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All systems go!

Keeping community-managed handpump systems going

Paper for the WASH systems symposium

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Investigating why handpumps fail, and asking that question at too general a level, may be less useful than asking the more positive question, 'What does it take to keep handpumps working?' and applying that question to the specific circumstances of each individual water point. This paper takes such an approach, first proposing a framework of elements that need to be in place for continued handpump functioning, then turning this into a diagnostic device for assessing the health of individual water points. The diagnostic instrument needs to be modified for the local context and applied with intelligence. The paper is based on an extensive but unsystematic body of field experience, observations and discussions, and so stands open to the charge of being insufficiently evidence-based. To address this I propose that the framework be tested using the large data sets on functionality that are emerging from academic research projects. Overall, the framework represents an improvement over analyses that merely list the well-known contributors to breakdown, long-term non-functionality and eventual abandonment of water points. Finally a simplified and memorable model ("4M") is used to summarise the major points.

Introduction

In the 2010 IRC Symposium, I co-authored a paper on the financial viability of community-managed handpumps as water supply points (Carter et al., 2010). The approach taken in that paper – a combination of conceptual framing with semi-structured (but long-term) observations and conversations in the field – could have been criticised for being subjective and anecdotal; but subsequent detailed research (Foster and Hope, 2016, 2017) has borne out its main contentions, while going much further to extend our understanding. Encouraged by this, I propose a similar approach here.

The overall topic of community-managed handpumps remains unchanged from the 2010 paper. The question addressed, however, is broader: What does it take to keep the basic water services provided by such water points working? Part of this requires a consideration of why such water points fail; but that is not the emphasis of this paper. My intention is to contribute in a small way to improving that part of the WASH system (IRC, 2017) that operates at community level, primarily in rural areas. From the system perspective, a new realism is needed about recurrent financing of services. Moreover, the management of water supply infrastructure by communities and support organisations needs to experience a step-change in seriousness if point water sources are to continue to play a key role in rural water services – and they must.

In the past few years we have seen a growing body of academic and grey literature on water point functionality and failure. Wilson et al. (2016), in an early publication from the Hidden Crisis project (UPGro, n.d.) reviewed 111 such documents. Most of this literature attempts either to quantify the magnitude of the non-functionality problem or to address why water points fail, but few papers offer explanatory conceptual frameworks, preferring instead to explore the strength of correlation between functionality and a plethora of well-known contributing factors to non-functionality.

A focus on failures and the causes of failure is useful up to a point. But arguably a more constructive and revealing approach is to ask what factors need to be in place to keep water services working.
The general question about water point failures – Why do water points fail? – is actually rather meaningless (although I confess to having asked it, and tried to answer it). It's a little like asking why people get sick, or why cars break down, or why aircraft crash. It is too general a question to permit a useful answer. Why a particular person got sick on a particular occasion, or why a particular water point broke down when it did (and what happened before and after that event) are much more useful questions.

In this paper I mainly have in mind boreholes with handpumps, often referred to in what follows as water points. I am also mainly interested in the context of sub-Saharan Africa, whence most of my experience derives. Some of the thinking may apply more widely, but that is for the reader to judge.

A final note in this introduction – I do not claim to have found any new notes to grace the music of WASH thinking. I have merely re-arranged the existing notes into a slightly different tune. I hope it may harmonise with the experiences of at least some who hear it.

Water point failure

Much of the literature on the topic of water point failure is loose in its terminology, referring to failure without being clear about whether non-functionality is temporary or permanent. If the failure is truly permanent, then the water point should be described as abandoned. (And even that term needs definition – for how long must a water point be out of service to count as abandoned? The Hidden Crisis project uses a period of one year of downtime to signify de facto abandonment.) The issue of functionality has been discussed by Carter and Ross (2016) and Whaley and Cleaver (2017). Among various research and mapping initiatives, the Hidden Crisis project (UPGro, n.d.) is publishing findings on non-functionality, together with definitions, methods, and data that will greatly inform our understanding of this subject over the next few years (Wilson et al., 2016; Kebede et al., 2017; Mwathunga et al., 2017; Owor et al., 2017; Bonsor et al., 2018).

