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User financing of rural handpump water services

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Abstract

It is probable that at least one billion people rely on water supplied by handpumps. Over the last 20 years it may be that double that number of handpumps has been installed in Africa and Asia. Hundreds of thousands have fallen into disrepair. Many provide unreliable services. At any one time about one third of all handpumps which are supposed to be in service are not. Numerous issues contribute to this failure of handpumps to provide sustainable services, but the adequacy of financial flows to cover recurrent costs is fundamental. This paper focuses on the financial viability of handpump water supply services, while placing this topic within the wider picture of water supply service sustainability. We take Len Abrams' definition of sustainability ("... continues to work over time") as the starting point, with all that this apparently simple phrase implies. Functionality data and estimates provide a snapshot of the state of services at a particular moment in time, but they cannot on their own tell us about the underlying reasons for the sustainability or otherwise of a service.We briefly present a conceptual framework for sustainable water supply services, which is fully consistent with the "community management plus" model of Baumann (2006). We highlight two key requirements for sustainability, namely financial viability (the main subject of this paper) and external support (including recurrent cost-sharing with water users by Government). We show that the typical revenues raised in rural communities served by handpumps (in the order of USD30-40 per year) may be sufficient for minor repairs and preventive maintenance, but that these sums are insufficient to cover the full life cycle costs, which Baumann estimates as about 7 times this figure.There is a mismatch between the aspirations of the water supply professions and user communities, on one hand, and on the other the ability or willingness of those same players to pay for the full costs of the service. Until this gap is bridged, sustainable handpump services may remain a dream.We conclude by calling on all players to recognise the importance of financial viability, and to design appropriate cost-sharing arrangements to enable sustainable service provision. We recommend more in-depth research into the true life cycle costs of handpumps, including the variability of those costs across countries, across technologies and within the same country and technology. We need to understand much more about the experiences of communities with handpump maintenance. And finally we recommend programmes of action research around innovative mechanisms for revenue generation, and alternative approaches to O&M supportwhich are not simply based on individual communities' responsibilities for their own handpumps.

Keywords

Sustainability, handpumps, rural water supply

INTRODUCTION

Many rural water supplies delivered by handpumps in low-income countries fail to provide reliable services, and a significant proportion break down and remain abandoned. The sustainability of such services is a challenge which professionals in the sector have known about for many years, but this challenge is only now being faced squarely by a number of influential organisations including the Rural Water Supply Network (RWSN, 2009), IRC (Schouten and Moriarty, 2003), Water for People (Breslin, 2010) and WaterAid (2010).

This paper uses the following working definition of sustainability, modified from a simple statement proposed some years ago by Len Abrams (Abrams, 2000). This is the approach taken in WaterAid's strategic framework for WASH sustainability (WaterAid, 2010).

> *Sustainability is about whether or not WASH services and good hygiene practices continue to work over time. No time limit is set on those continued services and accompanying behaviour changes. In other words, sustainability is about <u>permanent</u> beneficial change in WASH services and hygiene practices.*

As Abrams points out, "*if the water flows, then all of the many elements which are required for sustainability must have been in place. There must have been money for recurring expenses and for the occasional repair, there must have been acceptance from the consumers of the service, the source supplying the service must have been adequate, the design must have been properly done, and there must have been sound construction*."

Functionality is not the same as sustainability. It is a simple snapshot view of whether or not water supply systems are working at the time of inspection. It cannot on its own tell us anything about the reasons for the particular state that the water point is in, or why it may be providing an adequate service, intermittent service or no service at all. Functionality data are of limited value, but they are often the best indication we have of inadequacies in sustainable service provision.

Sustainability is about the inter-relationships of natural resources, physical assets and the services they provide; the people and organisations which use and manage them; and the rules and financial systems which facilitate effective management. Functionality on the other hand is about whether (and where degrees of service are possible, to what extent) a service is operating at a particular point in time. The partial functionality or non-functionality of a service may provide a trigger for more detailed investigations of sustainability, although as we point out in the paper, too few such investigations actually take place.

Why focus on handpumps?

