





## RESEARCH ARTICLE

# Institutional influences on local government support for professionalized maintenance of water supply infrastructure in rural Uganda: A qualitative analysis

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**Data Availability Statement:** Only qualitative data was used for this study. All data analyzed, with the exception of publicly available policy documents, was in the form of transcripts from semi-structured interviews. Excerpts from the interview transcripts are provided within the manuscript and summaries of the data's contents relevant to the study are provided in supporting information tables. In accordance with the approved protocol #19-0605 by the University of Colorado Boulder Institutional Review Board and to minimize risks to

## Abstract

Professionalized maintenance arrangements are emerging and growing to improve rural water service sustainability across sub-Saharan Africa, where local governments often act as rural service authorities. Uganda's Ministry of Water and Environment released a novel policy in 2019 to promote professionalization, outlining requirements of local governments to support professionalized maintenance under a new framework for rural water service delivery. We identify how responsibilities of local government actors shifted under this policy and then use Organizational Institutional Theory to explore how the institutional environment—composed of regulative, normative, and cultural-cognitive pillars—influences these actors' fulfillment of assigned functions under the new policy and support of professionalized maintenance arrangements. To do this, we collected, transcribed, and qualitatively coded data from semi-structured interviews with 93 Ugandan local government actors at all hierarchical levels across 22 sub-counties in three Ugandan districts. Due to infrequent references by interviewees to regulative influences on action such as formal rules and policies, we propose that the new policy alone is unlikely to motivate essential local government support. Allocated responsibilities must align with widely-cited normative and cultural-cognitive influences, including relationship expectations, typical processes and routines, political dynamics, notions of identity, perceived self-efficacy, and cultural beliefs. We recommend leveraging existing institutional influences where possible to motivate actions aligned with the policy. For example, local government actors can fulfill community expectations of them to solve prolonged nonfunctionality by connecting communities to professionalized maintenance service providers instead of performing individual out-of-pocket repairs. Improving understanding of local service authority perspectives is essential as professionalized maintenance arrangements emerge and grow and as new policies expand and shift essential support functions.

our participants, raw data from this study in the form of interview transcripts may not be made publicly available for any purpose. Additionally, participants were informed that raw data would not be made publicly available as part of the approved verbal consent process. To ensure privacy and confidentiality and minimize risks to participants, no individuals who were part of this study may be enabled to access information regarding the other participants or the data they provided. Thus, all metadata provided in supporting information tables is completely de-identified and grouped only according to position classifications of “technical” or “political,” as defined in the “Methods” section of the manuscript.

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**Competing interests:** AJW is an Academic Editor for PLOS Water. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. For the sake of transparency, the authors acknowledge that two authors, Adam Harvey and Elizabeth Buhungiro, are employed by a professionalized maintenance service provider operating in the three districts where the study was conducted in Uganda, Whave Solutions.

## Introduction

### Background and motivation

Decades of infrastructure expansion alongside irregular and inadequate maintenance have resulted in unreliable water supply systems in low- and middle-income countries [1, 2]. Evidence suggests that at least 30% of groundwater-based supplies in sub-Saharan Africa are non-functional within the first few years of construction [3], and literature has uncovered inequalities between rural and urban areas on access to improved water, sanitation, and hygiene [4]. In the Sustainable Development Goal (SDG) era, sustainably maintaining existing infrastructure is imperative to achieving SDG 6, “availability and sustainable management of drinking water and sanitation for all” [5]. For the last several decades, informal and unsystematic maintenance of rural water infrastructure in sub-Saharan Africa has been the norm. For example, the community-based management approach (CBM) has allocated crucial maintenance functions to rural communities and been supported in national policies, but multiple studies have uncovered inadequate CBM implementation and associated it with continued high nonfunctionality rates [3, 6–12].

Literature on the failures of CBM is well summarized by van den Broek & Brown [6] and Whaley & Cleaver [11], who posit that alternative approaches to maintaining rural water infrastructure in low-income contexts have not been adequately pursued and explored. Van den Broek & Brown [6] assert that simple reforms will not address the core failings that prevent CBM from improving infrastructure reliability; their findings show no evidence that communities want full citizen control of their infrastructure. Similarly, Whaley & Cleaver’s exhaustive review of literature on the relationship between CBM and nonfunctionality [11] calls for an improved understanding of rural water governance beyond the community level.

New approaches are emerging within the global water, sanitation, and hygiene (WASH) sector which seek to professionalize the maintenance of rural water infrastructure [13–15]. Ideally, professionalized maintenance approaches achieve pre-determined service outcomes through a system in which service providers are legally appointed and regulated by service authorities to perform preventive maintenance and repairs [16, 17]. Professionalized approaches are increasingly recognized for their importance in improving rural water service sustainability [14, 18–20]. Specifically, professionalized maintenance providers hold significant potential to cater to the needs of diverse rural water point management cultures that already exist across sub-Saharan Africa as professionalization becomes more common [21].

Given the prevalence of decentralization in sub-Saharan Africa and specifically Uganda over the last several decades [22, 23], local government actors often act as service authorities in the region. Expectations and requirements for their engagement in service delivery for rural communities will likely continue to increase as methods of service delivery change [21]. Thus, local government support for professionalized maintenance arrangements is imperative to their success. For example, support functions may include service monitoring and regulation of private service providers where no independent regulator exists [24]. By better understanding influences on local government actors’ abilities to fulfill support functions, it is possible to identify constraining factors to mitigate and motivating factors to leverage to enable local government support for professionalized maintenance arrangements and help them achieve improved service outcomes.

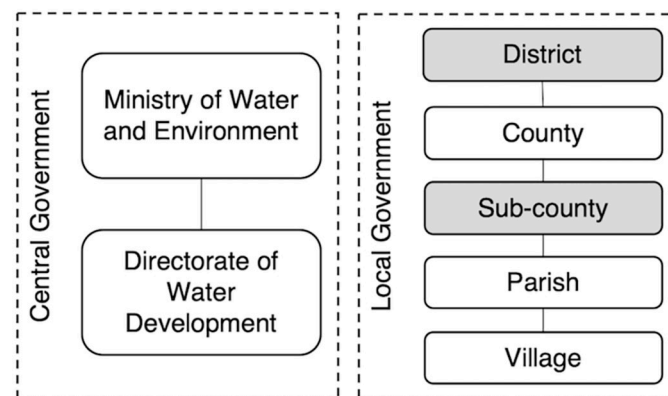
### Context and study aims

Relevant literature from Uganda and across sub-Saharan Africa highlight a lack of local government strength and capacity to support public service delivery and find that local

government capacity improvement is necessary to realize rural water service improvements [25–27]. Local government actors must not only understand their roles and responsibilities, but also feel enabled to fulfill them [17, 28]. Despite calls for a paradigm shift enabling professionalized maintenance arrangements in sub-Saharan Africa [29], which depends on local governments acting as service authorities in many decentralized contexts [16, 30], the perspectives of local government actors regarding their roles and responsibilities are underrepresented in the literature.

In 2019, Uganda released a new National Framework for the Operation and Maintenance of Rural Water Supplies (new O&M framework) to address the recognized failures of inadequately supported CBM [31]. Under the new O&M framework, the service authorities (local governments) formally outsource professionalized maintenance responsibilities by contracting Area Service Providers (ASPs), dedicated entities that operate and maintain all water supply infrastructure in a service area defined by the authority. Under the current framework, ASPs may be NGOs, private companies, existing public and semipublic entities, or other entities with the required expertise. The new O&M framework specifically assigns new and expands existing support roles to local governments in line with their service authority mandates. In Uganda, the district and sub-county tiers of the local government structure hold primary responsibility under the new O&M framework (Fig 1). However, given evidence of existing rural water policy and practice discrepancies in Uganda and elsewhere [32–35], and the novelty of these responsibilities in Uganda’s rural water provision context, the new O&M framework alone may not motivate local government support. As professionalized maintenance arrangements depart from CBM, a deeper understanding of how these arrangements align or misalign with existing systems of influence is necessary to motivate support that will result in sustainably improved service outcomes [11].

Roles and responsibilities are the result of continuous decisions made and actions taken by relevant actors, and it is important to understand their driving influences, many of which may extend beyond the influence of a policy or formal mandate. For example, previous studies have examined the ways in which typical roles have emerged as a result of development partner relationships [36] and historical spatial and political development patterns [37]. A recent study from India found that local government actions were specifically dominated by political incentives, corruption, and social relationships and posited that developing new plans, strategies, and policies may not translate to rural water security improvements [38]. Beyond policy



**Fig 1. Structure of Ugandan government hierarchy relevant to rural water service provision, highlighting the local government levels where administrative and technical resources are concentrated.**

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development, literature has shown that failure to recognize social norms during policy implementation results in inadequate fulfillment of allocated roles and responsibilities [39]. As well, acknowledgements and perceptions of newly-allocated responsibilities may vary across local contexts [40]. It is recognized that geographic inequalities in improved water supply coverage exist at local levels beyond the rural/urban divide [41], but there is a dearth of research investigating the potential of new policies within local contexts to motivate actions with potential to improve sustainable water supply in rural areas.