All civil, mechanical and social infrastructure is prone to breakdown sooner or later. Occasionally, under very peculiar and favourable circumstances, something lasts and continues to serve or perform as it was intended. A happy marriage lasts for seventy years; a long peace prevails within a country or between countries; a vintage car or aircraft still works many decades after it was built; a handpump is still functional after 30–40 years. But these cases are exceptional. The norm is that 'things fall apart' sooner or later. Breakdown – the term used in this paper to refer to service failure of a water point – is normal, to be expected, and to be planned for. It need not be permanent, and this paper explores how to avoid its being so.

Preventing and dealing with breakdown

In community-based water point management, communities can put in place several measures to prevent or delay breakdown. However, regardless of how effective those measures are, eventually the service provided by the water point will break down. The response of the water user community at that point and over the coming days determines whether non-functionality is a temporary affair (rapid recovery from a short-term illness, to use the human illness analogy) or leads to permanent abandonment (the demise of the patient). The conceptual framework presented later in the paper includes both preventive measures and responsive factors. It assumes that communities can manage their water points, but only to a certain extent; some aspects of water point breakdown simply cannot be dealt with by water users in the absence of external support, and the responsiveness of that support is crucial. This reflects a wide body of opinion, including experience enshrined in Schouten and Moriarty's (2003) important book, Baumann's (2006) community-management-plus model, and echoed in other subsequent literature, if somewhat stridently at times (e.g., Chowns, 2015).

Approach

In this paper I first set out a conceptual framework that includes the main factors necessary for minimising the occurrence of handpump breakdowns, and for dealing with them when they occur. The conceptual framework is not built from an extensive body of scientific data, but rather from the four decades of experience of this author, combined with numerous discussions with community members, field workers and professional colleagues. In a sense, the articulation of the conceptual framework is an attempt to translate a body of tacit knowledge (Polanyi, 1958) into explicit knowledge. The tacit knowledge that underpins the conceptual framework is informed by the academic and grey literature, some of which has already been cited. But the assembly of the conceptual framework has more in common with a creative design process described, for example, by Whelan et al. (2017).

The intention of this approach is to provide a possible framing for some of the questions that can be asked of, and answered by, analysis of large data sets. It is my view that unless the right conceptual framework (or something close to it) informs the right investigative questions, large bodies of data on functionality, management arrangements, financing and related aspects of rural water services will continue to conceal their secrets. It is for others to test the validity of the framework presented here, and I encourage them to do so.

