

Research Paper

Going to scale with rural water supply: a reflection on experiences from sustaining community managed piped water schemes in rural Zimbabwe

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ABSTRACT

Access to safely managed water is a basic human right, yet rural water supply still remains a challenge in Zimbabwe. This study sought to assess sustainability of community managed piped water schemes developed under the rural WASH program as a model for rural water supply. Both qualitative and quantitative research methods were used in the collection of data. The program developed 33 schemes out of which 36.4% have since broken down. System failure is high amongst diesel and electricity powered schemes compared to solar powered. Alarmingly, all the schemes have water point committees set up and trained with support from the project. The current status-quo therefore reflects a capacity gap amongst the set water point committees. In many cases they have failed to operationalize the water fund, institute water demand management, support and retain pump operatives. Moving forward, the sector therefore needs to adopt a demand responsive approach when targeting schemes for rehabilitation. This will help address structural issues in the management of the schemes like social capital, ownership of the investment and cost recovery. Government should also consider going to scale with the solar powered schemes which are seemingly resilient and compatible with the community based management system.

Key words | community managed piped water scheme, rehabilitation, rural water supply, sustainability

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HIGHLIGHTS

- Informing future programming for community managed piped water schemes by project staffers.
- Giving pointers for sustainability of community managed piped water schemes.
- Influencing policy around rural water supply through the piped water scheme model.
- Strengthening community based management system for rural piped water schemes.

INTRODUCTION

History has it that very low priority has been given to issues of economic and social development in rural Zimbabwe

pre-independence (Sibanda & Makwata 2017). In 1980, Zimbabwe adopted a dual system for rural water supply (RWS) characterized by hand-driven and motorized pumps (Kativhu 2016). A significant proportion of community-managed piped water schemes (CMPWS) were developed during this period servicing marginalized rural communities

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(Hoko *et al.* 2009). Many of the schemes were diesel powered, maintained through the District Development Fund's (DDF) three-tier maintenance system. However, this situation was to change midway through the decade with the Zimbabwe national master plan for rural water recommending that priority be put on primary water supplies with CMPWS being constructed only after the entire rural population had access to improved primary water supplies (Zimbabwe Ministry of Energy Water Resources and Development 1985). This discord in government policy retarded growth of the CMPWS model.

As time went by, a number of schemes that government had invested in over the years later succumbed to a weakened operation and maintenance (O&M) system. The long down time of schemes resulted in many systems getting vandalized (GoZ 2016). However, the coming in of Sustainable Development Goals (SDGs) and the new narrative on universal access to water revolutionized the sector. This saw the CMPWS model being revitalized as an option of choice with the potential to significantly reach out to a higher number of people. Additionally, this model also provides a higher level service and the fact that standpipes can be extended down to individual households means a large reduction on the time taken to complete a round trip fetching water (UNICEF 2019).

In a study on time spent fetching water and the alternatives forgone for women in sub-Saharan Africa (SSA), Agesa & Agesa (2019) demonstrated that due to lack of piped water, household members in SSA, typically girls, fetch water from sources located far away from their homes. An econometric study presented in their research considered fetching water/schooling time trade-off as a possible and partial explanation for the relatively high dropout rate for girls in school which is a peril to the entire 2030 agenda for sustainable development. In this regard, the main objective of this study was to synthesize the major lessons learnt from the implementation of CMPWS as a model for rural water supply (RWS) in Zimbabwe. Based on this, recommendations were proffered on how to further strengthen this model for increased efficiency and effectiveness. Special focus was given to issues of policy, institutional arrangements, and capacities related to CMPWS.

Theory of change – the rural WASH program's (RWP) water infrastructure pillar

Realizing universal access to safe and affordable drinking water by 2030 presents a huge challenge for all countries, not just those with low incomes. Achieving SDG 6.1 means addressing the 'unfinished business' of extending services to 844 million people who still lack basic water services, and progressively improving the quality of services to 2.1 billion people who lack water accessible on premises, available when needed and free from contamination (UN-Water 2018). In 2012, years before the onset of the SDG era, the RWP had already embraced piped water schemes (PWS) as a fitting model for RWS. The philosophy behind it was that improved access to higher level service was going to trigger improvement in health and economic well-being for the rural poor (GoZ 2012).

Zimbabwe is a good case study of the disastrous consequences of neglecting RWS. A breakdown in the most basic elements of water and sanitation infrastructure underpinned the 2008/2009 cholera epidemic in Zimbabwe (Cuneo *et al.* 2017). Revival of the PWS model was guided by the project's water infrastructure pillar's theory of change (Figure 1). This pillar anticipated that the development of PWS was going to increase access to potable water by communities resulting in reduced cases of diarrhoeal diseases and hence an improvement in the lives of the rural poor (GoZ 2012).

