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Sustaining handpumps in Africa: lessons from Zambia and Ghana

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Between April and June 2002 field evaluations were conducted by WEDC in Zambia and Ghana as part of the DFID-funded research project 'Guidelines for Sustainable Handpumps in Africa'. The purpose of these visits was to evaluate 'successful' handpump projects and determine what factors contribute to sustainability.

The project literature review (Parry-Jones et al., 2001a) identified eight factors critical to sustainability, these were refined during the visits to the following six:

- Institutional and policy arrangements
- Financing and cost recovery
- Community and social aspects
- Technology and the natural environment
- Spare parts supply
- Maintenance systems

This paper outlines the key findings of the field evaluations under each of these headings. Full field reports for each country are available online at http://www.lboro.ac.uk/wedc/projects/shp/index.htm.

Checklists were developed as part of the fieldwork methodologies (Parry-Jones et al., 2001b) and used to guide discussions with different stakeholders. These included community groups and leaders, private organisations, external support agency staff, and Government and non-governmental organisation (NGO) staff at National-, Regional- and District-levels.

Institutional and policy arrangements

One clear lesson from both Zambia and Ghana is that communities cannot sustain handpumps in isolation. On-going Government or NGO support through appropriate institutional structures is an essential component of a sustainable project.

Zambia has Water, Sanitation and Hygiene Education (WASHE) interdisciplinary teams down to District-level, consisting of Government and NGO staff. UNICEF has been instrumental in developing the WASHE strategy and network. In Ghana, the Government Community Water and Sanitation Agency (CWSA) is responsible for overseeing rural water supplies, and works in partnership with external support agencies and NGOs. In both cases, well-organised responsible bodies at District-level are important to liaise with and support communities, and to monitor and report on coverage, operation and maintenance.

Both study countries have National standardisation policies whereby a limited number of models of handpumps are recommended for installation in the country. Ghana has standardised on the India Mark II, the Afridev, the Nira and the Vergnet, whilst Zambia has standardised on the India Mark II alone. It is expected that this will have significant benefits in terms of spares availability and quality control, and development of repair skills, but any such policies must have a degree of flexibility, and should not stifle local innovation.

Financing and cost recovery

Ghana and Zambia are both heavily dependent on donor support for implementation of, and on-going support to, rural water supply projects. Governments are currently unable to provide significant financing to meet even World Bank targets for counterpart funding.

In both countries communities are now expected to contribute to the initial cost of installation but such contributions are largely symbolic. The cost of borehole drilling is by far the largest single development cost, running into thousands of dollars, and at present can only be met on any reasonable scale through support from external donors.

Operation and maintenance (O&M) costs are met largely by the community. Some communities collect water fees at the point of collection, whilst others collect a monthly household charge. Bank charges and currency devaluation deter communities from storing maintenance funds in banks, especially where spare parts prices are affected by foreign exchange rates. Alternative storage mechanisms such as investing in stored agricultural produce or purchasing spare parts in advance of breakdown are, in general, more effective.

Many communities started collecting maintenance funds on the basis of a fixed charge per household immediately after installation. This soon stopped when they experienced no operational problems with their pumps. Where communities did not collect any fees in advance of breakdown this did not necessarily increase the downtime of the pump, although in some cases this did lead to long-term failures.

Community and social aspects

Community ownership would appear to no longer be a major issue. All communities visited expressed a strong sense of ownership regardless of whether or not they had made any contribution (in cash or in kind) to the initial installation of the pump.

Community WATSAN or V-WASHE (Village-WASHE) committees provide reasonably effective management of handpump operation and maintenance. This was especially the case where there were strong links with District WATSAN staff via Environmental Health Assistants or Community Organisers. The role of a community committee becomes more important as the number of handpumps in a given community increases.

The number of users per handpump depends on the community's perception of need, not an arbitrary number per pump. Where several pumps are installed in a community in line with project requirements, the community may decide to maintain only a fraction of these. If project approaches are to be truly demand responsive, and handpumps are not to fall into long-term disrepair, the service level appropriate to any given community must be determined by that community.

In Zambia, several community handpumps were visited which are located in isolated positions out of sight of the nearest dwelling. Such pumps were shared by scattered households and sometimes several villages, and located at a central point. The management responsibilities for pumps shared by different communities were less clear than when owned by a single community. Sustainability levels were often lower.