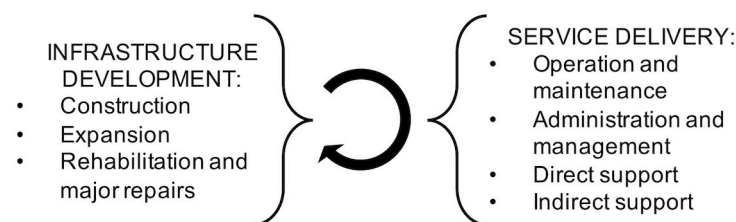
It is timely to examine how local institutional environments, defined in this study as social frameworks that guide action within a local context, influence essential local government support responsibilities. We examine shifts in local government roles and responsibilities under Uganda's new O&M framework and identify likely influences on their fulfillment. To identify and characterize influences, we examine Uganda's rural water institutional environment across three districts through the lens of Organizational Institutional Theory, which defines institutions as social systems of "cultural-cognitive, normative, and regulative elements that, together with associated activities and resources, provide stability and meaning to social life" [42]. We apply this theoretical lens to analyze responses from semi-structured interviews with 93 local government actors to identify constraints and motivations that guide their actions and perspectives of responsibilities allocated to them. We ask the following questions:

1. How does the institutional environment influence local government support for professionalized maintenance of rural water infrastructure in Uganda?
2. What implications do these influences have for the realization of Uganda's new policy and the future of professionalized maintenance?

This study is among the first to explore a new policy's potential to enable local government support for professionalized maintenance arrangements in low-income contexts. Doing so allowed us to identify constraints that need to be addressed to motivate local government support and institutional influences to leverage to improve the implementation of Uganda's new O&M framework and motivate compliance.

## Theoretical overview

**Roles and responsibilities for rural water provision.** The provision of rural water services, of which maintenance is an integral part, can be characterized as an indefinite series of life cycle stages; categories of roles and responsibilities for rural water service provision in low- and middle-income contexts (Fig 2) are conceptualized based on previous studies and reports [17, 18, 43]. We conceptualize these responsibilities based on a life cycle perspective, accounting for the holistic impacts of project cycles and connections between the various stages of infrastructure life [44, 45].



**Fig 2. Rural water services cycle and associated categories of roles and responsibilities.**

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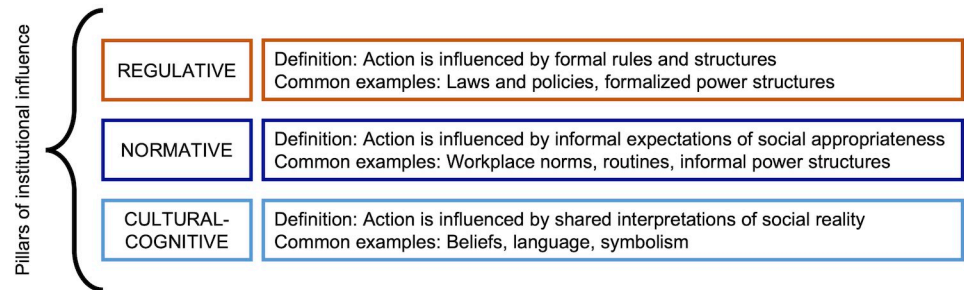
This cycle is characterized by two stages: infrastructure development and service delivery. Infrastructure development consists of capital-intensive and discrete activities, including infrastructure construction, expansion, and rehabilitation and major repairs. Rural water infrastructure, often a hand pump on a borehole in sub-Saharan Africa, is first constructed by a variety of actors, including governments, donors, and donor-funded implementers such as NGOs, private companies, and individuals within communities themselves. After construction, various roles and responsibilities are fulfilled during the service delivery stage of the cycle, until the infrastructure falls into complete disrepair, is decommissioned, or is abandoned completely. At this stage the cycle continues back to the infrastructure development stage where rehabilitations and major repairs restore and/or improve the infrastructure, including expansions to reach larger populations. Importantly, with increased focus on service delivery, needs for infrastructure development and associated capital expenditure reduce.

Service delivery is the stage most often neglected for public infrastructure [43], often resulting in poor infrastructure performance and high rates of infrastructure breakdown in low- and middle-income contexts [2, 17, 46, 47]. Service delivery includes the long-term steps to maintain infrastructure functionality at the desired level until the next system expansion or upgrade occurs, including operation and maintenance, administration, management, and the support required for key actors to fulfill their designated responsibilities, including both indirect and direct support functions. Direct support for service delivery is the structured set of tasks associated with the service itself; these tasks largely help service providers fulfill their required functions [48]. Specific tasks include technical advice, administrative support, organizational support, capacity building, training and performance monitoring, among others. Indirect support is the set of tasks which contribute to sector capacity overall, rather than applying specifically to a discrete program or project [49]. These tasks include the formation and passage of policies and strategies, sector-level planning, sector-level monitoring, and regulation. We structure our analysis based on this conceptual framework to identify shifts in local government requirements for, and institutional influences on: (1) infrastructure development support tasks, falling under categories of construction, expansion, and rehabilitation and major repairs; and (2) service delivery support functions, falling under categories of operation and maintenance, administration and management, direct support, and indirect support.

**Identifying constraints on action: Organizational Institutional Theory.** Literature highlights the importance of examining organizational culture and the broader political and social contexts in which projects are implemented to improve the success of development interventions [50]. We examine influences on the decisions and actions of local government actors through the lens of Organizational Institutional Theory, which allows us to examine the “formal and informal rules, monitoring and enforcement mechanisms, and systems of meaning that define the context within which people and organizations interact” [51].

Institutional environments guide action through regulative, normative, and cultural-cognitive pillars [52] (Fig 3). The regulative pillar of the institutional environment motivates or hinders action to avoid formal sanctions for non-compliance with formal rules; Uganda’s new O&M framework is a regulative influence. The normative pillar of the institutional environment is a system of binding expectations that motivates or hinders action based on a constraining power to behave in socially appropriate ways, enforced through informal sanctions and pressures from friends, family, and religious, professional, and status peer groups. The cultural-cognitive pillar of the institutional environment is a system of shared, taken-for-granted interpretations of social reality that motivates or hinders action because of an inability to conceive alternative options.

Institutional influences overlap with and influence each other. For example, engrained beliefs and systems of shared meaning (cultural-cognitive) may lead to acceptable standards of



**Fig 3. Pillars of Organizational Institutional Theory hypothesized to influence local government actors' fulfillment of infrastructure development and service delivery roles and responsibilities.** Definitions for pillars adapted from *The institutional environment of global project organizations* by Scott, WR [52].

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social behavior (normative). Expected behavior (normative) may ultimately be codified into enforceable law (regulative), or formal rules (regulative) may reduce our conceivable options for behavior (cultural-cognitive). The distinction between pillars of institutional influence is thus largely analytical. However, identifying dominating influences constraining different local government support functions enables a deeper understanding of the root causes of these constraints and possible avenues through which to motivate change [53]. Distinguishing regulative, normative, and cultural-cognitive influences also allows for the identification of strong alignments across pillars which uphold and reinforce the resilience of the institutional environment, and the misalignments which provide leverage for sustainable social change [52].

In this study, we hypothesize that the regulative influence of a new policy alone is not sufficient to motivate local government support requirements for professionalized maintenance. Normative and cultural-cognitive influences likely constrain action taken by local government actors and must be well-understood to motivate local government support and ultimately realize improved outcomes of service reliability.

## Methods

### Policy comparison

To address our research questions, we first examined shifts in local government support requirements within professionalized maintenance arrangements, contextualized to the Ugandan policy landscape. We uploaded the Ugandan policy documents seen in Table 1 to QSR NVivo 12 for qualitative coding, including laws and policies prior to and including the new O&M framework. Legal and policy documents were first compiled based on field experience

**Table 1. Policies analyzed to examine shifts in local government responsibilities.**

Policy / Strategy	Year
The Water Act	1997
The Local Governments Act	1997
The National Water Policy	1999
A National Framework for Operation and Maintenance of Rural Water Supplies	2004
District Implementation Manual	2013
Water and Environment Sector Development Plan	2015
Rural Water Supply and Sanitation: Community Management Handbook for Extension Workers	2016
Water and Sanitation Gender Strategy	2018
National Framework for Operation and Maintenance of Rural Water Infrastructure in Uganda	2019

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and review of the Uganda Ministry of Water and Environment's online library, and then vetted such that only documents which referenced responsibilities for rural water service delivery were coded and analyzed. We coded excerpts within these documents which referenced responsibilities of local government actors based on infrastructure development and service delivery functions. Allocations of roles and responsibilities within the new O&M framework did not conflict with existing laws and policies but did increase local government support required for certain functions. These findings are presented in *Results*.

