



Options for rural water supply

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THIS PAPER ILLUSTRATES the importance of community involvement in rural water supply projects by examples taken from the authors work in Zimbabwe and South Africa. It further examines the options of commercially produced handpumps against pumps manufactured at village level, and the broader choices of borehole development, spring supply, and photovoltaic pumping (PVP).

The principal objective of the Zimbabwe work is to assist rural farmers to become self sufficient in food production, and to improve nutrition levels through dry season vegetable production. However, the technology developed was also applied by the local communities to water supply.

The projects in Southern KwaZulu Natal are concerned with village water supply. The Crisis Intervention Program (CIP) aimed to provide primary water supply to communities suffering from drought and lack of infrastructure.

Development and dissemination

Conventional large scale irrigation schemes have not been a success in Africa (Moris and Thom 1990). An important underlying problem is the attempted imposition of new technologies and management practices, that are alien to the indigenous culture, and not involving the local community at an early stage.

The focus of the work in Zimbabwe is on micro-scale irrigation, that is, irrigation by single farmers or family groups on very small plots each with their own water source. While such irrigation may be carried out anywhere that groundwater is accessible, it is widespread on dambos (vleis) in Zimbabwe. During the dry season wells draw groundwater stored in shallow quifers.

In order to make this activity attractive to more farmers human powered pumps are necessary to replace the watering can. This work was undertaken because the local communities identified it as a need, a good start!

Initially, environmental and socio-economic studies were carried out which established the feasibility of micro-scale irrigation on dambos. Subsequently, simple pumping and irrigation technology for the exploitation of these shallow groundwater resources was developed (Faulkner, 1991) The development and dissemination of this technology was paramount to the success of the work. Central to the process was a strategy based on close interaction between farmers, fabricators, researchers and extension agents.

Farmers were involved in the initial development and fabrication of the pumps, so that they considered them to be 'their own'. This contrasts with the conventional ap-

proach of presenting farmers with a pump that is produced in a factory, and for which they feel little or no responsibility. The technologists concentrate on research and development and leave diffusion of the results to others. This leaves the local community with little sense of ownership. Against this background direct and early involvement of farmers and artisans in the work reported here was considered vital. It was more important to get the technology into farmers' fields early on in the project than to perfect the design under controlled scientific conditions. Because of this, dissemination took place concurrently with research, and problems associated with the dissemination process could be identified and addressed. Thus many useful farmer modifications were identified and incorporated in the design. The project fieldwork was based at the University of Zimbabwe, in Harare, and links were developed with Agritex.

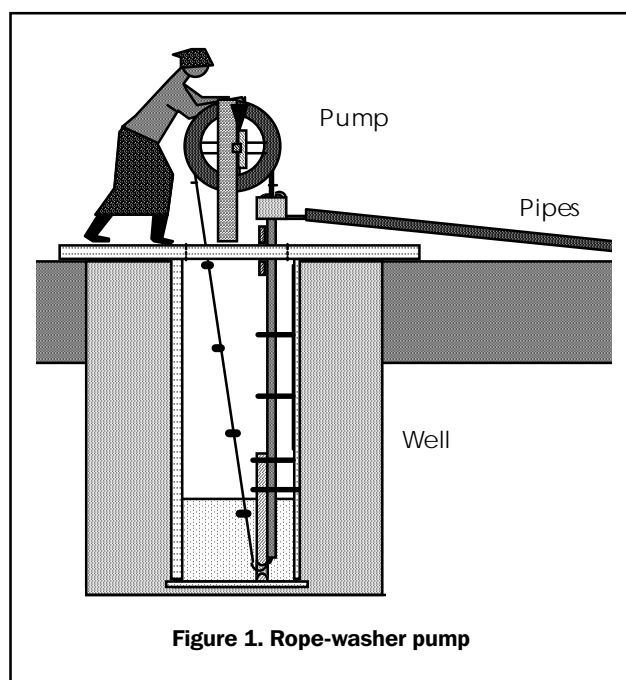
Local non-governmental organisations (NGOs) were also approached. Agritex (government agricultural extension service) is capable of reaching large numbers of farmers in a fairly conventional centralised diffusion system, while NGOs can work very flexibly with new ideas.

Detailed description of the development of the human powered pumps is given elsewhere (Faulkner, 1991). There were four types tested in the field, the key criteria being that of local manufacture and village level maintenance (VL0M). The most successful pump, which has continued wide adoption, is the rope-washer pump, shown in Figure 1.

The cost of making the rope-washer pump is as little as R150 due to the availability of the materials used. In Zimbabwe many hand pumps are produced in the commercial factory sector. For example, the Bush pump, developed and produced in Zimbabwe and with an estimated 15,000 units in service, is used for community water supply and is a model for many other developing countries. However, it is not suitable for use by individual farmers for irrigation, due to its high capital cost and its restriction to vertical wells.

The rope-washer pump is more a collection of component parts than a single unit. Thus the nature of the materials, and the simple manufacturing techniques required, make the rope-washer pump eminently suitable for manufacture at village level. Thus by training artisans at regional workshops, the technology becomes widely disseminated. Indeed, many farmers could make their own pumps.

However, it became apparent that local producers experienced constraints in producing pumps for sale in their



immediate locality. Many of their friends and neighbours are relatives, and it can be quite difficult to get them to pay cash for goods or services. It seems easier to sell to non-relatives outside the home area where there are no pre-existing obligations. A further constraint on production for sale to other farmers is the availability of credit to purchase the materials required.

In one of the project areas, Chihota, a credit club was started to address this problem, which enjoyed some success. It was later incorporated into a pioneering credit scheme initiated by Zimbabwe's Agricultural Finance Corporation.