Handpumps shared by institutions (e.g. schools, clinics) and communities demonstrated fairly high levels of sustainability. The institutional capacity, ability to safely store money and better access to transportation often results in decreased downtime. However, where the institution dominated the maintenance committee the sense of community ownership became lost.

Technology and the natural environment

Aggressive groundwater resulting in rapid corrosion of galvanized iron rising mains and rods was a problem in some areas of both countries visited. In some cases, handpumps functioned for less than two years before suffering breakdown due to corrosion problems.

As a result of this, modification of the India Mark II handpump has occurred in both Zambia and Ghana. The Ghana-Modified India Mark II has stainless-steel riser pipes and cylinder, and is one of the pumps selected for standardisation nationwide. In one Province in Zambia, the India Mark II has also been modified by using a non-standard, stainless-steel cylinder and stainless-steel pipes and rods. Using different versions of the Mark II in different Provinces has resulted in some confusion and problems with spares supply. Since the pump-heads are similar, the type of below-ground arrangement, and hence type of spares required, is not obvious until the pump is lifted. It would be helpful if clear labeling on the pump-head indicated the type of pump and down-the-hole components used.

Some interesting technical observations regarding the India Mark II are as follows:

- Some pumps, particularly those installed in large diameter boreholes, formerly used for powered pumps, suffer from swinging rising mains. During pumping the cylinder or riser pipes can be heard to hit the casing. The use of centralisers on the rising mains would prevent this and would lead to less failures of pipe and rod joints.
- Bearings begin to fail after about five years but communities rarely arrange for them to be replaced in time.
- Spout heights and diameters inappropriate for filling plastic jerrycans that are commonly used to collect water often lead to high spillage of water.
- Poor new installations indicate the need for refresher training and post-installation testing.

Another general observation in Zambia, applying to all models of pump, is that there is often inadequate attention to concrete aprons and drainage. Cracking of aprons and drains, and silted-up soakaways are often left unattended and maintenance tends to focus only on the handpump. Prevention of erosion of the ground around apron slabs by surrounding it with stones that can not be eroded is good practice.

The Afridev is one of the standardised pumps in Ghana and is currently being installed as part of an experimentation phase in one part of Zambia. In Ghana it has proved to be reliable in overcoming problems of aggressive groundwater, and is easy to maintain without the need for the numerous specialist tools required for the Mark II.

Currently, despite policies to the contrary, communities are provided with minimal technology choice. The handpump is often seen as the only viable type of improved water supply and often alternative technologies are not explained or offered. However, in some cases, communities are provided with a separate hand-dug well as well as a handpump-equipped borehole. This has the positive effect that in the case of handpump breakdown the community still has access to water, but may diminish the will to maintain the handpump. The field evaluations indicated that where communities have easy access to alternative water sources the sustainability of the handpump decreases.

In Southern Province in Zambia many communities have moved from higher to poorer service levels, whereby wind-powered or diesel pumps have fallen into disrepair and have been replaced with handpumps. This indicates that such technologies were not sustainable, but does not automatically mean that handpumps will be.

Spare parts supply

The provision of handpump spare parts is undoubtedly a key issue affecting project sustainability. The supply of spares in both study countries is heavily subsidised at present. In Zambia, spares are available from in-country importers in Lusaka but those available from the District Councils are subsidised by UNICEF. They are sold to

communities at approximately 30% of true cost. In Ghana, spares are sold at a fixed market price but the cost of storage and transportation is generally met by CWSA or NGOs. Currently spares supply in both countries is a long way from being sustainable.

Attempts have been made in both countries to promote private sector provision of spares, but these have had highly limited success so far. In Ghana CWSA is currently encouraging private sector involvement in setting up a nationwide distribution network for spares. An initial stock of spare parts has been provided with donor support to act as a seed fund for the private wholesaler. The goal is a wholly commercial operation within three years. The predominant pumps used in both countries are public domain handpumps, and there remains considerable doubt as to whether the provision of spares for these pumps can be made commercially viable. One way in which it may be viable is if there is an adequate density of handpumps in a given area to generate sufficient turnover of spares and hence sufficient profit for a private supplier. The handpump density breakpoint or threshold that must be reached for each particular model of pump is currently unknown.