The number of people in low- and middle-income countries who rely on groundwater, and specifically on handpumps, is unknown, but undoubtedly very high. An estimate of those using groundwater (delivered by motorised pumps and handpumps) was made by Cranfield University and others (2006), a figure of 1.75-2.0bn. It is likely that the majority of these people, certainly well over 1bn, depend on handpumps. Baumann (2009) estimated that 600,000-800,000 handpumps have been installed in Africa in the last 20 years. The corresponding figures for Asia are likely to be at least as high. If these figures are realistic, it is probable that only a minority are still functioning at the present time.

A recent study for UNICEF (Sansom and Koestler) has estimated that about 60,000 handpumps are installed annually in sub-Saharan Africa. In India, the largest groundwater user in the world, it is estimated (World Bank, 2010) that 85% of drinking water is groundwater dependent. Exactly how much of this abstraction is carried out by handpumps, and how many continue to be installed annually, is unclear. However it is evident that across sub-Saharan Africa and much of Asia, but especially in the former, handpump water supplies will continue to be a major contributor to rural water services for the foreseeable future.

Handpump functionality

RWSN recently published estimates of handpump functionality for 20 countries in sub-Saharan Africa. These data are presented in Figure 1.

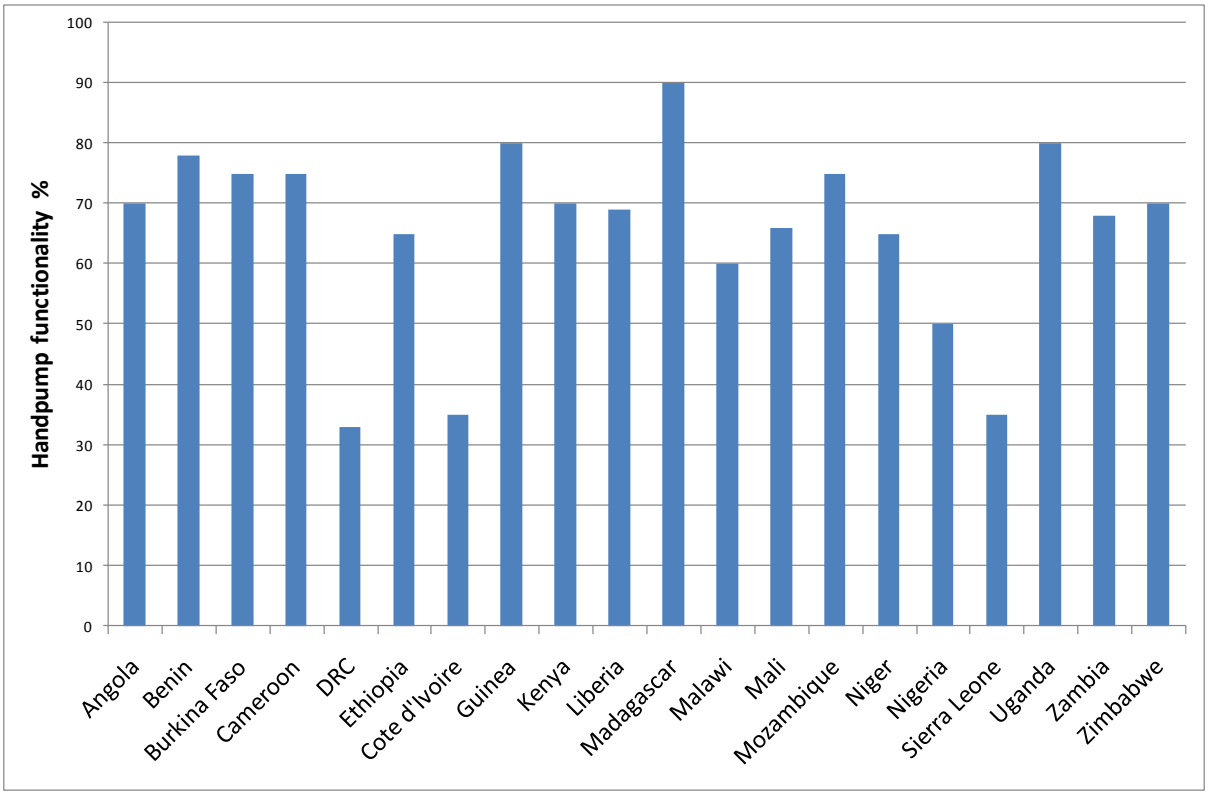

Figure 1 **Estimated functionality of handpumps in 20 African countries**

Source: RWSN (2009)

It is these functionality figures, typically around 60-65%, which provide the impetus for more detailed questioning about how to achieve sustainability.