### Interview data collection

To uncover what motivated or hindered fulfillment of support functions, we collected and analyzed responses to semi-structured interviews with 93 local government actors that spanned political, or elected (47 interviewees), and technical, or appointed (46 interviewees), branches of the local government structure. The representation of interviewees by district/sub-county affiliation, technical/political affiliation, and position is detailed in [Table 2](#). Since some respondents fill multiple roles, the total number of positions in [Table 2](#) is greater than the total number of respondents. These interviews occurred in 22 sub-counties across 3 districts in Uganda between March and June 2020 where at least one Area Service Provider has been active for several years, though most study contexts feature rural water service provision from multiple public and private entities. Political interviewees included chairpersons and councilors on village, parish, sub-county, and district government councils, and, for the purpose and scope of this study, are distinguished from national-level politicians such as members of parliament. Technical interviewees included Community Development Officers and Chiefs at the sub-county and district levels; District Water Officers and Assistant District Water Officers, District Engineers and Assistant District Engineers at the district level. Interviewees had varying levels of prior exposure to Area Service Providers operating in each study context, and this exposure was not part of the criteria for study participation.

Semi-structured interview guides were tailored to technical and political actors based on the policy review. Interview questions included both broad questions to uncover emergent influences on action and specific questions targeting regulative, normative, and cultural-cognitive influences. Examples of broader questions asked include: *What have you been focusing on in your work for the last quarter? Do you feel you were able to meet your goals during the last financial year, and why or why not?* Examples of specific questions on institutional influences include: *If I were to take your position tomorrow in this district/sub-county, what is something I would be appreciated for doing?* A question asked specifically to political

**Table 2. Interviewee details by district/sub-county affiliation, technical/political affiliation, and position.**

	District level respondents	Sub-county level respondents
<b>Technical (total respondents)</b>	<ul style="list-style-type: none"> <li>• District Water Officer (DWO) or Assistant DWO (5)</li> <li>• District Engineer or Assistant Engineer (2)</li> </ul>	<ul style="list-style-type: none"> <li>• Community Development Officer (16)</li> <li>• Subcounty Chief (15)</li> <li>• Parish Chief (8)</li> </ul>
<b>Political (total respondents)</b>	<ul style="list-style-type: none"> <li>• District Councilor / Council Secretaries (4)</li> <li>• District Council Speaker (1)</li> <li>• District Council Chairperson / Vice Chairperson (3)</li> </ul>	<ul style="list-style-type: none"> <li>• Subcounty Councilor / Council Secretaries (17)</li> <li>• Subcounty Council Speaker (4)</li> <li>• Subcounty Council Chairperson / Vice Chairperson (16)</li> <li>• Village Councilor (1)</li> <li>• Village Council Chairperson (4)</li> </ul>

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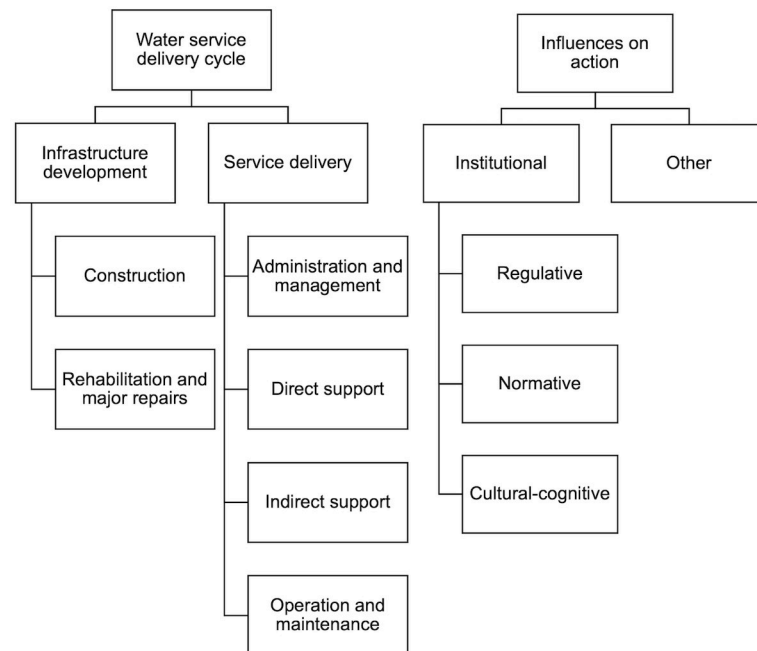
actors was: *How does supporting professionalized maintenance affect your relationship with your voters?* The complete interview guide is available in [S1 File](#). Interviews spanned 45 to 90 minutes and were conducted by local research assistants in English, the common language for business and formal interactions within Uganda. Interviews were recorded and then transcribed by the first author for analysis following receipt of consent from each respondent. Two respondents requested not to be recorded, so research assistants took detailed notes.

To reduce bias and create a conversational environment, two Ugandan nationals were hired and trained in February 2020 by the first author to conduct the interviews. The local research assistants had no prior exposure to any service providers or participants in the study contexts. Both research assistants had prior experience with semi-structured interviewing and researching local government actors in Uganda. Data collection was completed between March and June 2020, with fieldwork pausing for two months during Uganda's inter-district travel ban due to COVID-19. Once fieldwork resumed, the research assistants strictly adhered to all national and local regulations regarding COVID-19, including allowing no more than 3 unrelated persons in a vehicle at one time, wearing masks at all times, providing masks for research participants who did not have them, and adhering to local curfews on inter-district travel.

### Interview data analysis

In total, we transcribed, qualitatively coded, and analyzed 3,380 audio minutes of interviews to identify institutional influences on action across service delivery cycle support functions. QSR NVivo 12 was used for transcript coding and analysis. First, transcripts were assigned file classifications of "technical" or "political" to compare responses between these two local government actor groups. A node structure composed of two sub-structures ([Fig 4](#)) then guided the coding process. Roles and responsibilities were coded according to sub-structure 1: infrastructure development and service delivery support functions. This included references along the lines of "I did this," "I do this all the time," "I must always do this," or "this is my role." Once all transcripts had been coded into node sub-structure 1, influences on action were coded according to sub-structure 2 through the lens of institutional pillars, including an "other" category to capture influences which were not widely shared among respondents or did not fit the criteria of a regulative, normative, or cultural-cognitive influence. Thus, all references were double-coded as 1) a support function within the service delivery cycle, and 2) an institutional influence cited to affect the fulfillment of that support function. Two researchers coded the interviews independently, and discrepancies between coding were identified and coding terms and definitions modified to ensure clarity and replicability. Cohen's Kappa was calculated to determine inter-coder agreement. The final coefficient was 0.78, indicating moderate to strong agreement between coders [[54](#)]. The coding terms and definitions can be found in [S1 Table, Coding terms and definitions](#). The coding scheme was deductive overall since it was based on two conceptual frameworks, the Service Delivery Cycle and Organizational Institutional Theory [[55](#)].

Institutional influences on actions were coded as regulative, normative, or cultural-cognitive according to the following criteria. The regulative pillar included references which justified action on the basis of rules and sanctions, with legality being the basis for the stated action. This included formally imposed hierarchy and power structures. The normative pillar included references which justified action on the basis of acceptability and appropriateness, including references to social obligations and standard practices. The cultural-cognitive pillar, though difficult to separate from normative influences, included references which justified action or behavior



**Fig 4. Dual node sub-structures used for coding interview transcripts, sub-structure 1 (left) and sub-structure 2 (right).**

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on the basis of (in)comprehensibility and taken-for-granted ideals which represented larger, shared systems of belief and meaning. Influences which did not meet any of these criteria were grouped into the “other” category, generally including references that appeared to be related to individual perceptions, rather than shared, taken-for-granted social frameworks.

As a general rule, institutional influences were only coded when referencing an influence on the respondent’s personal actions. In the few cases where an interviewee discussed an institutional influence on other actors’ actions, the reference was removed from the final groups of excerpts if it was not cited by at least one individual within the referenced group. For example, if a technical actor stated that political actors always act in a certain way due to a specific influence, if no political actor cited that influence within the final excerpts under that influence, it was removed.

Matrices were created using NVivo’s matrix query function for the double coded support functions and institutional influences where rows represented the service delivery stages and columns represented the emergent institutional and other influences. While the values in these matrices highlighted recurring themes in interview responses, the most meaningful conclusions were drawn by reading and interpreting the excerpts.

