



A multi-decadal and social-ecological systems analysis of community waterpoint payment behaviours in rural Kenya



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ABSTRACT

Community-based financing of rural water supply operation and maintenance is a well-established policy principle in sub-Saharan Africa. Yet evidence from over 90,000 waterpoints in five sub-Saharan African countries suggests a majority of communities fail to establish and sustain a revenue collection system. As a result, insufficient finances to repair waterpoints can lead to lengthy downtimes or abandonment, threatening the health and welfare of millions of water users forced to revert to unsafe or distant alternatives. Applying a social-ecological systems framework to community waterpoints in rural Kenya, we empirically assess the prevalence and determinants of financial contributions among water users. The analysis draws on multi-decadal data covering 229 years' worth of water committee financial records consisting of more than 53,000 household payments. Results reveal that non-payment and late payment are prevalent, and payment behaviours are predicted by groundwater quality, waterpoint location, productive water use, and rainfall season. The findings reflect the socio-ecological nature of waterpoint sustainability in rural sub-Saharan Africa and confirm that households are not always willing and able to pay for an improved water supply. This situation is symptomatic of a fundamental operation and maintenance financing challenge that must be addressed if the Sustainable Development Goal of universal access to safe water is to be achieved.

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1. Introduction

Low levels of water supply sustainability pose a threat to development in rural areas of sub-Saharan Africa. Waterpoints that draw on groundwater – namely wells and boreholes – are the most prevalent and rapidly expanding drinking water supply option across the continent (Banerjee and Morella, 2011), accessed by more than 250 million rural inhabitants. Over the last three decades, community-managed handpumps have been the mainstay techno-institutional approach to rural waterpoint development (Arlosoroff et al., 1987; Harvey and Reed, 2007). Handpumps and community management have long been considered ideal bedfellows: a low-cost and simple technology for lifting groundwater

combined with an institutional model premised on the assumption that local users are willing and able to self-organise. However, with an estimated one in three handpumps non-functional at any one time (RWSN, 2009), flaws in this techno-institutional coupling have become apparent. Communities often struggle to carry out operation and maintenance (O&M) responsibilities, and the resultant service disruptions likely force millions of households to revert to unsafe or far-off water sources at any point in time. In an effort to expand safe water supplies to the 270 million rural Africans who still rely on unimproved sources (WHO/UNICEF, 2015), each year governments and development partners continue to spend hundreds of millions of dollars on an estimated 60,000 waterpoints fitted with handpumps (Sansom and Koestler, 2009). Unfortunately, unless there is an improvement in the way O&M is carried out, historical evidence suggests these investments will fail to generate the desired human development outcomes, and safe water access in rural sub-Saharan Africa will continue to lag behind the rest of the world.

One of the foremost collective action challenges of keeping rural waterpoints functional is the financing of O&M activities. Revenue

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collection from water users is a well-established cornerstone of community management (Arlosoroff et al., 1987; Briscoe and de Ferranti, 1988), and is widely regarded as critical to sustainability (Carter et al., 1999; Harvey, 2007; Foster, 2013). While full cost recovery – including capital costs – is viewed as unrealistic in rural sub-Saharan Africa (Harvey, 2007), community management proceeds upon the assumption that self-financing of recurrent O&M costs is attainable. Furthermore, it has been argued that neither governments nor donors can be relied upon to finance O&M costs on a long-term basis (Briscoe and de Ferranti, 1988). As a result, community-based financing of O&M is now formalised in rural water policies across the continent (Banerjee and Morella, 2011; African Development Bank, 2010). However, recently assembled waterpoint datasets suggest this expectation is not being met. Pooling data from 92,594 waterpoints fitted with handpumps across five countries reveals 3 in 5 are not accompanied by any form of revenue collection, and only 1 in 5 water user groups chooses to regularly collect and save funds in advance of a breakdown (Table 1).

Even where arrangements are put in place to regularly collect fees, it has been noted that a sizable proportion of waterpoint users fail to meet their payment obligations (Carter et al., 2010). However, little effort has been made to quantify the extent of this non-payment problem or empirically evaluate the underlying causes. While national water service regulators regularly publish revenue collection metrics for urban piped schemes in sub-Saharan Africa (EWURA, 2013; NWASCO, 2013; WASREB, 2014), the measurement of financial indicators for rural waterpoint systems remains a major knowledge gap. Moreover, though there is an established body of literature examining determinants of willingness to pay for hypothetical water services in rural sub-Saharan Africa (World Bank Water Demand Research Team, 1993; Arouna and Dabbert, 2012; Naiga and Penker, 2014), there have been few attempts to evaluate the conditions affecting actual payment behaviours (Hanatani and Fuse, 2012). This is of critical importance given evidence of a divergence between factors which influence a household's willingness to pay and those which determine their actual behaviours (Griffin et al., 1995).

