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Moving Toward Prevention: Rural Water Maintenance and Sustained Service Delivery

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All systems go!

Moving toward prevention: rural water maintenance and sustained service delivery

Paper for the WASH systems symposium

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50 years of IRC.
WASH systems that transform lives.

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The Sustainable WASH Systems Learning Partnership (SWS) recognises the need to shift global focus toward water and sanitation services maintenance as integral to sustainable infrastructure expansion. SDG6 highlights the importance of sustainable safe water service delivery to low and middle-income communities. Regular and preventative maintenance can help achieve this goal. Maintenance approaches for long-term rural water service delivery span many contexts, but there has been little coordinated effort to more holistically understand these approaches. Improved understanding will ideally strengthen both the approaches and the WASH sector systems which encompass them, leading toward improved service delivery. This paper outlines a research plan to be conducted across the SWS consortium to learn from maintenance approaches both internal and external to the partnership. It follows a study commissioned by IRC WASH and SWS which gathered information on prominent existing approaches from key informants. The study developed a taxonomy of maintenance approaches and a context driven framework for each. Our research will build upon this study, applying a systems lens to understand important dynamics and interactions. We will map and analyse these approaches using systems dynamics tools and best practices that take in to account each model's factors, actors and interconnections. Analysis tools include purposive text analysis, causal loop diagrams, stock and flow diagrams, and political economy analysis. Overall, we seek to analyze each model's integration with the broader WASH sector and contribute increased knowledge and recommendations on successful approaches to sustaining rural water service delivery.

Introduction – Rural Water Maintenance Research

Problem statement

Increased water supply coverage rates in low and middle-income communities have been met with high non-functionality rates (Tsimpo and Wodon, 2018; Etongo, Fagan, Kabonesa, and Asaba B., 2018). Decades of infrastructure expansion with limited prioritisation of long-term sustainability has resulted in an epidemic of broken or unreliable water supply systems across these communities. There has been little effort and attention dedicated to ensuring maintenance services are provided for water delivery infrastructure which mostly comprise hand pumps and piped water systems. Regular pre-emptive maintenance is rarely provided, increasing system failure rates and repair and maintenance costs. Non-functioning water points often cause consumers to seek alternative unsafe water sources and reduce their likelihood to pay for safe water service provision.

Throughout the international water, sanitation, and hygiene (WASH) sector, various models are being developed and implemented to address this maintenance issue (USAID Sustainable WASH Systems Learning Partnership, n.d.). These models seek to employ preventative techniques to avoid breakdown, akin to how most car owners engage in routine maintenance to avoid the large costs of ultimate breakdown. Although these maintenance models are becoming more prevalent, limited knowledge has been generated and disseminated about how they fit and function within the local context. Indeed, each maintenance model is unique, driven and influenced by a diverse array of stakeholders (actors), factors, and interactions which form a complex WASH system that drives daily operations. The system is composed of various sub-systems, including the local political context, regulatory environment, social customs and norms, local institutional systems, and many others. Thus, an improved understanding of the broader complex WASH system and its interactions with each maintenance model will not only help us learn how these models can be scaled and applied in new contexts, but also how to strengthen the overarching system towards the goal of sustainable water service provision.

Maintenance Approaches within the Sustainable WASH Systems Learning Partnership

This research is being conducted as part of the U.S. Agency for International Development (USAID) Sustainable WASH Systems Learning Partnership (SWS), a partnership which seeks to apply, research and learn about promising systems-based approaches to improve the sustainability of WASH services in low and middle-income communities (USAID, n.d.). On a cross-consortium level, we are interested in increasing understanding and learning in the realm of water system maintenance, resulting in the development of this research plan. Several organisations within SWS employ maintenance approaches for improved water service delivery: Whave, IRC, and the University of Oxford.

Whave is a Ugandan non-profit organisation that partners communities to provide access to sustained water services.

