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Rural water development experience in Malawi

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ABSTRACT

The paper considers the process by which Malawi has achieved considerable success in its implementation of rural water schemes - in particular recent experience in the development of the dug-well and bore-hole programme. The paper maintains that an appreciation of the steps which led to significant breakthroughs, and the problems which had to be solved are just as important as the final mix of factors which contribute to a viable programme. Without proper appreciation of the development process involved it is considered that the dissemination of the 'Malawi experience' elsewhere is questionable. The paper highlight the problems which Malawi had to face and how by changes in its administrative structure it achieved its present implementation strategy.

INTRODUCTION

In comparative recent years the significant developments in rural water programmes in Malawi has gained the country a reputation of success in this area of development. The first significant breakthrough in Malawi was in the field of gravity-fed piped water schemes - these started from a small beginning in 1968 to the possibility of about 25% of the rural population being served by such schemes by 1990 (this being about the practical limit unless extensive water storage and/or treatment is considered).

Today, Malawi features prominently in the UNDP/World Bank Handpump Development Programme and in the development of low-cost rural water supplies under its 'integrated ground-water project' concept. This concept involves the complete provision of ground-water supplies in one area at a time by a project team whose task is to assess a defined area of the country with regard to the potential for dug-well, and/or boreholes and to implement an integrated project. In 1980 the incorporation of the various rural water programmes under one Government body - the Department of Lands, Evaluation and Water (DLVW) allowed the proper consideration of the alternatives and paved the way for the 'integrated project' approach.

The problem with any success is that as far as the outside world is concerned the crucial steps in the development process which led to breakthroughs are only too often ignored or not fully appreciated in the focussing of attention onto the final mix of factors which contribute to a viable programme. In this way theimportant lessons learnt and the significant factors which enabled the all important 'embryonic stage' to be nurtured are often not publicised. The author maintains that an understanding of the background to a successful rural development programme is crucial if the development experience and programme is to be properly understood and disseminated in other countries.

The experience in Malawi has shown - particularly with the rural piped water schemes - that for rural development programmes to take root they must expand at a controlled rate. Any attempts to speed up the development process beyond what might be termed the natural pace of development is probably doomed to failure. What are the limiting factors? Naturally, the technology must be appropriate and satisfactory. In the case of the piped water schemes the technology was simple, proven and dependable - although its introduction to Malawi had to proceed in a careful and measured way so that the necessary materials, techniques and training were perfected. This involved three distinct phases - the pilot project phase; the consolidation phase and an expansion phase. Success in the rural piped water schemes can be attributed to an appropriate government organisation which enabled:

(i) adequate field organisation/supervision and training coupled with good overall project management;
(ii) significant community participation at the implementation stage of the programme and, to some extent, in the initial planning stage.

An outline of Malawi's experience in rural piped water supplies is given in another paper (1). A detailed evaluation of that programme has also been documented (2).

MALAWIAN EXPERIENCE IN GROUNDWATER DEVELOPMENTS PRIOR TO 1980

A successful rural water programme does not emerge without considerable in-country development experience - some of which is bound to be far from satisfactory. The mix of factors required to initiate a successful programme - administrative, socio-economic,

technical, organisational, etc - have all to be in place if a significant breakthrough is to be achieved. It must also be appreciated that any meaningful rural development involves phases through which the project must progress before a viable programme - capable of expansion throughout the country can be realised. Such a task cannot be achieved quickly - a measured pace of development has to be sought which is compatible with the actual situation being dealt with. The situation in Malawi prior to 1980 indicated that several problems were inherent in early attempts at groundwater development. It is instructive to outline these prior to the consideration of the steps taken to improve the situation. The problems which were identified in the early groundwater programme were:

- uncoordinated programme administration
- inadequate professional input and poor borehole site selection
- poor borehole design
- field supervision/management problems
- an inappropriate handpump with poor maintenance structure
- lack of community involvement.

These problems may be outlined briefly as follows:

(a) The bore-hole and dug-well programmes were initiated and implemented separately without coordination. Until early 1980 the two principal Government agencies involved were in different Ministeries. The rural piped water scheme and dug-wells programme were implemented by the Ministry of Community Development and the bore-hole programme was the preserve of the Department of Geological Surveys. There was no coordination between these bodies.

(b) Bore-hole sitings were traditionally carried out by geologists rather than hydrologists with negligible reference made to existing geophysical or construction data. Both siting and construction were carried out with little understanding of the occurrence of ground water. There was little consideration given to the most appropriate abstraction methods for local conditions. Boreholes were sometimes drilled where water levels were within 2 to 3 m of the ground and dug wells were started where water levels were deep. Borehole design was the same whatever the eventual use and yield requirements (Boreholes were drilled to a depth of 45 to 60 m).
It should also be noted that there was no professional geological input to the dug wells programme.

(c) The borehole design was the same whatever the eventual use and yield requirements of the borehole. Boreholes were drilled to a depth of 45 to 60 m and lined with 168 mm O D mild steel casing, or left as 'open-hole' in consolidated formations. Slotted casing was generally set at the bottom of the hole, regardless of the geological section. The annular space between the 168 mm steel casing and borehole was filled with 6 to 12 mm crushed roadstone as a gravel pack. This material was much too coarse to prevent the inflow of fine material into the borehole. As a consequence the pump components - particularly cup leathers and cylinders were damaged and had to be replaced frequently. Drawing in silt and sand also led to the borehole silting up which meant that many boreholes were either abandoned or required frequent cleaning.