2. Conceptual framework

Insights and analytical approaches from collective action and common-pool resource (CPR) literature have the potential to shed more light on why some communities are able to self-finance waterpoint O&M, while others fail. Scholarly interest in collective action and CPR dilemmas emerged more than four decades ago,

when Hardin (1968) theorised that commons used collectively would inevitably result in overexploitation, degradation and collapse of the resource. Olson (1965) also postulated dire consequences for large groups entrusted with solving collection action problems. While these seminal works initiated a wave of theoretical and empirical research, their predictions have turned out to be overly pessimistic. This is not to deny that collective management of CPRs can in some instances lead to overuse and destruction, particularly when users are anonymous, do not communicate, and receive no feedback (Basurto and Ostrom, 2009). However, examples of users successfully collaborating and managing resources in a sustainable fashion have been noted across a range of resource types, including fisheries, forests, grazing pastures and water resources (Basurto and Ostrom, 2009).

More recently, CPR scholars have turned their attention to the conditions under which groups successfully self-organise and sustainably manage resources (Ostrom, 1990; Wade, 1994; Baland and Platteau, 1996; Agrawal, 2003). Identification of factors which facilitate or hinder CPR management continues to provoke debate, and disagreement as to the size and direction of associations endures (Araral, 2009). Given the complexity of collective action and CPR processes, a single and comprehensive explanatory theory has proved elusive. Analysis and interpretation is often complicated by the feedback relationships that cause variables to affect each other recursively (Meinzen-Dick et al., 2004). Moreover, despite a multitude of studies spanning a range of CPR challenges, two key obstacles have thwarted the accumulation and synthesis of insights. First, CPR management inherently involves interaction between human and environmental systems, thereby bringing together disciplines which traditionally adopt discordant languages and methods. Second, variables measured and assessed are often high in number or inconsistent across studies, thereby complicating efforts to compare findings, conduct meta-analyses and formulate global theories (Agrawal, 2003; Ostrom and Cox, 2010).

In order to counter these challenges, Ostrom (2007, 2009) crafted a multilevel social-ecological system (SES) framework as a common diagnostic tool for analysing factors that influence outcomes for complex environmental and human systems. The SES framework is intended to aid cumulative learning by laying out a classification system and vocabulary that helps organise analysis and communicate findings (Ostrom and Cox, 2010). Shaped by decades of theoretical and empirical work, the framework is premised upon the logic that SES outcomes can be explained by factors contained within four core sub-systems – resource systems, resource units, governance systems, and users – as well as related ecosystems, and broader social-political-economic settings.

Table 1
Prevalence of revenue collection for waterpoints fitted with handpumps in five sub-Saharan African countries.

Country	Scope	No. handpumps	Handpumps with revenue collection (%)	Primary revenue collection approach (%)	
				Payment upon breakdown	Regular fees in advance of breakdown
Kenya	8 counties ^a	2119	52.2 ^b	8.1	44.0
Liberia	National	9388	46.8 ^c	30.2	16.6
Sierra Leone	National	12,003	20.0 ^d	15.5	4.5
Tanzania	National	21,884	42.1 ^e	13.2	28.9
Uganda	National	47,200	42.8	—	—
Total		92,594	40.4 (37.6)^f	17.4^f	20.2^f

Authors' analysis based on publicly available waterpoint datasets (Virtual Kenya, 2015; National Water Sanitation and Hygiene Promotion Committee, 2014; Sierra Leone, STATWASH Portal, 2014; Government of Tanzania, 2014; Government of Uganda, 2012).

^a Busia, Embu, Isiolo, Kajiado, Kiambu, Kisumu, Kwale, Turkana.

^b Excludes 229 handpumps with unknown revenue collection regime.

^c Excludes 51 handpumps with unknown revenue collection regime.

^d Excludes 682 handpumps which were under construction, and 12 handpumps with unknown revenue collection regime.

^e Excludes 2899 handpumps with unknown revenue collection regime.

^f Excludes data from Uganda, which do not distinguish between revenue collection approaches.

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