The RWP targeted to develop 33 schemes across the five project provinces of Mashonaland West, Midlands, Masvingo, Matabeleland North and Matabeleland South. A scheme was designed to service at least 1200 people. A community based management (CBM) system was employed as the strategy to support O&M of the schemes. Deliberate effort was made to solarize some of the schemes with an objective to make the O&M bill manageable at the community level. Each PWS was allocated, on average, USD50,000 to cover costs for feasibility study, civil works and commissioning (GoZ 2012). In return, recipient communities contributed locally available resources and labour.

Upfront measures that were put in place by the programme to strengthen sustainability of the rehabilitated schemes included capacity building and equipping of pump operators and water point committees (WPCs). Identified pump operators were exposed to on-job training and

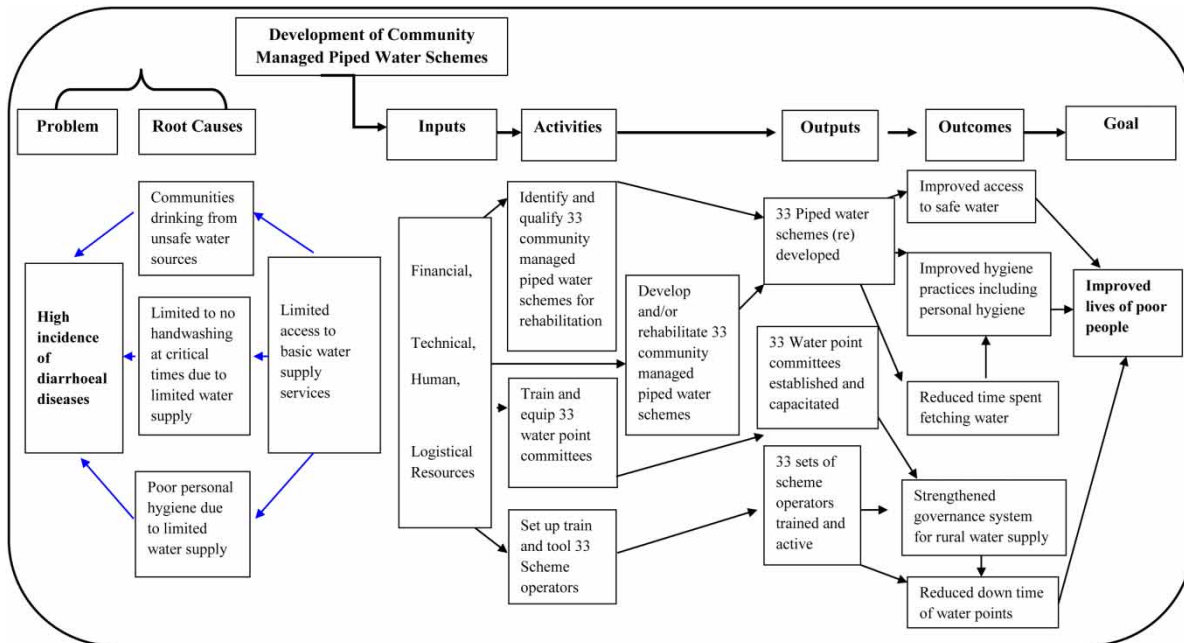


Figure 1 | The community managed piped scheme model's theory of change.

certification by the contractor during rehabilitation of the schemes. The training curriculum was structured to cover critical O&M issues.

METHODOLOGY

The study used qualitative and quantitative research methods in data collection. Questionnaires were administered to 33 WPCs selected using convenience sampling. The questionnaire solicited for information on a number of variables ranging from households served and their characteristics, presence and composition of WPCs, water fund, alternative uses of water, pumping mechanisms and other key questions of a technical nature. The questionnaire method of data collection was chosen for its capacity to collect bulk-structured data that can be easily analyzed using Excel.

Focus group discussions (FGDs) were also held with members of the programme management team (PMT) to obtain their views for providing oversight support to CMPWS. This was also complimented by online interviews conducted with selected key informants who included Social Service Officers from five rural local authorities and

District Development Fund (DDF) Coordinators at the provincial level.

The qualitative component of the research also focused on a desk review of existing project documents and past literature on PWS. This also included a recollection of policy and strategic issues around PWS raised during a thematic round table discussion on SDG6 held on the sidelines of the 6th Session of the African Regional Forum on Sustainable Development on the 24th February 2020. Some of the key documents consulted include the RWP document, project baseline and endline survey reports, including reports from quality assurance visits by government structures, a report on the rapid assessment of CMPWS and also mid-term project evaluation reports.