### Ethics statement

This study was approved by the University of Colorado Boulder Institutional Review Board (protocol #19–0605). Informed verbal consent was obtained by the research assistants prior to all interviews based on an approved verbal consent script. Consent was recorded on the recording device when participants consented to have their interview recorded and was recorded in the notes for all interviewees who requested not to be recorded. A waiver of written documentation of informed consent was approved and obtained from the approving Institutional Review Board, as verbal informed consent is a more socially acceptable norm in the

research context, the research presents no more than minimal risk of harm to subjects, and the research involves no procedures for which written consent is normally required outside of the research context. Data was grouped only by the respondent's position title and the level of the local government in which the respondent worked; no other socially constructed groupings were applied to the data for analysis. No privately owned or protected land was accessed as part of the fieldwork for this study, and the research assistants obtained approval from the Chief Administrative Officer of each district prior to commencing fieldwork.

## Results

### Shifts in local government support requirements

Based on foundational principals and key characteristics of professionalized maintenance, arrangements must align with and be supported by national sector policies and guidelines [16]. Thus, we examine local government support requirements based on Uganda's O&M framework, though similar support requirements may be expected in other low-income contexts where rural water service provision has been decentralized to local governments and CBM has been prevalent in the past.

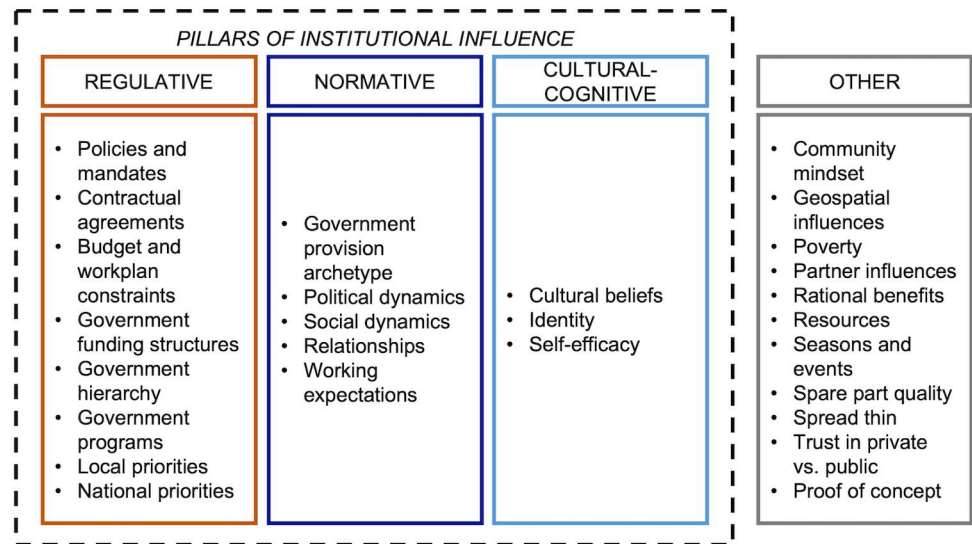
Within the new O&M framework, local government support requirements increase for administration and management functions and are further emphasized for direct and indirect support tasks. Local government support remains vital for infrastructure development and O&M is generally handed over to approved ASPs.

As an example of increased administration and management support requirements under professionalized maintenance arrangements, local governments must contract and procure ASPs and leverage their capacity and human resources to provide administrative and organizational support to communities, hand pump mechanics and technicians, and lower levels of government, e.g., districts providing this support to sub-counties. Direct and indirect support tasks have been allocated to local governments in existing policies, such as The Local Governments Act [23], and are further emphasized in the new O&M framework for their importance to professionalized maintenance. For example, service monitoring and regulation, falling under direct and indirect support, respectively, are more clearly allocated to local governments in Uganda within the new O&M framework, and these functions must generally be fulfilled by them in contexts where rural water services are decentralized [19, 24], especially in the absence of an independent regulator, which is the case in Uganda. Direct and indirect support tasks also remain from other existing policies, including regular community engagement through sensitization and trainings to motivate tariff payment by communities, and enactment and enforcement of local laws, respectively.

### Overview of institutional influences on local government support functions

Analysis of local government interviews uncovered many ways in which the pillars of the local government's organizational institutional environment constrain and/or motivate action (Fig 5). To be concise, we present the institutional influences that were the most commonly cited, as well as trends with respect to the respondent's attributes (political vs. technical and district vs. sub-county). Interview excerpts are provided as evidence, but not specifically attributed to protect the confidentiality of our respondents.

Table 3 shows the relative frequency of cited influences (columns) on fulfillment of responsibilities (rows), as well as the percentage of respondents who mentioned each relationship. Number of unique responses for all influence types (Fig 3) on all roles and responsibilities (Fig 2) can be found in S2–S5 Tables. Regulative and normative influences were cited most frequently as influencing infrastructure development support, and normative



**Fig 5. Institutional influences on local government support, categorized by pillar.**

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influences were cited most frequently as influencing service delivery support. Notably, regulative influences accounted for only 15% of all cited influences on service delivery support functions. Given the ease with which regulative influences are generally identified and discussed, by both those who make decisions and act within institutional environments and those who observe them, it is significant that regulative influences were so infrequently

**Table 3. Relative frequency of references to influences on action and actors who cited them.**

Service Delivery Cycle Stage	Regulative	Normative	Cultural-cognitive	Other
<b>Infrastructure development (110<sup>a</sup>)</b>	<b>31%<sup>b</sup>; 23%<sup>c</sup></b>	<b>32%; 24%</b>	<b>16%; 15%</b>	<b>21%; 12%</b>
<i>Construction (91)</i>	35%; 22%	31%; 19%	15%; 12%	19%; 6%
<i>Rehabilitation and major repairs (30)</i>	10%; 3%	30%; 8%	20%; 5%	40%; 5%
<i>Technical respondents, overall</i>	34% <sup>d</sup>	39%	16%	11%
<i>Political respondents, overall</i>	34%	29%	23%	14%
<i>District respondents, overall</i>	45%	20%	5%	30%
<i>Sub-county respondents, overall</i>	23%	39%	23%	16%
<b>Service delivery (625<sup>a</sup>)</b>	<b>15%<sup>b</sup>; 62%<sup>c</sup></b>	<b>34%; 81%</b>	<b>24%; 77%</b>	<b>26%; 74%</b>
<i>Administration and management (68)</i>	15%; 10%	32%; 20%	21%; 15%	32%; 17%
<i>Direct support (414)</i>	14%; 45%	33%; 73%	22%; 57%	31%; 68%
<i>Indirect support (93)</i>	25%; 23%	38%; 29%	18%; 14%	19%; 17%
<i>Operation and maintenance (84)</i>	17%; 14%	33%; 26%	36%; 27%	14%; 9%
<i>Technical respondents, overall</i>	16% <sup>d</sup>	34%	19%	30%
<i>Political respondents, overall</i>	14%	35%	29%	22%
<i>District respondents, overall</i>	25%	31%	21%	23%
<i>Sub-county respondents, overall</i>	13%	35%	24%	28%

<sup>a</sup> Total amount of references to influences on the service delivery cycle category.

<sup>b</sup> Relative frequency of references to the corresponding type of influence on action.

<sup>c</sup> Relative frequency of actors who referenced the corresponding type of influence on action.

<sup>d</sup> Relative frequency of references to the corresponding type of influence by the corresponding category of respondents.

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referenced. Building on existing literature [32, 33], we propose that the regulative influence of a new policy will not on its own be sufficient to enable local government support for service delivery unless newly allocated functions align with normative and cultural-cognitive pillars of the institutional environment.

Table 3 also demonstrates the balance of influences on support functions by technical and political respondents and by district and sub-county respondents. Notably, despite a balance in the total number of technical and political respondents, technical respondents cite influences on action overall far more than political respondents, potentially reflecting their stronger connection to rural water service delivery issues on a regular basis. Cultural-cognitive influences on both infrastructure development and service delivery functions were cited more often by political respondents, who primarily are hindered from engaging in infrastructure development support by a widespread lack of self-efficacy, and who often support service delivery functions due to their notions of identity as leaders and their cultural beliefs. Relatively, district actors discussed influences on infrastructure development overall more frequently than sub-county actors, likely because decision-making for new infrastructure is centered at the district level. District actors also cited regulative influences on both infrastructure development and service delivery more often than sub-county actors, who more often cited normative and cultural-cognitive influences for both categories of roles and responsibilities. New policies may thus have more of an influence on district actors' support, while existing normative and cultural-cognitive influences may especially need to be leveraged to increase support from lower local government actors who often hold closer relationships with communities.

### **Institutional influences on infrastructure development support**

Overall, regulative, normative, cultural-cognitive, and other influences on construction and rehabilitations reinforce the status-quo: local governments are constrained in their abilities to construct new and rehabilitate existing water points through formally outlined processes, budgets, and workplans; and political actors engage in informal political provision where they personally finance and carry out construction, rehabilitation, and O&M functions. Infrastructure development was also cited to be performed by NGOs within the district or sub-county who often do not follow the legal procedures for performing these functions, including required coordination with the local governments. Due to fewer references to impacts on infrastructure development overall and due to the similarities in responses within the two categories, influences on construction and rehabilitation are presented together. No references were made to infrastructure expansion.