Communities sign contracts and pay a small annual fee and in return receive regular preventative maintenance services to keep water flowing (Whave, n.d.). Regarding rural water services in Uganda, IRC works with a network of people in western Uganda, such as the government-established Hand Pump Mechanics Associations, to improve maintenance services and engage community members in the sustainability of their water services (Watsisi, 2017). Oxford, working in partnership with UNICEF Kenya and Rural Focus Ltd., is supporting a risk management-based approach to water service delivery through maintenance services, supporting institutional development in and learning at the county-level in Kenya (University of Oxford, REACH, and UNICEF, n.d.). Our cross-consortium research and learning will seek to map and analyse the maintenance approaches of these partners on both a localised and a holistic level, filling the gaps of existing knowledge on how these models integrate within local institutional, economic, social, and political systems.

Research Plan: Systems Mapping and Analysis of Water Maintenance Models

Overview

We seek to improve sector-wide understanding on maintenance models and influence efforts to strengthen the local systems that surround them. For the purpose of this research, maintenance models are defined broadly as 'a formalised process designed to conduct routine preventative and corrective maintenance on water service delivery systems with the desired outcome of long-term water service delivery.' The maintenance models in question involve many components that include combinations of preventative maintenance, corrective maintenance, and/or rehabilitation.

Our research closely follows a study commissioned by IRC and SWS on maintenance models used for water service delivery in the international WASH sector1. This study sought to research, review and describe existing models; develop a taxonomy of maintenance models; develop a framework for high-level analysis of these models, and apply this framework to a limited number of examples (Lockwood, 2018). Our research will build upon this study, further examining these models through a systems lens to understand the dynamics and interactions driving them.

Our research plan is divided into two stages: 1) systems mapping of maintenance models; and 2) systems analysis of maintenance models. Stage 1 will be the focus of this paper. We now detail the research questions formulated for each stage.

Research Questions

Our formulated research questions seek to highlight the importance of interactions between relevant actors and important factors within the specific context in which each maintenance model is employed.

Stage 1

We will address two primary components, i) the genesis of each maintenance model and ii) the interactions within the model that drive success or failure. Specifically, questions include:

1. What maintenance models are being used by different organisations? Why and how did these models emerge? In particular, who drove the process, and how were they conceived, funded and established?
2. How do the factors within each maintenance model interact to influence successful and sustainable service delivery? (feedback loops, reinforcing behaviours or mechanisms etc.)
3. How do actors within each maintenance model interact with each other to influence the desired outcome of safe and sustained water service delivery?
4. How does factor and actor interaction compare across contexts for maintenance models? What are the major implications of these mapped interactions for the planning and management of safe and sustained service delivery?

Stage 2

The second stage of this research will leverage the findings from Stage 1 to identify opportunities for continued analysis. From a systems lens, Stage 2 will evaluate how each model uniquely intervenes within each local system, and the associated implications this might have on the outcome of sustained service delivery. Improved understanding from Stage 1 of the actors influencing each maintenance model will influence not only the analysis conducted in Stage 2, but also recommendations made regarding actions to be taken by specific actors within each contextual WASH system. Potential research questions for the second stage of the research include the following.

1. How do the models address the factors identified as important to their operation, for example, financing (finance flows, who is paying for what and why) or regulation/oversight/accountability mechanisms, and improvements in service delivery (e.g. functionality rates)?
2. With our understanding derived from the systems mapping and analysis of these maintenance models, where are the most common programmatic weaknesses and how might we improve them going forward?

Research Methods

Qualitative data has the potential to provide rich information relevant for modelling complex systems. From qualitative text data, important causal linkages can be inferred to map the various factors and interactions that drive the system's daily operations, providing helpful information regarding cause and effect relationships that might not have been noticed in the data at first glance. Causal loop diagrams (CLDs) that visually and analytically describe the relationships between these factors can then be created to not only provide insight to the interworking of each model and the overarching WASH system, but also the continued analysis for how shifts in this system might drive outcomes (Kim and Andersen, 2012). Following the creation of CLDs, continued analysis can break out the identified factors and causal loops to better understand what drives a given maintenance model's success or failure to accomplish the stated goal of sustainable water service delivery.