Dissemination of the technology through the regional Agritex training centres, and by extension staff in many communal areas, has been a success. Several NGOs have been actively promoting the use of the technology. At present, the most notable of these is World Vision who offer training and some materials to farmers, who must then make their own pumps.

Two videos were produced for training purposes. One is a 20 minute programme which shows the detailed construction of a rope-washer pump, and is aimed at extension workers, artisans and farmers. An important feature of this video is that it does not rely on a narrative, and hence is accessible to audiences irrespective of their language. The second is a 10 minute programme with an English narrative and dealing on a more general level. Both were used successfully in several training courses run during the project, particularly at the Agritex regional training centres, and were shown on the national TV network. An important aspect of using video is that it raises the status of simple technology, which may not have the instant appeal of more modern high-technology gadgets.

Toy pumps were also made and used for training purposes. There are a number of ways in which the results of

the dissemination process can be gauged. The most obvious is the measurement of the number of pumps in use. However, this is difficult with technology that is produced and distributed by a dispersed informal sector. Following informal contacts with NGOs and Agritex staff, it is clear that the number of rope-washer pumps in operation in Zimbabwe is of the order of several hundred units, and increasing steadily.

Water supply in Natal

Southern KwaZulu Natal (SKZN) is situated in the south east of South Africa, and covers an area of some 5,500 km². Formal settlements are concentrated along the coastal strip and the hinterland. These are dominated by underdeveloped rural communities. These consist of family household units, or "imizi", scattered along the ridge lines. The economy is based on subsistence agriculture. There is a direct parallel with communities living in the HighVeld zone of Zimbabwe.

A number of boreholes existed in the area, fitted with commercial type handpumps which required servicing and maintenance by a private contractor. Those installed under the CIP were of the same type. The people thus had no sense of ownership for these. The depths of the boreholes are up to 100m. Community liaison is critical to any development, but with the CIP this was limited to the confirmation of the site of each borehole with the local headman (induna). The level of technology used in the borehole construction militated against further community involvement.

In contrast, the level of technology used in spring protection and development is more applicable to VLOM. Springs are a traditional source of water in SKZN, and their development is a means of improving an existing and known methodology. The process involves constructing a box around the spring and piping the water collected to a storage tank. A tap or standpipe is connected to the tank.

People from the local community undertook the construction of each spring protection. The contractor supplied the materials, trained the local labour force, and supervised the work. This gave a strong sense of ownership to the community on completion, and ensured that future maintenance can be undertaken at the community level. This is both cheaper and more efficient than having to call in private contractors. The capital cost of a spring protection at about R8,000 is less than a quarter of the cost of a borehole installation. The maintenance cost of each handpump is about R1,500 per year, whereas that for the springs is negligible. It might be expected that boreholes will yield a more reliable water supply. However, boreholes are less numerous than sustainable springs in the area, and the maintenance of the handpump is critical to the reliability of a borehole.

Photovoltaic pumping

There are many advantages from using solar energy as a source of power. The energy itself is free, and there are no

problems with the supply of fuels such as diesel. There have been a number of studies of PVP (Davis et al, 1994). The complete system consists of an array of PV cells, which convert solar radiation into electricity which drives a motor connected to the pump.

PVP for rural water supply has been utilised with varying degrees of technical and institutional success in Southern Africa, particularly Namibia, Botswana, Lesotho and Zimbabwe. PVP has also been used extensively in Francophone West Africa, South-East Asia and South America. The German company GTZ have tested PVP in seven developing countries. Despite this, PVP in South Africa is mostly limited to private farms, game reserves and a few rural water supply applications in KwaZulu and the former Transkei. About 3,000 installations are operating in South Africa, in the lower output range of 25 to 300 m³.m. This unit is the total volume lifted in a day multiplied by the lift, for example 10 m³ lifted through 30 m.

The components of the system may be manufactured within South Africa, although there is only one assembler of the PV modules. The Rural Technology Unit (RTU), located in the lower Mpako of the former Transkei, has been operating as a rural development service organisation since 1989 (Davis, 1994). Several PVP systems were installed by RTU. The service provided included technical advice, credit facilities, and installation service and maintenance backup. Installations were financed by a combination of government subsidies, development grants and community contributions. The relative contributions varied with each installation.

The high initial cost remains a significant drawback. For example, the total cost of a PVP system (including borehole) for a 200 m³.m per day application is R25,000. Much of this cost is the PV panel, but these costs are reducing as the development of solar power continues. However, this is offset over time by the minimal running costs, and over the life of a scheme (20 years) would be cheaper than a diesel powered system. Naturally, factors such as geographic location and access, fuel availability and interest rates, also affect viability.

In Lesotho, work undertaken by the Village Water Supply Section found that for heads up to 50 m, PVP systems are viable when the daily duty is less than 1,300 m³.m per day. For applications of less than 200 m³.m per day, handpumps become a more economically viable option.

Using the above criteria, there are about 4,000 communities in KwaZulu Natal where PVP is a viable option, assuming that each community is less than 1,000 people with an average demand of 25 L per person per day. Practical problems which must be overcome are the vulnerability of the panels to damage and theft. The inexperience of local people and installers with PVP systems may be tackled through local training programs. The highest level of community involvement, from planning through installation to maintenance, is necessary for success.

The renewable energy source with no waste products makes PVP an environmentally sustainable development.

The low maintenance requirements further mean that this may become much more attractive and widespread for village water supply in the future.

Conclusions

The success of water supply to rural communities depends very much on maximum community involvement. This in turn is greatly enhanced where the local people are familiar with the technology, and can then manufacture, install and maintain the system.

Despite problems of cost and present unfamiliarity, PVP systems are applicable to some cases for rural water supply, and their use is likely to increase in the future.

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