Normative influences such as typical processes and routines outline taken-for-granted roles and responsibilities for infrastructure development and determine who is best capacitated to carry out these functions. Sub-county and district actors generally agreed that the district's role is to utilize funds from the central government to allocate boreholes to each sub-county and lead construction and rehabilitation, while the sub-county's role is to determine where new boreholes will be drilled and ensure that communities accept water point ownership. These normatively motivated responsibilities align with allocations within the new O&M framework, indicating that typical processes and routines may motivate compliance.

However, regulative influences like government funding structures hinder these functions by limiting available resources. Forty percent of all actors who referenced infrastructure development functions cited resources as a constraint in some way. Sixty-five percent of those actors further cited a reliance on the central government for rural water sector funding, saying that the government funding structures through which financial allocations occur limit how

many water points can be constructed or rehabilitated. Fourteen actors specifically referenced central funding disbursements being delayed or arriving in smaller quantities than originally budgeted for, as one actor clearly stated, “*we’ve not achieved our expectations due to (delayed) release of funds by the central government.*” Respondents further cited that inadequate or delayed funding disbursements result in budget deficits for fulfilling workplan goals. Therefore, local government actors sometimes prioritize other development activities, as referenced by an individual, “*we just allocate (water point construction) in the budget, but we don’t finance it. . . we put most of the money in the roads. . .*”. If adequate resources are not made available, local government actors may not fulfill support functions allocated to them in policy, even if normative influences would otherwise motivate compliance.

A cultural-cognitive influence cited by 32% of all respondents, primarily sub-county actors, to additionally hinder infrastructure development is a widespread belief in the local government’s lack of self-efficacy. These actors expressed feelings of powerlessness and hopelessness in their abilities to take part in infrastructure development processes, as described by one individual, “*I don’t think the government can ever be in position to do things the way (service provider) does them.*” Another actor described this widespread belief as independent of the level of resources available, saying “. . .there’s this belief that goes around (that) funds (are) not enough, always that funds are not enough. There’s some true element in it, but even if you give us one billion (shillings) today, we (would) end up saying it’s not enough.” This influence was cited among respondents to result in reliance on higher government branches or development partners for activities such as construction. Sub-county governments sometimes no longer budget for infrastructure development at all. As one sub-county actor explained, “*I would propose that maybe the government, maybe the NGO’s, come in to support the sub-county. Because our budget does not care about (water) issues.*” For infrastructure development responsibilities allocated in policy to be fulfilled in practice, especially regarding infrastructure-specific functions, this lack of self-efficacy must be addressed.

The formally sanctioned government process for infrastructure development is not the only one; political dynamics, a normative influence discussed by 35% of respondents, motivate elected and aspiring political actors to personally finance, construct, and rehabilitate boreholes to win favor among their electors. Interviews were conducted in the year prior to Uganda’s nation-wide elections and thus the effects of politics emerged in detail among our respondents. Informal politician provision is summarized well by one respondent, who said, “*as we prepare now for the votes, soon (the politicians) will start to bring boreholes in the areas where they’re expecting to stand as the leaders.*” While it may seem that informal politician provision fills a government funding gap, five technical government actors discussed how this informal infrastructure provision results in uneven water point distribution due to community favoritism by political actors and poor-quality construction using sub-standard materials. Additionally, once a political actor has constructed or rehabilitated a borehole, the user community expects them to ensure its long-term functionality, and when political actors do not have the funds to continue major repairs, infrastructure becomes nonfunctional for extended periods of time. One individual described this situation, saying, “. . .(politicians) repair during the campaign time when they want votes. . . those (community members) take it in mind that, since the politician repaired for us sometime back, whenever it breaks down we shall be consulting that person. But sometimes the politicians will tell them ‘. . . I don’t have the money (right now).’ So they keep on waiting for the politician to repair the borehole as they keep on consuming this (unsafe) water.” According to our respondents, informal politician infrastructure provision perpetuates nonfunctionality by placing the burden of long-term service provision on political actors who lack the capacity for regular, preventive maintenance and repairs.

Other influences on construction and rehabilitation which do not conform to definitions of the regulative, normative, and cultural-cognitive pillars of the institutional environment were cited by 12% of respondents, comprising 21% of all unique references to influences on infrastructure development. Fig 5 highlights the conceptual broadness of the “other” category, spanning geospatial influences, generic references to poverty or resources, seasonality, and technical challenges, among others. Most references (67%) to other influences concerned resource constraints hindering construction and rehabilitation. Given the prevalence of other influences in all categories of roles and responsibilities, influences beyond social systems influence local government support and may result in non-compliance with new policies, providing an area for future research as professionalized maintenance arrangements grow in number and scale.

### Institutional influences on service delivery support

Regulative influences on service delivery support were cited far less often than normative, cultural-cognitive, and other influences; thus, the regulative influence of a new policy may not alone motivate essential local government support for service delivery. The normative and cultural-cognitive pillars of the institutional environment influence actions that both do and do not align with the new O&M framework; leveraging existing institutional influences for aligned actions presents a possible solution for policy compliance, especially for cultural-cognitive influences, which are deeply embedded and much more difficult to change. Overall, regulative, normative, cultural-cognitive, and other influences on service delivery highlight the close relationships local government actors hold with communities and provide alternative perspectives on internal and external pressures, especially regarding political dynamics.

**Operation and maintenance.** Responses regarding influences on O&M uncover similar themes as infrastructure development regarding regulative resource constraints, normative routines and processes, and a cultural-cognitive lack of self-efficacy. Normative political dynamics are similarly cited to motivate informal politician-financed O&M. Political actors specifically cited that they are not able to keep up with the resulting demand for O&M tasks outside of campaign seasons, reinforcing the lack of sustainability with this approach. Only 9% of respondents mentioned “other” influences on action not captured by the regulative, normative, and cultural-cognitive pillars, representing 14% of all references to influences on O&M. These references primarily discussed a lack of resources constraining follow-through on support.

While technical actors generally referenced normative political dynamics, routine events that have become expected and sanctioned political behavior over time, when explaining politician-financed O&M, political actors often cited normative relationship expectations from communities as motivating this behavior. One political respondent described a recent event, saying, “*they rang me and said “oh our borehole (is broken)! And the mechanic went and repaired. But (the community) did not want to pay the money! That is the problem! And if you put pressure on them (to pay for it themselves), you cannot get the vote.”* External pressures from these relationship expectations, referenced by 50% of all political actors, were cited to constrain political actors beyond the electoral incentives referenced by technical actors.

Additionally, over 20% of all political actors interviewed cited that cultural-cognitive notions of identity motivated them to personally fund and/or perform O&M functions because of their leadership status. As one individual described, “*people from the village look at me as a leader, to have money (for O&M).*” This identity motivated others, however, to pay large upfront contributions for their communities to access the services of existing professionalized service providers prior to the new O&M framework, setting an example for

constituents to continue these payments on their own. One individual described this, saying, “I wanted to lead them as an example, a role model, as a leader. I gave them 100,000 (shillings) as a contribution (to their service provider enrollment fee) for them to see that ‘now Chairman has paid this, we should also pay’.” Political actors may be incentivized to support approaches which relieve often-cited burdens placed on them by internal and external pressures, as a political actor explained “. . . (it was) before the service providers, where a certain borehole broke down and people were (connected to) the person with whom I contested. . . So I had to put out 150,000 shillings and repair the borehole. But when the (professionalized) approach came in, I was relieved. I’ve never gotten any other burden of repairing another water source.”

**Administration and management.** Administration and management, direct support, and indirect support functions involve higher levels of community engagement and, according to our respondents, are the ones local government actors may be best positioned to fulfill. Normative institutional influences and other influences were cited most often to impact administration and management, representing 32% each of all cited influences on these tasks, though responses differ regarding whether the influence motivated actions aligned or misaligned with the framework. Other influences on administration and management outside the pillars of institutional influence primarily included external pressures from NGOs and service providers to fulfill certain functions such as tariff collection support and the availability of resources, primarily transportation resources for community engagement.

Normative social dynamics within communities, such as the frequently discussed lack of trust between communities and water user committees due to mismanagement of collected funds, hinder local government actors’ abilities to support tariff collection. One actor described, “when it breaks down, and when the user committees go around. . . extract money from them, some people lost the morale of contributing to the facilities. Now when (the service provider) comes in. . . (community members) look at (the service provider) as if (it) is extorting money from them.” Local government actors recognize these social dynamics and actively leverage their own relationships with communities to increase trust and accountability. For example, local government actors cited supporting communities to open bank accounts, as described by one actor, “we are recommending them to always bank their money. . . and produce their receipts so that even if the committee sits or the community says ‘ah, where is our money?’ You can be able to show them that we bank the money at such and such a place.”