For the first stage of this research, we will use purposive text analysis, a qualitative analysis technique from the field of system dynamics, to develop CLDs that represent the local sub-systems that make up each model's context. Purposive text data will be used from interviews with key stakeholders representing each maintenance model. Following qualitative coding of these interviews, purposive text analysis allows us to pull important themes, descriptive details and causal pathways from the responses of those who most closely interact with these maintenance models on a continuous basis. CLDs can then be drawn, creating a causal map of the system identifying key variables, important causal links, and leverage points (Kim and Andersen, 2012). The second stage of this research will involve further analysis into rural water maintenance models based on the findings of the systems mapping stage.

We will use data collected from a later stage of the aforementioned IRC/SWS study, which involved in-depth data collection on a select number of maintenance models, both within and external to the SWS consortium, to assess the contextual WASH system in which each model was developed and to determine how each programme has evolved over time. Most of this data was collected through interviews with relevant stakeholders for each maintenance model. Where possible, these interviews were recorded and transcribed, preserving verbal statements in their original form to minimise bias in the research and create causal maps from the rawest form of the data possible. Where recording of the interviews was not possible, detailed and comprehensive notes were taken during each interview. Several targeted interview questions regarding factors, actors, and the interactions between them were included in this data collection process to inform the first stage of this research. The questions included:

1. Who are the stakeholders responsible for long-term safe water service delivery within your model, and how do these stakeholders work together or with others?
2. In your opinion, what are the things necessary to ensure the sustainability of your service delivery model, and how do you believe these things will lead to sustainability?
    a. Additionally, what political, economic and/or societal factors influence your model on a regular basis? (local politics, national politics, election cycles, rainy/dry season changes)

What's next? Conclusion and Next Steps

As maintenance models for water service provision continue to emerge and grow within the global WASH sector, it is important to increase knowledge on successful approaches for sustainable water service delivery. By systematically mapping, analysing and improving understanding of these maintenance models on an individual and cross-case basis, we will offer systems-based recommendations to strengthen maintenance models. The systems mapping portion addresses the 'why' and 'how' components behind each maintenance model's emergence in the WASH sector and the process through which it engages in the local system. It also seeks to identify the key relationships and interactions within each model driving its daily process and long-term ability to provide water services, looking at both factors and actors that are important to the model.

Following the systems mapping portion of our research, our next step is to formalise the analysis processes for the second stage, using our findings regarding significant drivers and interactions within each model. For the systems analysis portion of this research, we will seek to understand the ways that maintenance models address the factors, actors and interactions identified during the first stage of this research. The analysis will include the Whave and Fundifix models at a minimum, and may include others depending on availability of data. Potential methods of analysis may include financial modelling through stock-and-flow diagrams, including a sensitivity analysis based on tariff structures and water user fees, and Political Economy Analysis (PEA) for examining the political, regulatory and power mechanisms affecting each model. PEA is often employed in international development to understand the drivers behind political behaviour within

systems of interest. It provides insight into the interests and incentives of the actors relevant to each system and how these relate to specific outcomes/actions, and the effects of political, social and cultural norms and institutions on specific projects (DFID, 2009).

In the future, we will identify common gaps based on the research and analysis, informing recommendations and improving understanding on a better way forward for rural water maintenance. Water maintenance models hold potential for impacting the sustainability of water service delivery, warranting the importance of this research and its subsequent recommendations and conclusions.

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. This report is made possible by the generous support of the American people through USAID under the terms of the Cooperative Agreement AID-OAA-A-16-00075. The contents are the responsibility of the Sustainable WASH Systems Learning Partnership and do not necessarily reflect the views of USAID or the United States Government. For more information, visit www.globalwaters.org/SWS, or contact Elizabeth Jordan (EJordan@usaid.gov).

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Note/s

1The study is being carried out by SWS partners in consultation with Harold Lockwood of Aguaconsult, UK.

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