Why are rural water supply services not sustained?

The following paragraphs from a paper published by Richard Carter and colleagues more than 10 years ago (Carter et al, 1999), and based on considerable experience of rural water supply programmes in sub-Saharan Africa, are presented here with minor modifications. Their thrust is still valid today.

"The common observation is that many water and sanitation programmes in developing countries have not 'continued to work overtime'. They have not been sustainable.
The causes of breakdown or non-sustainability of rural handpumped water services are numerous:

- *communities or households may never have been convinced of the desirability of new water sources in the first place;*
- *construction quality (including siting, adequacy of drilling depth and of well development) may have been compromised;*
- *the financial costs which communities are expected to raise as a contribution to capital or recurrent expenses may be unacceptable, unaffordable, or impracticable (eg monthly or quarterly cash contributions may be impossible for households which only receive income at harvest);*
- *communities may never have felt or experienced ownership of the new infrastructure, and Governments may have been over-stretched and under-resourced, so that repairs and maintenance have not taken place;*
- *even where full community participation or management has been planned in from the start, community-level committees and caretakers have lost interest or trained individuals have moved away. This can be a particular risk if community-level organisation is on a voluntary basis;*
- *changes in groundwater recharge or abstraction rates may have affected water tables, leading to reduced reliability of water supplies.*

Although the 'continues-to-work-over-time' definition of sustainability gives an impression of static conditions, this may be far from reality. What is required by this definition is a fixed or improving output - constancy in water supply services - which may be achieved through evolving and adaptive delivery mechanisms. Although community participation has for many years been an essential foundation-stone of water and sanitation projects in developing countries, this alone is no automatic guarantee of success. Much more is needed."

A conceptual framework for sustainable water supply services

Much more is indeed needed. Numerous components need to be in place to achieve sustainable services. In this paper we focus on two of the most critical, namely the adequacy of revenues generated by users for operation and maintenance; and the support services, including recurrent cost-sharing, provided by Governments or others. However to set these

in context, **Error! Reference source not found.** shows in a simple conceptual framework the relationship between 13 individual components and the success of what has been described as “community management plus” (Baumann, 2006).

Overall the conceptual framework attempts to represent a number of critical factors. First (1), without real need and demand there is little or no prospect of water supply services being sustained. Second, there are several aspects of programme design and implementation (2-8) which are fundamental to the achievement of effective and sustainable community-based operation and maintenance. The evidence of a functioning community-based management system is to be found in the existence of an active Water User Committee (WUC) or equivalent, and the others aspects shown in the central shaded box. Finally, external support to the community management system is needed in relation to the various aspects shown as items 9-13.

The focus of this paper is the financial viability of rural handpump water supply services. This is not to say that the remaining factors in **Error! Reference source not found.** are unimportant. However, financial viability is an important *sine qua non* of sustainable service.

METHODOLOGY

The discussions in this paper are not based on a formal research methodology, and this is perhaps a reflection of the wider inadequacies of research efforts in this important area of understanding. Few detailed and rigorous research studies have been carried out on this important topic. However the observations and conclusions in the paper are based on a combination of (a) questioning and learning carried out during numerous programme evaluations and reviews undertaken in several African countries, (b) secondary data and information from the literature, and (c) the experience and tacit knowledge of the authors and others with whom we have worked.

The primary knowledge about financial viability of rural water services generated from the questioning just referred to has been consistent in its approach – a semi-structured/conversational style of interviews with community members and members of Water User Committees. The findings have also been remarkably consistent, from numerous countries in sub-Saharan Africa. Some of the findings have come from programme and project evaluations of implementing agencies in Ethiopia, Malawi, Uganda and Zambia, most of which is unpublished. WaterAid will shortly be publishing findings of studies of sustainability carried out in Madagascar, Mali, Mozambique and Zambia, and has recently published findings from Tanzania (Taylor, 2009; WaterAid, 2009). TAWASNET’s recent research report (TAWASNET, 2010) provides findings in broad agreement with this paper.