An interesting observation from Zambia is that in general, fast-moving spares such as cup seals and washers can only be purchased from District Councils as part of a complete spares kit which includes a chain, axle pin, bearings and bolts. This measure creates an inefficient use of resources and acts as an additional barrier to lifting current subsidies.

Maintenance systems

A general observation on maintenance in both study countries is that decentralised, community-based systems, using the services of Area Pump Menders (APMs) where necessary, are more effective than centralised systems.

In Eastern and Southern Provinces in Zambia, community volunteers are responsible for basic preventive maintenance (greasing and bolt tightening) and APMs are employed for more complex maintenance and repairs. APMs are trained and equipped with tools by the D-WASHE (District-WASHE) teams. They are responsible for 10-20 pumps in the area in which they reside and are supposed to charge communities fixed fees for above- and below-ground maintenance. An increasing number of women have been recruited as APMs and have proved themselves equally competent to their male counterparts.

Ghana has very similar maintenance systems which rely on pump mechanics or community volunteers to fulfill the role of the APM. These individuals are supported by CWSA or NGOs in the same manner as D-WASHE in Zambia.

Standard India Mark II toolkits are provided to APMs, or are sometimes kept at public places such as rural health clinics. One problem identified by the research team was that repairers were not provided with PTFE tape or other thread-filling material, often resulting in poor pipe joints and increased leakage which probably promotes corrosion. 'Fishing tools' for fishing out dropped pipes are kept by D-WASHE at District capitals and APMs are able to use these.

The increased use of the Afridev handpump in Ghana has eased the problem of tool provision, since only a single spanner is needed. It will be interesting to see how the Afridev fares in Zambia compared with the India Mark II.

Where centralised maintenance systems are in place, as in Central Province, Zambia, the cost of repairs to the community is considerably higher than where there are APMs. As a result, users often make their own attempts to repair the pump with make-shift tools, or call on private individuals rather than use the expensive centralised system. Problems occur where such people do not understand the pump properly.

Country comparison

It is interesting to note how similar the overall situation is in the two countries. Table 1 summarises the main points of interest from each country for each sustainability factor.

Conclusions

The literature review (Parry-Jones et al., 2001a) identified three core issues relating to sustainability, namely:

- Minimal external assistance in the long-term;
- Financing of regular operation and maintenance costs by users; and
- Continued flow of benefits over a long period.

Re-examination of these issues in the light of the recent field visits to Zambia and Ghana suggests that the projects identified are not truly sustainable since they are dependent upon:

Table 1.Country comparison

Sustainability factor	Zambia	Ghana
Institutions and policies	WASHE Standardisation	CWSA Standardisation
Financing and cost recovery	External donor funding of implementation; Community financing of maintenance	External donor funding of implementation; Community financing of maintenance
Community and social aspects	Strong sense of ownership; V-WASHE committees	Strong sense of ownership; WATSAN committees
Technology and environment	Corrosion of GI; Limited technology choice	Corrosion of GI; Limited technology choice
Spare parts supply	Subsidised spares; Unsuccessful attempts to promote private sector involvement	Subsidised spares; Current attempts to promote private sector involvement
Maintenance systems	Decentralised – APMs; Centralised (Central Province only)	Decentralised – pump mechanics/ volunteers

- Heavy donor support;
- Subsidisation of spare parts; and
- Significant, structured Government or NGO support.

It may, however, be more appropriate to redefine our definition of sustainability. Financial sustainability can be viewed in the context of the National economy. Provided that external support is likely to continue at a comparable rate it can be argued that such a set up is sustainable.

A realistic approach to spare parts supply must also be adopted. The findings of this research suggest that where public domain pumps are selected for standardisation, responsibility for spare parts provision best lies with Government agencies or local NGOs. If the provision of spare parts is to be commercially viable this is probably more realistic where it is coupled with the supply and installation of handpumps, rather than as a stand-alone activity.

There is no single way of implementing a sustainable system of handpump delivery and maintenance but institutional support from Government, NGOs or the private sector is an important component of any system. All communities require a supporting framework to enable them to manage handpump operation and maintenance effectively. At present the private sector is not interested in taking on this role.

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(All references can be accessed via outputs at http://www.lboro.ac.uk/wedc/projects/shp/index.htm)

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