Findings from the study

Targeting of schemes for rehabilitation

A total of five out of the eight rural provinces in Zimbabwe benefitted from phase-one of the RWP whose water infrastructure pillar sought to increase communities' access to safe water supply through the rehabilitation of 33 PWS.

This target (Figure 2) constituted 5.8% of the total schemes developed around the country post-independence.

To harmonise the rehabilitation process, the RWP had a defined protocol guiding all the programme districts. The protocol addressed a broad range of issues from pre-identification of sites, community awareness, water demand analysis, and preliminary design to capacity testing of the borehole for confirmation of yield and reliability of the proposed water source. Water sampling and testing was also carried out to establish any special needs for water treatment. All the 33 schemes rehabilitated under the RWP went through this protocol.

Functionality status of CMPWS pre- and post-programme implementation

Out of the 573 PWS identified by the survey pre-implementation of the RWP, 50.4% of the schemes were on breakdown for various reasons. Matabeleland South Province had the highest proportion of non-functional schemes (66.7%) whereas Mashonaland East, with only 35.6%, had the lowest (Figure 3). The 33 schemes rehabilitated under the RWP therefore constituted 11.4% of the total schemes that were broken down.

A deliberate attempt was made to equip some of the targeted schemes for rehabilitation with solar powered pumps. Table 1 gives a summary of the pumping mechanisms for the 33 rehabilitated schemes.

In summary, 39.4% of the schemes were put on solar, 30.3% diesel, 18.2% electricity and 12.1% gravity fed. From the findings, 36.4% of the 33 schemes rehabilitated by the project have since broken down with beneficiary communities reportedly failing to foot bills for the requisite rehabilitations (Figure 4).

Operationalization of the water point fund

Study results showed that 100% of the 33 schemes rehabilitated under the RWP had an established water fund. In 88% of the schemes, water users were being levied USD0.50 per month per household, USD1.00 in 3% whilst in the other remaining 9% water funds were there but defunct and no contributions were being made by water users (Table 2).

Social capital

The manner in which RWS systems are run and managed is a large deterrent of their sustainability. The quality of management is in itself a product of the social capital existing amongst water users and between the institution of water users and its support structures. Ninety-four per cent of the schemes rehabilitated under the RWP are community managed, meaning that communities are largely responsible for all O&M issues affecting the schemes. In the remaining 6% government, through either the Rural District Council (RDC) or the Zimbabwe National Water Authority

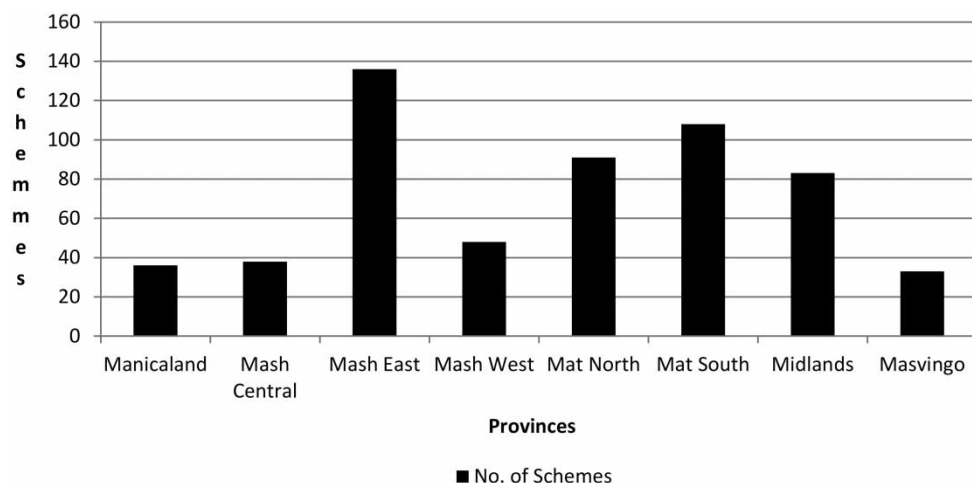


Figure 2 | National distribution of CMPWS.