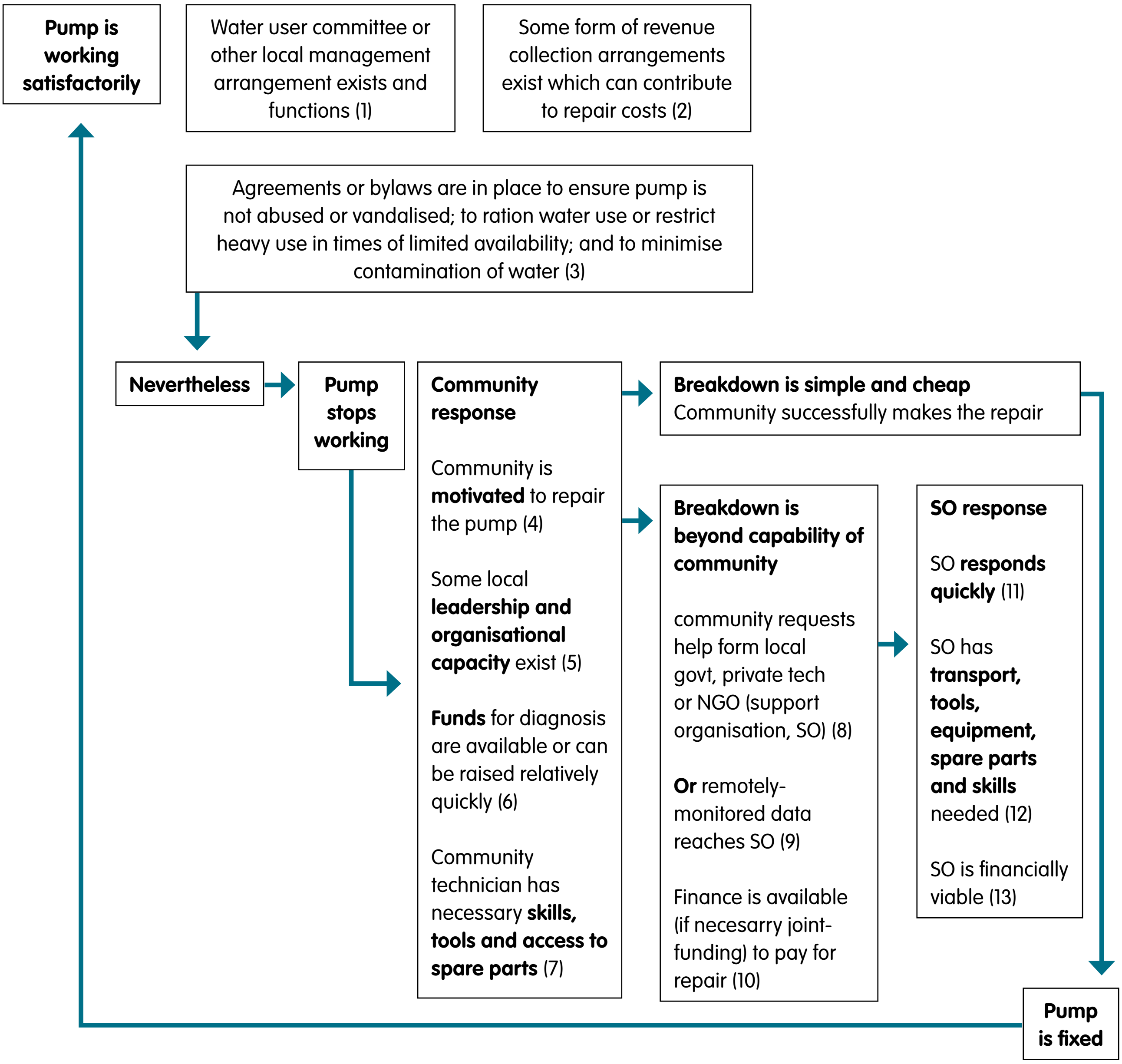
A conceptual framework for keeping water points working

Figure 1 sets out the proposed conceptual framework. The numbers in the cells refer to the notes and the explanatory text that follows.

Assuming that the water point is working and delivering at least a reasonable or acceptable standard of service (in turn implying that its yield, accessibility, reliability and water quality are acceptable to the users), the community can attempt to prevent or delay water point breakdown by having three measures in place. These are summarised in boxes (1) – (3) in the figure.

It is important to reiterate though that however good those arrangements are, sooner or later the water point will break down. What happens next is crucial.

FIGURE 1. KEEPING THE PUMP WORKING AND FIXING IT WHEN THE INEVITABLE HAPPENS



Given a certain level of motivation on the part of the community (4), sufficient leadership (either through formal or informal means) (5), the ability to mobilise sufficient funds (6), and the physical means and skills available (7), the water users may be able to effect a minor repair. In this case, downtime is likely to be short, and a non-functional water point is restored to use relatively quickly.