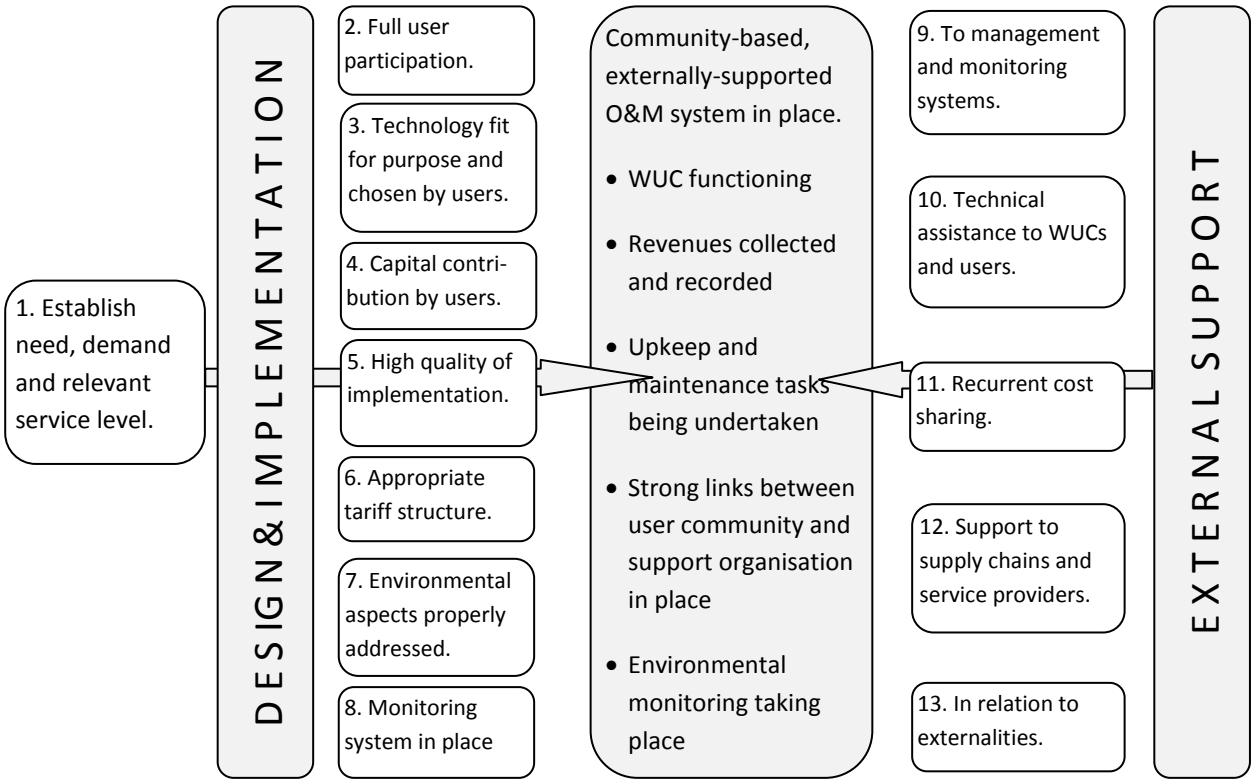

Figure 2 Conceptual framework for effective externally supported community-based management of water supply services

Findings and discussion

The line of questioning about financial viability used in rural communities responsible for managing their handpump water supplies has involved five broad questions or groups of questions. Each of these is headlined and discussed in turn below.

Do you pay for your water supply?

Although rural water supply capital investments are usually highly subsidised, it is comparatively rare nowadays to encounter water user communities which do not pay a tariff for an engineered water supply. Most Governments and NGOs observe the principle that operation and maintenance incurs costs, and that those costs should be borne by those who enjoy the service. However there are exceptions and these generally exist for one of two reasons (excluding South Africa's free basic water policy).

Either an NGO or faith-based organisation has been responsible for the construction of the water point, and in a spirit of well-meaning (but misplaced) charity it has advised the community that the water point is a gift, the water is free, and no revenues need be collected. In some cases that NGO stays around and provides maintenance and repair services for the indefinite future, but in other cases it does not, and inevitably breakdown and consequent abandonment happen sooner or later.

The other common situation of non-payment occurs around the time of local elections, when prospective politicians let it be known (falsely) that they were responsible for arranging the service, that no payment is required, but that their fictional patronage has a price in terms of votes.