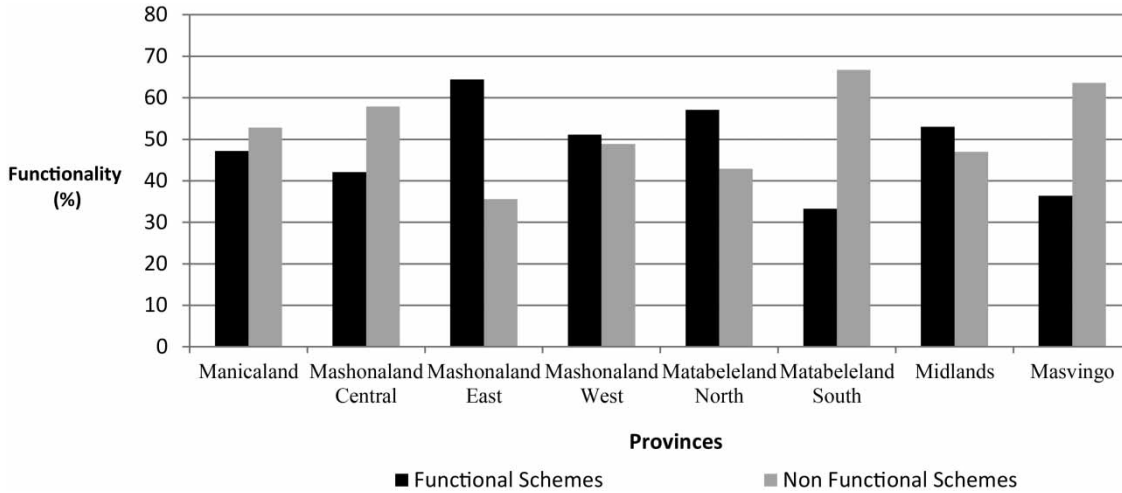


Figure 3 | Functionality of PWS across provinces.

Table 1 | Overview of pumping mechanisms for rehabilitated CMPWS under the RWP

Parameter	Midlands (N = 6)		Masvingo (N = 6)		Mash W (N = 7)		Mat N (N = 7)		Mat S (=7)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Solar	3	50	4	66	4	57	1	14	1	14
Diesel	2	33	1	17	0	0	2	29	5	71
Electricity	1	17	1	17	1	14	2	29	1	14
Gravity	0	0	0	0	2	29	2	29	0	0

Notes: Mash W: Mashonaland West; Mat N: Matabeleland North; Mat S: Matabeleland South.

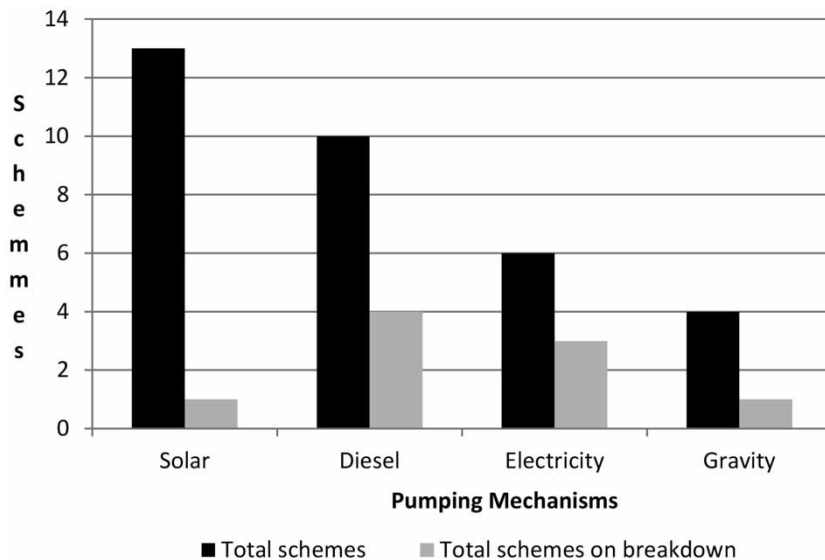


Figure 4 | Scheme breakdowns by pumping mechanism.

Table 2 | Average monthly contributions to the water fund by individual households

Average monthly household contributions (USD)	% frequency (N = 33)
≤0	9
≥0.1–≤0.5	76
≥0.6–≤1	12
≥1.1	3
Total	100

*Local currency converted to USD at a rate of 1:30 as at January 2020.

(ZINWA) is in charge (Figure 5). CBM therefore emerges as the most popular management system for the majority of the PWS.

The FGD held with the PMT established that, whatever model pre-existed, the new arrangement was expected to strengthen the governance system for the scheme in question and ultimately guarantee a reduction in down time in case of any breakdowns.

Setting up of water point committees

Results from the questionnaire administered revealed that 100% of the schemes targeted had WPCs appointed and trained through the project. In 60% of the schemes, women occupied key leadership positions of chairperson, secretary and treasurer. From the various interviews held

with officials from Local Authorities, it emerged that selection of members into the WPCs is a responsibility of the community of users. Higher level structures only play an advisory role. The study results revealed that the majority of WPC members were chosen based on their influence politically, religiously or socially. Some 16.32% of the WPC members running the affairs of the schemes were found to be illiterate. Of the 16.32% illiterate members, 31.25% of them were occupying strategic positions of committee secretary or treasurer.