Local government actors—especially political actors—often reference close relationships with communities. One political respondent cited leveraging the trust built through these relationships to convince a community to pay a service provider’s enrollment fee, guaranteeing to cover the funds if they were lost, telling them, “you pay the money. Those (service providers) are very good. They come to help us, please pay the money. . . If they fail. I will pay (the money back to you).” Relationships with communities often motivate political actors to take action on behalf of their electors, which may be leveraged to motivate support for professionalized maintenance.

Inadequate transportation resources were the most-often cited “other” influence on administration and management, direct support, and indirect support functions that involved community engagement. Notably, over 25% of respondents who discussed this constraint referenced taking action despite inadequate transportation. For example, some respondents referenced using personal funds for travel to conduct trainings, as one individual said, “you find you even have to use your salary maybe some days to go to the field to carry out these activities.”

**Direct support.** Direct support functions were referenced by 93% of interview respondents, the most of any category, indicating their prominence in local government actors’ minds. Similar to administration and management, normative influences were the most often cited to impact direct support functions, 33% of cited influences on direct support. More

respondents also cited other (non-institutional) influences on direct support than for any other service delivery cycle category. These influences on direct support were cited by 68% of all respondents and represented 31% of all cited influences on this category. As with other categories of support, resource constraints were referenced often, especially related to transportation resources for travel to communities. Additionally, generic references to an unwillingness of communities to pay for services was cited to hinder progress in community engagement support that could not be distinguished as normative or cultural-cognitive from the content of the conversation.

Normative position expectations and routines and regulative policies and mandates were cited to motivate service monitoring and community discussions to mobilize tariff payment. Generally, local government actors feel they are expected to be present in communities, keeping them informed of current issues and providing solutions to frequent or prolonged breakdowns. Political actors at local levels are given unique platforms at community events for spreading information and influencing public opinion, as described by one respondent, *“Everywhere I stay, or in a burial ceremony or wherever, I tell them that water is life. . . we (politicians) may have more access than other leaders to talk to those people.”* Normative expectations within these relationships motivate a wide variety of actions but hold potential for supportive action. This alludes to a cultural-cognitive motivator—beliefs, and specifically the belief that “water is life”—which motivated respondents to remind community members of duties such as tariff payment.

Political actors’ cultural-cognitive identities as leaders often motivates informal politician provision of infrastructure. Several respondents, however, referenced the credit they receive from their constituents when convincing them to join professionalized service arrangements, as described by one actor, *“if I went to a community (where) a borehole is not functional. . . and I bring service providers to enroll (them in) it, then I change their lives by having safe and clean water.”* Another respondent said *“. . . if you are a leader, you must accept to lead. . . I’ll tell (my community) frankly that we need a clean source of water. By the way I even become proud about it! That my people have been having good water. . .”* Notions of identity may thus be leveraged to motivate policy compliance.

Some technical actors referenced these platforms alternatively being used to reinforce the cultural-cognitive belief among both community members and political actors that the government should and is able to provide public services for free. One individual referenced this, saying, *“the politicians tend to interfere by rest assuring these communities that the government will do it for all.”*

Normative working expectations such as the expectation of “facilitation,” informal payment in exchange for support, were often cited to influence direct support. One actor described revoking support for a service provider because of this expectation, stating *“(for) many years I was mobilizing them. . . (but) we want a lot of money. We have so many works to do. . . That is why I stopped!”* Communities also expect payment in order to attend events such as trainings, impacting local government actors’ abilities to fulfill these functions, as one actor described, *“when you go there for the training, (community members) expect some transport refund or lunch. . . (when) they realize there’s nothing you’re giving them, you just see them walking away.”*

**Indirect support.** Overall, indirect support is most affected by normative institutional influences, accounting for 33% of all cited influences on these actions. Other influences accounted for 19% of all cited influences on indirect support, mentioned by 17% of respondents. These were primarily generic references to community attitudes, similar to influences on direct support, and pressures from service providers and other development partners that have influenced the passage of local policies in the past.

Normative influences generally motivate sector monitoring and regulation but hinder policy development, passage, and enforcement. Normative position expectations and typical processes were cited to motivate local government actors to closely monitor and regulate NGOs and other implementing organizations. Normative relationship expectations from communities align to additively motivate this trend; government actors cited an expectation that they serve as the connecting link between their communities and sector partners. Though these normative influences motivate a desire to monitor and regulate sector actors, there are several interview references to difficulties fulfilling this responsibility, as described by one actor, “we have a challenge of (development partners) not communicating with our office. . . you are not aware of what is happening. . . by the time you reach (the community) they tell you that someone has already worked on (the handpump). Sometimes they worked on it poorly. . . Now we’re looking for such information (about who did it). It becomes miserable.” Local government support depends on respect for their authority by these actors, though based on our respondents, this respect is not always given. Increased coordination between sector actors and local governments has been previously demonstrated to improve local government performance for supporting rural water service provision [56] and must be addressed in contexts where it limits local government actors’ abilities to fulfill assigned functions.

References to normative routines and typical processes and the regulative government hierarchy structure uncover conflicting perspectives regarding which local government level holds the responsibility for drafting and passing local policies. Overall, these normative and regulative influences align to hinder local policy development. Relationship expectations from communities also make it politically unpopular for political actors to enforce policies. As with other support functions, political actors occasionally recognized that the role of policy development is formally allocated to them in policies and mandates or stated that this responsibility is allocated to them within contractual agreements with service providers. Cultural-cognitive notions of identity motivate the fulfillment, passage and enforcement of policies for similar reasons that it motivates other support functions: actors see this as a function of their identities as leaders.

## Discussion

Existing institutional influences across all three pillars constrain local government support; given the low relative frequency of regulative influences on action within our data, the regulative influence of a new policy alone may not motivate support where existing institutions drive alternative action or inaction. This is especially relevant for service delivery support functions, such as support for tariff collection or the passage of supportive policies, where normative and cultural-cognitive influences were referenced to motivate action far more often by respondents. However, our evidence highlights discrepancies across respondents in resultant actions from individual institutional influences. Normative and cultural-cognitive influences that result in unsupportive actions for professionalized maintenance among some actors motivates supportive actions among others. This suggests that normative and cultural-cognitive influences may be leveraged to motivate actions aligned with new mandates in policies and professionalized maintenance arrangements. For example, normative social dynamics were cited by some actors to hinder tariff collection support due to community trust issues stemming from water user committees mismanaging funds. Some actors, however, stated that the same influence motivated them to help communities open bank accounts to change this dynamic and support future tariff collection efforts. Cultural-cognitive notions of identity related to being a “leader” were cited by some political actors to motivate personally conducting and financing construction, rehabilitations, and O&M tasks; other political actors, however, said that this

motivated them to connect their communities with service providers who could more sustainably manage their water sources and ensure service reliability.

While any institutional influence is difficult to change, normative and regulative influences may be easier to change. Normative and regulative influences are more easily identified and understood by those whose actions are constrained; in contrast, cultural-cognitive influences are more deeply-embedded in cognitive schema, influencing action in ways which are often unquestioned. Thus, especially for cultural-cognitive influences, existing institutional influences which have driven actions aligned with the new O&M framework should be leveraged to motivate compliance among all actors through coordinated messaging and improved incentive structures. It must be noted that we may not have captured the full extent of the cultural-cognitive pillar of influence on infrastructure development and service delivery support. In contrast to regulative influences, cultural-cognitive influences are difficult to identify and, given their internalized nature, may not obviously surface during conversations [57].

Technical actors often cited the normative influence of political dynamics, saying that political actors fulfill infrastructure-specific functions to win elections. This phenomenon is also referenced in literature to impact both CBM [10, 12] and more professionalized systems [40, 58]. However, while our political respondents admitted providing and repairing infrastructure as a bid to win over electors, this was not the only nor most-often cited motivation. Rather, political actors often told the story through a perspective of inescapable community expectations providing external pressures and internal notions of identity motivating them to follow up on these expectations. While these influences often motivated political actors to pay for and fulfill infrastructure-specific functions themselves, some political actors said these influences motivated supportive actions for professionalized maintenance, in line with the previous point.

Given the likely persistence of informal politician infrastructure development and O&M provision, and the unique relationships, power, and authority these actors hold with communities, it is imperative to leverage opportunities to motivate political support for professionalized maintenance. Furthermore, our evidence suggests that political actors often feel burdened by this informal system of politician provision, unable to pay for the continuous repairs communities expect following construction or rehabilitation. With the right messaging and incentives in place, political actors may build status within their communities and satisfy voters by supporting professionalized maintenance arrangements. Our study provides evidence that, for some political actors with exposure to service providers, this motivational shift is already occurring. It is vital, however, that political actors recognize the risk that subsidizing maintenance tariffs for communities may result in continued reliance and a resultant continued unwillingness to pay.