If the breakdown – which may be a physical breakdown or breakdown of access, perhaps because of conflict – is too difficult for the community to manage, a number of things need to happen. First a call for help needs to go out, either by normal communication channels (8) or perhaps through an alert sent by a sensor on a handpump (9). Funds must be available, if necessary through cost-sharing by water users and the support organisation, to pay for the repair (10). Some, including myself, would argue that major repairs or interventions should be subsidised by national governments, but this is not always the case at present. A backstop organisation, referred to here as the support organisation must exist, respond promptly (11), and have the resources and skills to address the problem (12). For this community management–plus model to continue working, the support organisation must be financially viable (13). If the problem is too difficult for the support organisation to fix, it is likely that the water point will stay out of service and eventually be abandoned (not shown in the figure). The numbered items are elaborated further here:

1. Some form of **community management arrangement** must exist. This may be a local modification of an externally introduced water user committee, or it may be an adjunct to pre-existing community leadership

structures. The essential points are that it should be clear about its roles, that it should have recognition and authority both within and beyond the community, and that it should have the competence to fulfil its duties effectively.

2. Whether or not the community is able to cover the full life-cycle costs (Fonseca et al, 2010) of their water point (most likely not in low-income communities), some form of **revenue generation** must exist, if only to enable replacement of low-cost, fast-moving spare parts. The shortfall between minor maintenance expenditures (which most communities can cover) and capital maintenance costs (which they mostly cannot afford) is an issue of major importance that lies beyond the scope of this paper. The failure of governments to address that gap is a fundamental abrogation of their obligations under the human rights accords to which most nation states have committed themselves.
3. The local context around each water point is different, and those responsible for its management may have to deal with threats posed by children (using the pump as play apparatus), vandals, thieves or livestock. Over-use of water for non-domestic purposes (in the case of low-yielding or seasonally low-yielding water points) may need to be managed. Threats to water quality posed by nearby open defecation, latrine construction, grazing or livestock watering may need to be addressed. Each situation is different, but the community needs to be able to set in place **rules or bylaws** to mitigate risks. The management arrangement must also include physical, social and financial measures to ensure access by all, if ambitions for sustainability **and** inclusion are to be realised simultaneously.
4. **Community motivation** to repair the water point depends on many factors, including the availability and accessibility of alternative sources, the yield and water quality of the broken water point and the time of year (in relation to income, for example). User motivation is an essential pre-requisite (but not a sufficient condition) for the water point to be repaired, unless the repair service is undertaken entirely by a service provider, with no requirement for community involvement.
5. **Leadership and organisational capacity.** Some capability to lead, mobilise community members, and if necessary engage with external support organisations is also a necessary pre-requisite for the water point to be repaired.
6. **Funds** to cover spare parts and the costs incurred by support organisations are clearly crucial. No funds, no repairs. There may be a bank account with savings already set aside, or alternatively funds can be raised in direct response to the breakdown. This too is a fundamental pre-requisite for repair to be effected.
7. **Skills, tools and spare parts** need to be possessed by community technicians who attempt pump repairs. A significant obstacle is often the non-availability of spare parts within reasonable proximity of communities (thus requiring high travel costs).
8. If a repair is beyond the capability or resources of the community, outside help is needed. Communities will take the trouble to **call for assistance** only (a) if they are motivated to fix the water point and (b) if they believe the local government, private entity or NGO to whom they report will actually respond. They also need to know whom to call.
9. Several organisations are now trialling **instrumentation** that transmits some aspect of the handpump performance to satellite or over the mobile phone network. The hope is that such remote monitoring can provide the information needed by support organisations to improve their speed of response – and even to take pre-emptive action if a handpump is showing deterioration in performance.
10. In the event of a major repair, the water users may be unable or unwilling to pay for the necessary replacement part(s). In many cases a lack of trust in outsiders means that they are **reluctant to pay** a private support organisation the full direct costs of transport, its overhead and a small profit.
11. Whether the support organisation is local government, private sector or NGO, downtime can be minimised only if **response** is rapid.
12. Technicians providing backstopping to communities need the requisite **transport, skills, tools and equipment, and ready access to spare parts.** They may also need working capital to pre-finance repair activities prior to communities refunding their costs.
13. Private support organisations need a sufficient volume of business and the ability to charge adequate fees to enable them to be **financially viable** – otherwise they will go out of business.