Water demand management (WDM)

Questionnaires administered across all the 33 schemes confirmed that WPCs had received some basic training in WDM; 90.9% of the committees had records of their water users listed by household name, number of people per household and alternative uses of water by individual households. In 6.06% of the schemes, WPCs had gone to an extent of installing bulk water meters at all their strategic reservoirs to track abstractions including monitoring daily water collections by individual households. The results also indicated that in 66.67% of the schemes (Table 3), water was being used for other purposes outside domestic and institutional use.

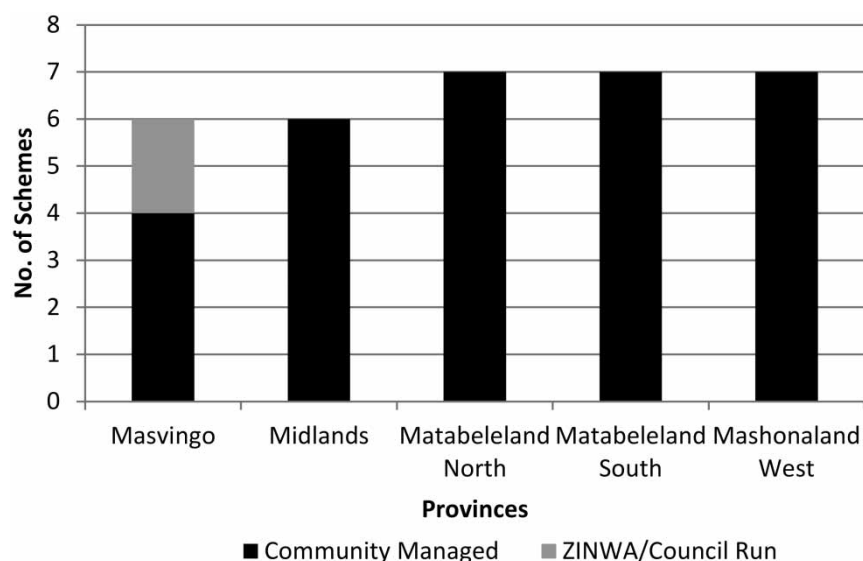
**Figure 5** | Management style for PWS.

Table 3 | Primary water uses

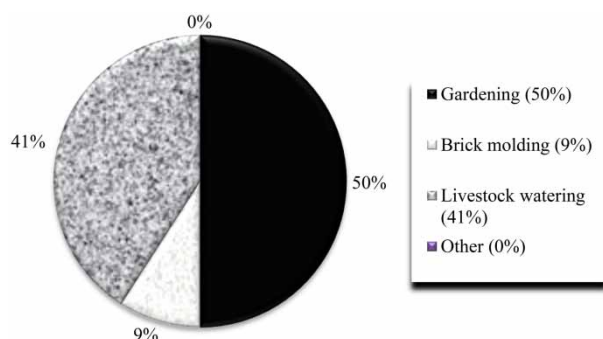
Uses	Score	%
Domestic (drinking water and other household activities) only	3	9.09
Domestic and institutional (drinking water and other household activities) only	8	24.24
Domestic and other livelihood activities	22	66.67

Of the 22 schemes where water was being put to multiple uses outside domestic, the most prominent activity was gardening, followed by livestock watering and brick moulding as summarized in [Figure 6](#).

These livelihood activities helped raise additional income and food reserves needed by communities to sustain life at the household level. Gardening scored highly in Masvingo, Midlands and Mashonaland West while livestock watering scored highly in the two livestock regions of Matabeleland North and South.

Operation and maintenance of piped water schemes

Results from a questionnaire administered across all the 33 districts established that on commissioning, 100% of the schemes had access to a trained pump operative. Interviews with DDF indicated that all contractors were mandated to facilitate on the job training for at least one pump operative per scheme identified from amongst the community of users. This cadre was expected to assist with regular system maintenance, trouble shooting and repairs in case of any technical breakdowns. However, the RWP evaluation report confirmed that in 55% of the schemes, pump

**Figure 6** | Alternative uses of water.

operatives have long since disengaged and their role was taken over by WPCs. Failure by schemes to meet the running costs for pump operatives was cited as one major reason for the drop outs.

Establishment of sustainable cost recovery mechanisms for PWS

Interviews held with DDF officers from the five project provinces revealed that in as much as communities demand access to a safely managed water service, very few are keen to contribute towards maintenance of the same. Currently, O&M user fees being charged across the five provinces do not commensurate with the costs of running the schemes. Study results confirm a decline in user fees levied on individual households between the years 2018 and 2020 ([Figure 7](#)). Matabeleland South Province has the least average household user fees charged between the two years with USD0.45 (February 2018) and USD0.16 (February 2020). Communities in Matabeleland South Province confirmed that O&M bills for many of their RWS systems are met by their diaspora children through set associations. In that regard, their monthly contributions were just meant to cover other petty issues.