Either of the two situations described rings the first alarm bells concerning system sustainability. Both represent an undermining of financial viability, and hence of sustainability as a whole.

However, the much more common situation in which user communities accept the principle of a tariff at least provides a good starting point for financial viability.

How much do you pay? How often? How was the tariff determined?

In many communities a fixed monthly cash payment per household is the norm. Sometimes the tariff is collected on a seasonal or annual basis, sometimes on a volumetric basis (per jerry can or bucket), and occasionally in kind. In the case of monthly per household payments the tariff typically amounts to about USD0.20. Assuming a handpump output of $6m^3/d$, and 50 households served per handpump, this translates to a price per cubic metre of about USD0.05. These figures vary, and the numbers given here are purely indicative, not averages of formally collected data.

When users are asked about how the tariff was agreed, the response usually refers to discussions around (a) the norm elsewhere in the country, and (b) a level which households feel able or willing to afford. Rarely if ever is there any reference to the actual costs of repair, maintenance and eventual replacement of the physical assets.

This lack of reference to the real life cycle costs rings the next set of alarm bells around financial viability.

At this stage in the conversation it is easy to carry out a simple calculation of the theoretical monthly income to the Water User Committee – typically about USD10 per month in sub-Saharan Africa.

Do you all pay? Do you really all pay?

Next, conversation moves to the question of who pays. Initially communities commonly respond in the affirmative when asked “do you all pay”? However by probing a little, and specifically asking about particularly poor households, female- or child-headed households, widows and widowers, the elderly or disabled, it usually emerges that there are indeed some households or individuals who never pay. These are exempted by the community as a whole, and justifiably so.

Further questioning on the same theme usually elicits the facts that (a) individual better-off households rarely if ever pay on behalf of their poorer neighbours, and (b) no communal arrangements exist for cross-subsidy of those who are exempted.

Another alarm bell rings at this point as it becomes apparent that the revenues actually collected are likely to fall short of those calculated previously – perhaps by 10-20%.

Of those of you who pay regularly, do you pay every month/year?

Once again the initial response to this question is often in the affirmative. Further probing however, about seasons and years of famine, flood or other external shocks usually reveals that there are years or seasons when the incomes of households and communities are particularly hard-hit, and their ability to pay is compromised. Consequently there can be significant gaps in the income stream, meaning that the maintenance and repair fund grows more slowly than planned, if at all.

Inspection of the WUC's record books and further calculations at this stage can reveal how dire the situation really is, with actual income usually falling well short of that expected from consideration of the number of user households and the agreed monthly or annual tariff.

This triggers the penultimate alarm bell, as the financial viability of the system is seen to be highly compromised. The actual income may fall to as low as 25-30% of the theoretical total on account of poverty-related exemptions and regular defaulting by the entire community.

What will you do if a major breakdown occurs?

After the discussions just described, a final question is put to the user community: "what will you do if or when a major breakdown occurs?". This is rarely met with any substantive plan of action. The inadequate resources, and often the limited mandate of local Government to provide support; the non-existence of other possibilities of help; and the evidently inadequate reserves of communities mean that the only honest answer is "we hope for the best, and expect nothing".

The true costs of sustainable handpump water services

The fact that the true life cycle costs of handpumps is rarely communicated to the users is largely because of our ignorance of what those true costs amount to. In a paper published four years ago Erich Baumann provided some estimates of these costs. They are summarised in Table 1.

The noteworthy point from these estimates is that the total life cycle costs of USD235 per year amount to nearly 7 times the costs of the minor repairs which are generally expected to be borne by the users (the first two items in Table 1**Error! Reference source not found.**). Baumann argues, as do we, for a significant element of cost-sharing, with users, local Government and central Government each contributing part of the total needed.

Component	**Cost (USD/year)**
Minor repairs including transport of mechanic	15
Spare parts including transport	20
Major repairs and borehole maintenance	100

Monitoring performance of individual facilities by the districts	30
Mechanisms for conflict and problem resolution	20
Marketing social facilitation retraining mechanics and communities	20
Monitoring performance of O&M system including supply chains	30
Total life cycle cost	**235**

Table 1 Estimated life cycle costs of handpump services under community management plus model

Source: Baumann (2006)

A further point for comparison with these figures is the theoretical annual total revenue per handpump, based on the figures presented earlier. If 50 households share access to a handpump, and if all pay an agreed tariff of USD0.20 per household per month, the annual income should amount to about USD120. For the reasons set out earlier the actual income is often substantially less than this, typically only a quarter to a third of that total. That amount, say USD30-40 per year, is sufficient to cover the average minor repair costs of handpumps, but not the full life cycle costs of minor and major maintenance, and monitoring and support from local and central Government.