Though our analysis provides evidence that many normative, cultural-cognitive, and regulative influences may motivate local government support for professionalized maintenance, the centralized government funding structure in Uganda results in inadequate resources for local government actors to fulfill both infrastructure development and service delivery support functions. Technical government actors often reference being well-trained and capable of supporting infrastructure development and service delivery under more professionalized arrangements, but often reference an inability to do so due to resource constraints or high rates of turnover, resulting in the informal political provision system common in all the study's districts and sub-counties. Other studies have also identified the lack of fiscal decentralization influencing development and service delivery in Uganda [25, 59], though it is recognized that institutional influences must be paired with adequate resources in order to sustainably motivate action [52]. Inadequate resources for local governments may render positive normative and cultural-cognitive influences less influential in determining action, especially for technical actors. Our evidence suggests that if resources for technical actors, especially transportation

resources, are supplemented by service providers or other actors in the near term, supportive actions are likely. This is only a temporary solution, however, as the inadequate centralized funding mechanisms must be addressed to ensure that local government actors are resourced for responsibilities they are otherwise motivated to fulfill.

According to literature, this issue is not unique to Uganda. Studies in Kenya [21, 60], and Mali [36], and studies investigating rural water services across multiple country contexts [19] also uncovered and discussed influences of inadequately decentralized government funding structures. This influence may be relevant in similar contexts where local governments bear the ultimate responsibility for service provision. Across multiple countries, strong connections to regional and national governments for information and skill transfer has been shown to improve local government capacity, indicating the relevance of this concept beyond financial resources, as well [56]. This finding adds to the existing literature calling for improved decentralized structures for these purposes. It is also essential that dissemination of the new framework and information provided to local government actors is paired with adequate resources and power to act on assigned functions, as information about new roles and responsibilities without corresponding resources will likely not ensure their fulfillment [61].

Lastly and importantly, normative, cultural-cognitive, and regulative influences were most frequently cited to motivate action for support functions involving community engagement, spanning administration and management, direct, and indirect support. Local government actors, and especially technical actors, acknowledge that these responsibilities are allocated to them in formal policies and mandates, that communities expect them to perform these responsibilities, and feel compelled to fulfill these functions due to their shared beliefs and personal identities. Multiple technical and political actors even said that they fulfill community engagement functions despite limited funding to do so and occasionally cited the use of personal funds to overcome resource constraints. Overall, our evidence suggests that community engagement support functions are the ones local government actors are best positioned and motivated to fulfill. As CBM systems transition to more professionalized services, service providers can leverage the strong relationships between local government actors and communities for functions related to administration and management, direct support, and indirect support. As with all support functions local governments are expected to fulfill, adequate resources must be made available for these activities to ensure that existing motivations result in high-quality engagement.

It must be noted that all respondents were in districts where there is already or has historically been at least one professionalized Area Service Provider. Results may differ in contexts with no exposure to professionalized maintenance arrangements, which provides another area for future study as professionalized approaches grow in number and scale. This study was conducted in three districts in Uganda with unique contexts which may differ from other sub-national contexts within Uganda or other country contexts outside of Uganda. For example, governmental hierarchy structures differ from one country context to the next. While summary results from prior interviews were discussed with participants after obtaining their initial responses to improve accurate interpretation, participant validation of all results and conclusions was not possible due to high local government turnover, COVID-19 restrictions, and protections to ensure participant confidentiality.

## Conclusions

This study is among the first to explore the potential of a new policy in Uganda to enable professionalized maintenance arrangements. Actions taken and decisions made by the local government respondents are largely driven by normative and cultural-cognitive influences; thus,

the regulative influence of Uganda's new O&M framework is not likely to ensure local government support for professionalized maintenance arrangements unless allocated roles and responsibilities align with existing normative and cultural-cognitive pillars of the institutional environment.

Overall, our results uncover widespread differences in the actions cited to take place due to normative and cultural-cognitive influences. Thus, many normative and cultural-cognitive influences such as relationship expectations and internal notions of identity may serve as levers for local government support if associated incentives, messaging, and appropriate resources are in place. However, formal government funding structures often constrain resource availability for local governments, creating regulative constraints that may limit the ability of existing normative and cultural-cognitive influences to motivate supportive actions.

Influences on local government support vary between political (elected) and technical (appointed) respondents. Thus, dissemination of the O&M framework in Uganda and messaging regarding roles and responsibilities should be targeted to each group to motivate compliance. While other studies have uncovered the influence of politics on rural water service provision, this study is among the first to account for the perspectives of political actors themselves. We find that though political actors perform informal infrastructure development and O&M tasks for electoral support, they are often burdened by resultant community expectations for repairs over the course of the infrastructure's service life. Political actors may be motivated by existing influences such as their internal notions of identity as leaders to support professionalized arrangements, providing solutions to their constituents' problems while relieving personal financial burdens.

All local government actors, especially political actors, hold uniquely close relationships with communities and are well-positioned to support community engagement tasks; respondents even referenced fulfilling these functions in the absence of available resources. While development partners and implementing organizations can leverage local government actors for essential community engagement functions, implementers must respect the authority of local government actors and ensure compliance with local laws and regulations, ensuring coordination with the local governments where they operate. We provide evidence that at all hierarchical levels of the local government structure, local government actors experience insufficient coordination with sector actors working in their jurisdictions, often resulting in a cited lack of self-efficacy regarding essential monitoring and regulation functions.

Given the recent release of Uganda's new O&M framework, it is timely to have examined the perspectives of local government actors to anticipate the challenges they may face in complying with outlined roles and responsibilities and what influences may serve as levers for motivating essential support. Enabling local government support is essential as professionalized maintenance arrangements emerge and grow in decentralized contexts in sub-Saharan Africa and as policies are enacted to improve the sustainability of rural water services.

## Supporting information

### **S1 Table. Coding terms and definitions.**

(PDF)

### **S2 Table. Coded references to regulative influences on local government support.**

(PDF)

### **S3 Table. Coded references to normative influences on local government support.**

(PDF)

**S4 Table. Coded references to cultural-cognitive influences on local government support.**  
(PDF)

**S5 Table. Coded references to other influences on local government support.**  
(PDF)

**S1 File. Interview guide.**  
(PDF)

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## References

1. Tsimpo C, Wodon Q. Water and Sanitation in Uganda. Washington, D.C.: World Bank; 2018.
2. Truslove J, Miller A V. M., Mannix N, Nhlema M, Rivett M, Coulson A, et al. Understanding the Functionality and Burden on Decentralised Rural Water Supply: Influence of Millennium Development Goal 7c Coverage Targets. *Water*. 2019 Mar 8; 11(3):494.
3. Bonsor HC, Oates N, Chilton PJ, Carter RC, Casey V, MacDonald AM, et al. A Hidden Crisis—strengthening the evidence base on the sustainability of rural groundwater supplies—results from a pilot study in Uganda. In: *Water, Sanitation and Hygiene Services Beyond 2015: Improving Access and Sustainability*. Loughborough University, UK: WEDC, Loughborough University; 2015.
4. Roche R, Bain R, Cumming O. A long way to go—Estimates of combined water, sanitation and hygiene coverage for 25 sub-Saharan African countries. Zeeb H, editor. *PLoS ONE*. 2017 Feb 9; 12(2): e0171783. <https://doi.org/10.1371/journal.pone.0171783> PMID: 28182796
5. United Nations General Assembly. Draft Resolution A/69/L.85: Transforming Our World: The 2030 Agenda for Sustainable Development. 2015.