Across all the five provinces, the study findings also indicated that regardless of the very low user fees being charged, some 6.2% of the total beneficiary households still fail to honour their monthly contributions.

DISCUSSION

Targeting of schemes for rehabilitation plays a critical role in determining the sustainability of those water points moving forward. [Kelly et al. \(2017\)](#) reiterated that this component is vital in low- and middle-income countries where water supply systems in rural areas are community-managed. One observed weakness with the RWP's protocol for targeting schemes for rehabilitation was its bias towards technical aspects of the schemes at the expense of the social component critical in defining ownership and ultimately sustainability of the schemes. [Kelly et al. \(2017\)](#) postulates that sense of ownership plays a role in organizing and

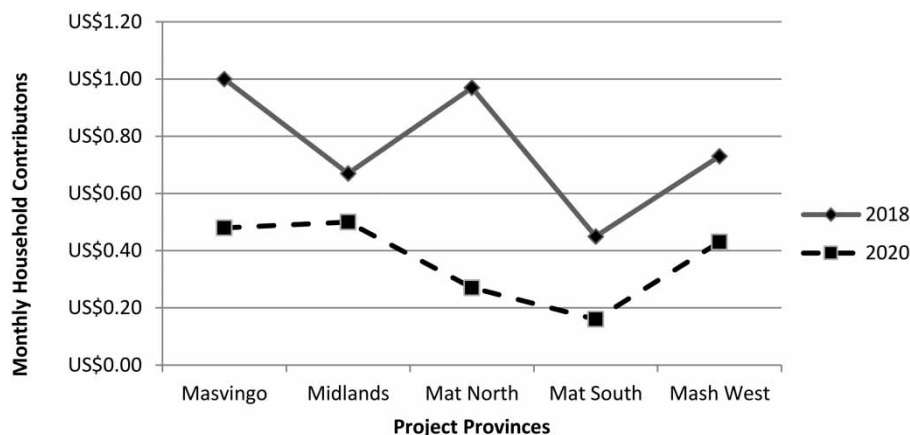


Figure 7 | Average household user fee-contributions across provinces.

enabling water system decision making processes including resource mobilization.

The bulk of the schemes targeted for rehabilitation under the RWP exhibited negligible evidence suggesting a preceding demand for the scheme from the community of users. One would assume some prior level of initiative from the community such as an expressed demand submitted to the respective local authority or communities already starting to self-mobilize resources to complement any external funding that may arise. Targeting existing broken down water points requiring rehabilitation without instituting a strong social intervention is a major drawback to sustainability of many RWS systems (Kativhu 2016). The persistent lack of meaningful ownership of the investment by beneficiaries across a number of PWS ultimately affects effective and efficient service delivery.

Analysis of findings on functionality of CMPWS revealed that communities preferred solar-powered water supply systems (WSS) at the expense of electricity or diesel-powered ones, which they alleged to have very high running costs. This explains the current high failure rate recorded amongst electricity and diesel-powered pumps with the balance also struggling to function normally. Hunter *et al.* (2010) asserts that regular and long down time of WSS often compromise the intended benefits of time-savings for other productive ventures and improved health and nutrition on the part of beneficiary communities.

Being able to understand relative drivers of the existing functionality of RWS systems is essential for future

interventions to deliver water supply services of lasting benefit (Bonsor *et al.* 2018). For this to happen, the sector needs to set an agreed definition of water point functionality. Debus (2014) stated that ‘functionality’ can be assessed using a sustainability indicator which checks if the lifting device is functional and able to provide a basic level of service. This indicator is more relevant than a mere functionality check because it aggregates several factors defining service level, viz water quality, quantity, continuity of service, accessibility and user-friendliness. Currently it is difficult to compare existing estimates of functionality accurately (Banks & Furey 2016) though there is now a growing research community focussed on standardizing definitions.

The issue of sustainability of RWS systems has preoccupied the National Action Committee for WASH throughout the lifetime of the integrated rural water and sanitation programme (GoZ 2012). At the community level, an effective, efficient and reliable O&M system for CMPWS is measured by the presence of a fully financed water point fund. An analysis of the figures currently being contributed by water users across various schemes exhibits a highly precarious situation. The figures involved fall far too short of what will be needed to meet a modest bill for rehabilitation. In similar research by Domínguez *et al.* (2016), funds contributed by communities are only sufficient to settle bills for minor repairs, but not for the improvements required by the system in terms of infrastructure and O&M. He went on further to illuminate that in most cases, WPCs make gross under budgets of the total costs of providing a service

including wages for staff, O&M costs and depreciation, all of which compromises the sustainability of water points.