From framework to diagnostic instrument

The framework lends itself to the creation of a diagnostic checklist, not so much for diagnosing causes of failure – although it can be used for that – but rather for carrying out a simple health check when the water point is still working. Used in this way, it may flag possible risks or indicate how arrangements and conditions that prevailed at the last check-up have subsequently improved or deteriorated. To use the human patient analogy again, when a health check shows raised blood pressure or increased weight compared with the last check, alarm bells may ring, and pre-emptive action can be taken.

Element / questions	Assessment
(1) Is there a functioning water point management arrangement at the community level that is clear about its roles, has recognition and authority both within and beyond the community, and is competent to fulfil its duties effectively?	
(2) Is there an agreed and functioning revenue collection arrangement in place, even if it is only sufficient to cover minor repairs?	
(3) Has the community leadership agreed on rules for water point management, which can address context-specific risks (such as abuse of the pump by children, vandalism or theft) to the water point?	
(4) In case of breakdown, how strong is the motivation of the community to attempt a repair? Are there readily accessible alternative sources of water that may inhibit such motivation?	
(5) Is there sufficient leadership within the community to organise and attempt a repair? Is there the organisational capacity to mobilise community members as necessary?	
(6) Are funds available, or can they be raised quickly, to pay for repairs carried out by the community?	
(7) Does the community actually possess the skills and tools to effect a simple repair? Can the community readily access spare parts?	
(8) In the case of a breakdown that is beyond the community's capacity, are the water users motivated to request external assistance from a designated support organisation?	
(9) If handpump performance is monitored remotely using sensors, is this system reliable at informing the designated support organisation?	
(10) Are funds available, or can they be raised quickly, to cover the costs of major repairs? These funds may originate from within the community, or outside, or a combination. Does local government provide financial or in-kind support for major repairs (capital maintenance)?	
(11) In case of call-out, does the designated support organisation respond quickly?	
(12) Does the designated support organisation have the transport, skills, tools and access to spares it needs to perform effectively?	
(13) Is the designated support organisation viable financially? Does it have a long enough contract or mandate to ensure continuity of service?	

The use of the elements in the conceptual framework in this way requires intelligence, not simply the blind application of a generic tool. The elements included in Figure 1 are generic, but their expression locally is very context specific. Table 1 sets out the diagnostic questions that naturally arise from Figure 1. The assessment column can be colour-shaded (red-amber-green) to flag the critical elements in a particular case.

What all this means for WASH systems

IRC and its partners in Agenda for Change believe that reliable and sustainable WASH services can only be delivered by strong and resilient national and local WASH systems (IRC, 2017). They define such systems as 'the networks of people, institutions, hardware and resources necessary to deliver services.' In this paper I have considered, explicitly or implicitly, all four of these aspects. A further short discussion follows.

People

The local community that enjoys the use of a water point has primary responsibility for its management. Unless and until rural utilities take over this management role – a distant prospect in much of sub-Saharan Africa – thereby transforming water users into paying customers, that responsibility will continue to rest with communities.

Institutions

I have emphasised the importance of institutions – organisations and how they function and relate to each other – not only within the community but beyond it. For community-managed water points, the back-stopping provided by local support organisations, be they public, private or civil society organisations, is crucial. The rules need to be clear, and the competence and quality of support highly professional.

Hardware

The quality of hardware matters, and matters a lot. There is enough field experience and published evidence to this effect to make it unquestionable. Communities cannot realistically be expected to manage shoddy hardware; however, give them high-quality physical assets, and the management task described in this paper is considerably easier.