6. van den Broek M, Brown J. Blueprint for breakdown? Community Based Management of rural ground-water in Uganda. *Geoforum*. 2015 Dec; 67:51–63.
7. Foster T. Predictors of Sustainability for Community-Managed Handpumps in Sub-Saharan Africa: Evidence from Liberia, Sierra Leone, and Uganda. *Environ Sci Technol*. 2013 Nov 5; 47(21):12037–46. <https://doi.org/10.1021/es402086n> PMID: 24111486
8. Cronk R, Bartram J. Factors Influencing Water System Functionality in Nigeria and Tanzania: A Regression and Bayesian Network Analysis. *Environ Sci Technol*. 2017 Oct 3; 51(19):11336–45. <https://doi.org/10.1021/acs.est.7b03287> PMID: 28854334
9. Keesiga D, Kayaga S. Management of cost recovery for sustainable rural water supply: case study from Uganda. In: *Transformation Towards Sustainable and Resilient WASH Services*. Egerton University, Nakuru, Kenya; 2018. p. 6.
10. Naiga R, Penker M, Hogni K. Challenging pathways to safe water access in rural Uganda: From supply to demand-driven water governance. *International Journal of the Commons*. 2015;237–60.
11. Whaley L, Cleaver F. Can 'functionality' save the community management model of rural water supply? *Water Resources and Rural Development*. 2017 Jun; 9:56–66.
12. Denis Le Sève M. A political economy analysis of Uganda's rural water supply sector. Overseas Development Institute (ODI); 2018 Oct.
13. Lockwood H. *Sustaining Rural Water: A Comparative Study of Maintenance Models for Community-Managed Schemes*. USAID, Sustainable WASH Systems Learning Partnership; 2019 Jul.
14. Harvey A. Rural water in Uganda—the three key questions: who, what, how? *Water Solutions*. 2019; 11.
15. Sustainable WASH Systems Learning Partnership. *Maintenance Approaches to Improve the Sustainability of Rural Water Supplies*. USAID, Sustainable WASH Systems Learning Partnership; 2020 Jan.
16. Sustainable WASH Systems Learning Partnership. *Professionalized Maintenance for Rural Water Service Provision: Toward a Common Language and Vision*. USAID, Sustainable WASH Systems Learning Partnership; 2021 Mar.
17. World Bank Group. *Sustainability Assessment of Rural Water Service Delivery Models: Findings of a Multi-Country Review* [Internet]. World Bank; 2017 [cited 2019 Oct 31]. <http://elibrary.worldbank.org/doi/book/10.1596/27988>.
18. Lockwood H, Mansour G. *Global Study on Sustainable Service Delivery Models for Rural Water*. World Bank Group; 2016 May.
19. Lockwood H, Smits S. *Supporting Rural Water Supply: Moving towards a Service Delivery Approach*. Warwickshire, UK: Practical Action Publishing Ltd.; 2011.
20. Koehler J, Thomson P, Hope R. Pump-Priming Payments for Sustainable Water Services in Rural Africa. *World Development*. 2015 Oct; 74:397–411.
21. Koehler J, Thomson P, Goodall S, Katuva J, Hope R. Institutional pluralism and water user behavior in rural Africa. *World Development*. 2021 Apr; 140:105231.
22. The Government of Uganda. *The Water Act, Cap. 152*. Apr 7, 1997.
23. The Government of Uganda. *The Local Governments Act, Cap. 243*. Mar 24, 1997.
24. RWSN. *Local Government and Rural Water Services that Last: A Way Forward: Rural Water Supply Reality Check*. St. Gallen, Switzerland: Skat Foundation; 2017.
25. Green E. Decentralization and Development in Contemporary Uganda. *Regional & Federal Studies*. 2015 Oct 20; 25(5):491–508.
26. Apreku SS. *Does decentralization improve public service delivery?: issues and policy implications for Uganda*. [Ottawa, Canada]: National Library of Canada; 2004.
27. Brosio G, Ahmad E, González M. Uganda: Managing More Effective Decentralization. *International Monetary Fund*. 2006 Dec 1; 34.
28. UNICEF. *Strengthening Enabling Environment for Water, Sanitation and Hygiene (WASH): Guidance Note*. 2016 p. 58.
29. Moriarty P, Smits S, Butterworth J, Franceys R. Trends in Rural Water Supply: Towards a Service Delivery Approach. *Water Alternatives*. 2013; 6(3):329–49.
30. Harvey PA, Reed RA. Community-managed water supplies in Africa: sustainable or dispensable? *Community Development Journal*. 2007; 42(3):365–78.
31. Directorate of Water Development. *National Framework for Operation and Maintenance of Rural Water Infrastructure in Uganda*. Ministry of Water and Environment, Republic of Uganda; 2019.
32. Ménard C, Jimenez A, Tropp H. Addressing the policy-implementation gaps in water services: the key role of meso-institutions. *Water International*. 2018 Jan 2; 43(1):13–33.

33. Chukwuma Obeta M. Rural water supply in Nigeria: policy gaps and future directions. *Water Policy*. 2018 Jun 1; 20(3):597–616.
34. Tantoh HB, Leonard L, Simatele MD. Strengthening the scaffolds of community flexibility: policy and institutional response to the rural water supply and sustainability challenge. *African Geographical Review*. 2019 Nov 19;1–16.
35. Fuest V, Haffner SA. PPP—policies, practices and problems in Ghana’s urban water supply. *Water Policy*. 2007 Apr 1; 9(2):169–92.
36. Jones SD. Bridging political economy analysis and critical institutionalism: an approach to help analyse institutional change for rural water services. *International Journal of the Commons*. 2015; 9(1):65–86.
37. Brottem LV. Dig Your Own Well: A Political Ecology of Rural Institutions in Western Sub-Saharan Africa. *Annals of the American Association of Geographers*. 2018 Jul 4; 108(4):1075–95.
38. Basu M, DasGupta R, Hashimoto S, Hoshino S. A multi-actor and bottom-up perspective on attaining rural water security: qualitative evidence from India. *Environ Dev Sustain*. 2021 Feb; 23(2):1461–84.
39. Amjad U, Ojomo E, Downs K, Cronk R, Bartram J. Rethinking Sustainability, Scaling Up, and Enabling Environment: A Framework for Their Implementation in Drinking Water Supply. *Water*. 2015 Apr 3; 7(12):1497–514.
40. Koehler J. Exploring policy perceptions and responsibility of devolved decision-making for water service delivery in Kenya’s 47 county governments. *Geoforum*. 2018 Jun; 92:68–80.
41. Pullan RL, Freeman MC, Gething PW, Brooker SJ. Geographical Inequalities in Use of Improved Drinking Water Supply and Sanitation across Sub-Saharan Africa: Mapping and Spatial Analysis of Cross-sectional Survey Data. Hunter PR, editor. *PLoS Med*. 2014 Apr 8; 11(4):e1001626. <https://doi.org/10.1371/journal.pmed.1001626> PMID: 24714528
42. Scott WR. *Institutions and Organizations: Ideas and Interests*. 3rd ed. Los Angeles, California: Sage Publications; 2008.
43. Giglio JM, Friar JH, Crittenden WF. Integrating lifecycle asset management in the public sector. *Business Horizons*. 2018 Jul; 61(4):511–9.
44. Muralikrishna Iyyanki V., Manickam Valli. *Environmental Management—Science and Engineering for Industry*. Elsevier Inc.; 2017.
45. Hauschild MZ, Rosenbaum RK, Olsen SI, editors. *Life Cycle Assessment* [Internet]. Cham: Springer International Publishing; 2018 [cited 2020 Apr 13]. <http://link.springer.com/10.1007/978-3-319-56475-3>.
46. Baumann, E. *May-day! May-day! Our hand pumps are not working!* St. Gallen, Switzerland: Rural Water Supply Network; 2009.
47. RWSN. *Myths of the Rural Water Supply Sector*. St. Gallen, Switzerland: Rural Water Supply Network; 2009.
48. McIntyre P, Smits S. Direct support post-construction to rural water service providers. *IRC*; 2015 Mar.
49. Smits S, Verhoeven J, Moriarty P, Fonseca C, Lockwood H. Arrangements and cost of providing support to rural water service providers. *IRC*; 2011 Nov.
50. Biggs S, Smith S. A Paradox of Learning in Project Cycle Management and the Role of Organizational Culture. *World Development*. 2003 Oct; 31(10):1743–57.
51. Campbell JL. *Institutional Change and Globalization*. Princeton University Press; 2004.
52. Scott WR. The institutional environment of global project organizations. *Engineering Project Organization Journal*. 2012 Jun; 2(1–2):27–35.
53. Scott WR. Institutional carriers: reviewing modes of transporting ideas over time and space and considering their consequences. *Industrial and Corporate Change*. 2003 Aug 1; 12(4):879–94.
54. Bazeley P., Jackson K. *Qualitative Data Analysis with NVivo*. Sage Publications; 2013.
55. Miles MB, Huberman AM, Saldaña J. *Qualitative data analysis: A methods sourcebook*. Thousand Oaks, California: SAGE Publications, Inc.; 2014.
56. McNicholl D, McRobie A, Cruickshank H. Characteristics of Stakeholder Networks Supporting Local Government Performance Improvements in Rural Water Supply: Cases from Ghana, Malawi, and Bolivia. *Water Alternatives*. 2017; 10(2):23.
57. Javernick-Will AN, Scott WR. Who Needs to Know What? Institutional Knowledge and Global Projects. *J Constr Eng Manag*. 2010 May; 12.
58. Harvey A. Steps to sustainability: a road map for WASH. *Waterlines*. 2017 Jul; 36(3):185–203.
59. Muriisa R. Decentralisation in Uganda: Prospects for Improved Service Delivery. *Afr Dev* [Internet]. 2010 Aug 2 [cited 2019 Dec 1]; 33(4). Available from: <http://www.ajol.info/index.php/ad/article/view/57344>.

60. Mwihaki NJ. Decentralisation as a tool in improving water governance in Kenya. *Water Policy*. 2018 Apr 1; 20(2):252–65.
61. Kosec K, Wantchekon L. Can information improve rural governance and service delivery? *World Development*. 2020 Jan; 125:104376.