exercise to help them explore solutions to their issues with water service functionality. This shows significant interest in the activity and the potential of factor mapping workshops to quickly build participants' understandings of the complex nature of sustaining water services and encourage them to develop a systems thinking mindset.

About the Sustainable WASH Systems Learning Partnership: The Sustainable WASH Systems Learning Partnership is a global United States Agency for International Development (USAID) cooperative agreement to identify locally-driven solutions to the challenge of developing robust local systems capable of sustaining water, sanitation, and hygiene (WASH) service delivery.

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For more information, visit www.globalwaters.org/SWS, or contact Daniel Hollander (Daniel.Hollander@colorado.edu) or Elizabeth Jordan (EJordan@usaid.gov).

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