Resources

Resources, especially financial resources, are fundamental. It is unrealistic to expect communities to pay more for water services than a few percent of their disposable cash income (a total amount that is usually considerably smaller than a notional poverty-line income, which is usually dominated by in-kind subsistence income). It is equally unreasonable for national governments to devolve responsibilities for community support to local governments, and then starve them of the necessary financial resources and personnel to deliver on their mandate.

Conclusions

The conceptual framework in this paper (Figure 1) arranges the key elements needed to keep water points working in order to show the relationships between them. In this way, the framework is an advance on simple lists or sets of 'building blocks'. Table 1 then goes on to arrange the elements as a diagnostic framework, which can be used either to monitor the health of the management arrangements, or to identify those factors that contributed to water point breakdown or abandonment in particular cases. Both must be used with intelligence and insight.

To summarise the message of this paper, the elements of the conceptual framework can be readily combined into a chain consisting of four links (Figure 2).

The first is **motivation** – the extent to which the community is committed to keeping the water point working, and arranging its repair when it, or some component of the service which it provides, does inevitably break down. Elements (3), (4) and (8) in the framework relate to this aspect.

The second link is **money** – the availability of funds to pay for spare parts and technician time, whether the repair is undertaken by the community or, in the case of a major repair, by a support organisation. In the framework this aspect is highlighted at elements (2), (6), (10) and (13).

The third link is an effective **maintenance** system – skills, spare parts, tools and transport to enable repairs to be undertaken. This appears as elements (1), (5), (7) and (12) in the framework.

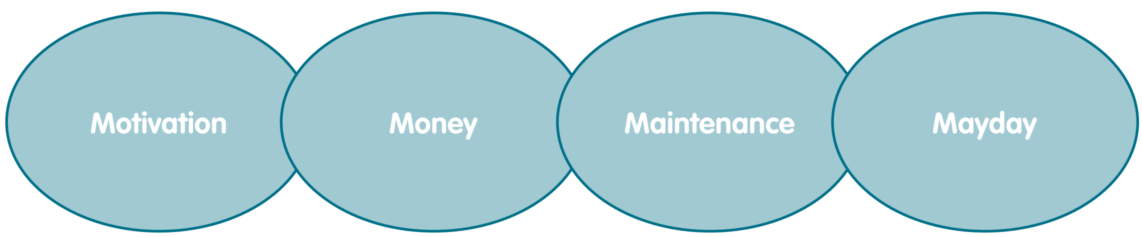
The fourth link I have called **mayday** (the international distress signal), to signify that the community is calling for external assistance. I have stressed in this paper the inevitability of breakdown, sooner or later. The second inevitability is that eventually something will happen that the community is unable to resolve – whether that is a conflict, a breakdown of trust or a major physical breakdown. In this case, a responsive, effective support organisation needs to provide backstopping to the community: elements (9) and (11).

As with a real chain, the breakage of any one link leads to breakage of the chain itself. Hence each breakdown, like each human illness or each aircraft crash, has its unique combination of contextual and causal reasons.

Acknowledgements

I would like to extend thanks to the many colleagues, community members and friends who have helped me gradually crystallise my thinking on the sustainability of services provided by rural community-managed water points. This paper is far from being the last word on the topic, but I hope it makes sense to those who are striving for sustainability in basic water services. At this time in particular I gratefully acknowledge conversations with colleagues in the UPGro Hidden Crisis project, especially Vincent Casey and Luke Whaley. My thanks also to Tim Foster for stimulating discussions which often seem to take place while queuing for lunch at conferences. I would like to thank Mario Milanesi and colleagues at Charity Water for stimulating conversations in 2017 in Tigray, northern Ethiopia. All views in this paper and any flaws in my ideas are my responsibility alone.

FIGURE 2. THE FOUR 'M' MODEL OF WATER POINT MANAGEMENT



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