Outside the issue of finances, social capital is also fundamental in enhancing the sustainability of RWS systems and becomes handy when dealing with complicated systems like PWS. Its major elements include civic networks, norms of reciprocity, and generalized trust (Bhandari & Yasunobu 2009). The whole notion of social capital is centred on community social relationships. Across the 33 districts, the social fabric connecting water users has been weakened by years of non-functionality of the schemes. This has been made worse by the fact that a number of the schemes served in excess of one ward. This brought in a number of heterogeneity issues compromising resilience and further growth of social capital. Kelly *et al.* (2017) argued that social capital and sense of ownership are inherently linked through community participation and can therefore interact to magnify or undermine each other's effects. Her theoretical framework further claims that social-capital and sense of ownership can have broader effects on socio-economic and gender equality in rural communities by creating opportunities for alternative resource mobilization.

A management regime for PWS also plays a central role in their sustainability. In as much as the selection of WPCs was a guided exercise, an analysis of the leadership selection process presented some striking gaps. The process was a rushed exercise completed during community sensitizations and later followed by a half day of capacity building of the elected members. The fact that the whole process left some loopholes, allowing incompetent but influential members of the community to secure management positions in the WPC, explains the reason why in most cases WPCs struggle to deliver, no matter how simple and straightforward the assignment may appear. Hutchings *et al.* (2015) stated that the success of CMPWS depends on the level and quality of management instituted to lead and direct its operations. The WPC is usually considered the central nerve where success or failure of the scheme is determined. The selection of incompetent members into the committee constrain decision making as, more often than not, the members in question overlook a number of critical management issues pertinent to the sustainability of their respective schemes (Hoko *et al.* 2009).

The degree to which a WSS fulfils its public health function is a direct variant of the efficiency and effectiveness of the overall management system in place. This is exhibited in a number of ways, one of which is WDM. A research by Kativhu (2016) revealed that where WPCs operate without assertive WDM plans, individual households' demand for water tends to increase exponentially. This explains why study results indicate a continued engagement of communities in alternative uses of water once their desire for water for domestic use is fulfilled. Communities have a general perception that ground water is infinite and water rationing is therefore illogical. This school of thought is a colossal management challenge when dealing with common property resources (Hardin 1968).

Climate change has of late started showing its negative effects on the water table, as evidenced by a sudden recession in ground water levels. Some boreholes which used to be prolific have since started reducing yield (GoZ 2016). This development is a direct consequence of climate change that the sector ought to start planning for, to avert future disasters in RWS. Water users at the community level need to be educated on the importance and value of water WDM while WPCs need to be skilled on the various spatial and temporal WDM strategies that can be employed without necessarily creating conflicts and divisions amongst the water users. Evidence from the national rural WASH information management system (RWIMS) indicates that for Mashonaland Central Province alone, 31.47% of the total boreholes enumerated have started reducing yield whilst 5.95% have dried up completely (Figure 8).

GoZ (2020) claims that a total of 23.6% of the over 336,000 rural households relying on ground water supplies in Mashonaland Central are affected by their water points drying up or reducing yield. Beyond this issue of ground water potential, the WHO/UNICEF Joint Monitoring Programme for Water Supply & Sanitation (2008) also restated that overindulgence of the pumping mechanism due to weak WDM strategies at play often results in regular system breakdown with a striking increase in the O&M bill, all to the detriment of water users.

An effective O&M system is vital in enhancing the sustainability of CMPWS. This is why the RWP had taken some time, effort and resources investing in capacity building of community level structures. Many schemes collapse a few