It is likely, furthermore, that the average life cycle costs conceal a good deal of variability from one technology to another (eg India Mark II compared to Afridev compared to ropepump), and from one unit to another. Some units provide reliable service for a considerable length of time before needing repairs, while others break down relatively quickly. This may be due to a combination of variation in pump construction quality, variations in borehole conditions (eg rest water level and dynamic level) and variation in water quality (eg solids content and corrosivity).

It is this variability which provides one of the strongest arguments for multi-pump insurance-type maintenance and repair services, which could be delivered by private sector operators, local Governments or NGOs – or some combination. These have recently been reviewed by WSP (Kleemeier and Narkevic, 2010), and although their performance in relation to handpump water supplies is yet to be proven, they represent an interesting and potentially promising option.

Rural consumers' willingness and ability to pay for water

Several underlying socio-economic and cultural reasons contribute to the sustainability challenges described above. Rural poverty, although not homogeneous, is deep and widespread. The widely cited "dollar-a-day" poverty measure conceals the fact that individuals in many rural African households handle cash sums significantly smaller than this – in the order of one dollar per month. Cash is scarce, and it has not traditionally been spent on water supply. Household spending priorities lie elsewhere.

This said, discussions with rural households often reveal the fact that actual spending priorities put water tariffs near the bottom of the list, while the value placed by those same households on safe drinking water is very high. There is a mismatch between people's expressed demand for engineered water supplies and their willingness to pay their true costs.

Undoubtedly in some communities the difficulty is not so much an unwillingness to pay as a true inability. Household and communities in particular situations of vulnerability or poverty, and where income-generating opportunities are very limited, simply cannot pay the tariffs required for handpump O&M.

Managing money in rural communities

Revenues generated in rural communities need to be held safely, accounted for, and protected from the effects of inflation. Where banking services are still not available, cash is often held by the WUC Treasurer. It is all to easy for such money to be misused or misappropriated, although in contrast, there are examples of considerable sums being raised and then operated successfully as revolving funds by the WUC.

Given the difficulties inherent in managing revenues at the community level, it is unsurprising that many communities soon give up collecting regular user fees and address handpump breakdowns in a more ad hoc manner as problems arise.

CONCLUSIONS

Six broad conclusions arise from the foregoing discussion. Two relate to areas of existing knowledge, two to our current ignorance, and two to corresponding areas for learning and for action research.

We know that:

1. The sums of money raised by water user communities for the maintenance and repair of their handpumps are usually insufficient, and often grossly so. In those situations where the fundamental issue is unwillingness rather than an inability to pay, there is scope for change. However, the importance of generating adequate revenues needs to be recognised by all those responsible for promoting sustainable water supply services.

2. The true costs ("full life cycle costs") of operation and maintenance must include not only the user-generated costs of routine maintenance and minor repairs, but also the costs of major repairs and overhauls (capital maintenance, which may amount to asset replacement – see Franceys and Pezon (2010) for explanation of the terminology), and also the costs of direct and indirect external support by local and central Government or some other agency. These additional costs are

significant, and the cost burden needs to be shared by central and local Government.

However, we know very little about:

3. The actual life cycle costs of handpumps in general, and

4. The variability of these costs across countries, across technologies and within the same country and technology.
   There are therefore two major imperatives for fundamental and applied research, with detailed documentation and dissemination of the findings.

5. Research is needed into the narratives and experiences of handpump user communities, the life cycle costs of different pump technologies, and the implications of different handpump ownership models (especially comparing the conventional externally-driven (highly subsidised) model with true community ownership of assets) for sustainability.

6. Action research is needed, especially around different approaches to community revenue generation and management, and around alternative (eg multi-community) models of support to handpump maintenance.
   These themes form an important part of the learning objectives of WaterAid around rural water service sustainability, and we encourage others to contribute to them too.

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