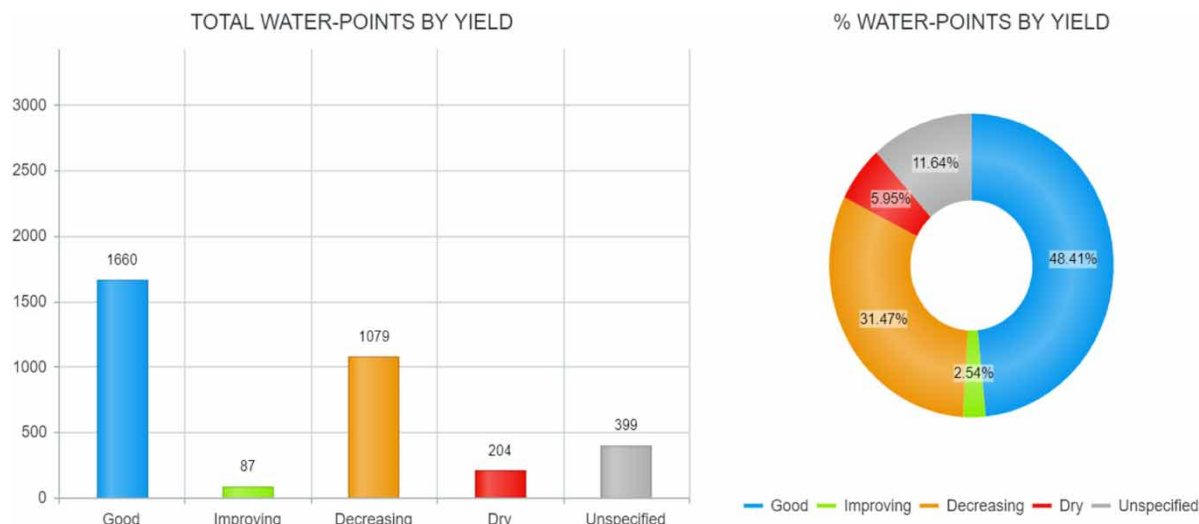


Figure 8 | Yield status of RWS systems in Mashonaland Central Province (GoZ 2020).

years after commissioning due to poor O&M. However, it is also imperative to note that O&M issues are not only technical, but also span across managerial, social, financial and institutional horizons (Hoko *et al.* 2009). Many schemes that were found struggling at the time of data collection exhibited some traces of poor planning, management and coordination.

Muneri (2015) also brought out cost recovery as a key determinant factor to successful O&M including long term sustainability of CMPWS. A weak cost recovery mechanism is one major obstacle in achieving sustainable drinking WSS in rural Zimbabwe. Under the RWP, just like many other preceding programmes, WPCs are advised on the need to establish a water point fund and levy water users monthly fees for O&M. Beyond this, very little to no guidance is given to WPCs on how to peg user fees, strengthen effectiveness of the collection system and most importantly how to vary user fees with changes in consumption levels. Domínguez *et al.* (2016) claimed that in most cases, a 'blind tariff' system is applied where water users are levied a uniform fee regardless of the volume of water consumed. In such a scenario, system breakdown in the future is unlikely to be resolved using the local water fund. All this tends to prolong downtime of water points and ultimately frustrate user communities, forcing them to resort to alternative water sources, many of which are unprotected and a danger to health.

CONCLUSION AND RECOMMENDATIONS

The study presents an insecure situation regarding the future of CMPWS as a model for rural water supply. Considering that access to safe water is now a recognized human right nationally and the world over, urgent action is needed to remedy the status-quo.

The study findings highlight some salient points critical in understanding and hopefully working out strategies to ensure the sustainability of PWS. First, it highlights the general functionality issues around CMPWS. The failure rate is glaringly high amongst electricity and diesel-powered schemes, the core reasons being high running costs and erratic supply of diesel and electricity in the market which affects the water pumping efficiency. It is therefore recommended that government goes to scale with solar-powered PWS whose running costs drop drastically post-implementation.

Second, targeting of schemes for rehabilitation is a key determinant factor for the sustainability of RWS systems. Rehabilitation of CMPWS ought to be carried out under the guidance the key principles of a demand-responsive approach to rural development. When establishing a CMPWS, the selection criteria ought to prioritize communities already in demand for water and then establish how best to set up a scheme together. That way, the already

existing demand would guarantee ownership of the scheme and assure future support towards requisite O&M.

Third is also the issue of social capital, which is a function of community social relations. The fact that the CMPWS model works through CBM means that individual households and their relationships play a pivotal role in the future operations of the PWS. Before setting up any scheme, responsible authorities ought to institute a thorough assessment of the level of social capital existing amongst targeted beneficiaries. Whatever comes out of that assessment is what then defines a community. In cases where social capital is highly compromised, it is better to invest in reconstruction of the social fabric first before any operations. The danger of ignoring these issues is that they always manifest themselves during the operational phase, compromising an enabling environment for sustainability of the schemes.

Fourth is the issue of water demand management. More often than not, communities treat water as an infinite, free access resource. However, with the current climate change issues, evidence clearly presents a recession in water tables calling for an urgent need to strengthen monitoring of who gets the resource, when and how. WPCs thus now need to be exposed to special training in critical thinking, allowing them to articulate complexities in the management of intricate water supply issues like WDM. The fact that user fees currently being levied on water users by WPCs are not guided by household water consumption is in itself a missed opportunity to enforce water saving while at the same time maximizing revenue collection.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

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