(d) The widely dispersed activities of both the borehole and the dug well programmes led to considerable difficulties in overall management of the programmes and in day-to-day supervision. As a result neither sound technical practice, timely decision - making nor efficient operation were easily achieved.

(e) As regards the existing borehole maintenance, repairs were required very frequently mainly due to very poor borehole design as indicated above. On average cup leathers needed to be changed about two or three times each year - more frequently in alluvial areas (up to eight times per year). The high frequency of breakdowns and the length of time required for each repair meant that maintenance units could only cope with breakdowns. The desirability of a preventative maintenance scheme was not possible.
The existing borehole pumps were heavy difficult and costly to repair. A 5 or 7 ton truck with a winch was necessary to lift the pump for even the most basic repair to downhole components. So maintenance problems originated not only from borehole design but also the handpump. This situation meant that borehole maintenance costs were very high - with transportation and associated expenses accounting for about 60% of total costs.
As far as the shallow-wells programme was concerned a maintenance system had not been properly established. On average the existing shallow well pumps required repair once every 6 to 12 months. The plunger, footvalve, bushes or adaptor unions were the components which usually needed attention. The author was involved in a shallow well field survey at an early stage of pump development work in Malawi and concluded that the maintenance requirements were attributable to both poor well design and construction, and inherent pump design problems. It was concluded at that time that just as much effort should be directed to well design

and construction as to handpump development.

(f) There was no involvement of the community at any stage of the borehole programme. Even at the crucial siting stage the villagers were not consulted. A geophysical siting team visited villagers on a routine manner according to a list submitted by the District Development Committee to Central Government. Little contact was generally made by the siting team with the village. Some time later a drilling team would arrive to drill a borehole at the specified site. Later a pump installation team would arrive to install a handpump. Sometimes it has only been at this point that the village has been aware of what is happening.

The problems outlined above (present at the beginning of 1980) showed the considerable improvement which was necessary to even begin to bring the situation to one where the Water Decade goals could be realised. A full appraisal of the situation was urgently required. At the start of the Decade in Malawi that is exactly what transpired.

RECENT GROUNDWATER DEVELOPMENTS IN MALAWI

As noted above a full assessment of the borehole and dug wells programmes revealed many problems which had to be dealt with if Malawi was to make any headway in terms of the UN Water Decade objectives. From this assessment a new approach to groundwater development was conceived - an integrated project for rural ground water supplies. The various considerations and the steps which were taken to solve the problems identified were:

(a) In April 1980, the existing uncoordinated borehole and dug wells programmes were brought together under one body - the Department of Lands Valuation and Water (DLVW). This facilitated the concept of an integrated groundwater project with the complete provision of groundwater supplies in one area at a time by a single project team.

(b) A detailed evaluation of existing hydrogeological data suggested the existence of an extensive, shallow weathered rock aquifer throughout much of the 'plateau' area of Malawi. The importance of this aquifer had largely been ignored in the past. This meant that a borehole completed in the weather zone aquifer need only be 20 m deep rather than 46 to 60 m as was common previously. This permitted the use of lightweight and inexpensive drilling rigs which could be towed by a small vehicle. A further consequence was the greatly reduced need for sophisticated siting procedures. The importance of the hydrologist as a key person in the integrated project was emphasised.

(c) The important components of the borehole, screen and gravel pack were subjected to careful hydraulic design. Locally available materials were sought to replace imported items. Locally extruded and slotted PVC casing replaced the imported mild steel casing. This facilitated a hundredfold increase in open area resulting in a considerable improvement in yields.

A survey for correctly graded gravel pack material which would prevent the movement of fine sand and silt into the boreholes was sought. This located beach sand from Lake Malawi which had the characteristics of a perfect gravel filter.

At the start of the integrated project in Malawi it was noted that there was no design criteria for dug wells and that a reliable dug well was not actually easy to construct. Both with boreholes and dug wells evidence was growing that the single biggest cause of handpump breakdowns was borehole/well design. It was clear that if dug wells were to play a major part in the integrated project then further work on their design would be necessary.

In parallel with the consideration of borehole design was the question of the most appropriate means of borehole drilling. It was appreciated that the one item of equipment in rural groundwater supply programmes that caused the most problems in selection was the drilling rig.

A study of the various drilling methods - from the large multi-purpose rotary rig which can drill in almost any formation with great speed and efficiency but which will have been imported at high cost, to the low-cost hand operated drilling equipment showed that there was no simple answer to the question - 'What drilling method is best for rural ground-water supply boreholes?'

The assessment of drilling rigs in Malawi specific to the integrated project concept led to the idea of an integrated project rig. The requirement in Malawi is for 200 mm diameter holes to a depth of 30 to 50 m (upper limit 80 m) in unconsolidated and semi-consolidated formations for which cable tool drilling is possibly more appropriate. However, for similar depths in hard rocks a small air-flush rotary rig is needed. A strong light-weight combination cable tool-percussion rig with a 'swing-in' mechanically driven rotary facility (mounted on a two-axle trailer) would suit the Malawi requirements. The numbers of similar requirements elsewhere in the world justifies the development of purpose-built rigs rather than using off-the-shelf

equipment designed for a range of tasks.

(d) An essential prerequisite for the success of an integrated rural development project is suitably trained and well-motivated staff coupled with good project management. With the previous uncoordinated and widely dispersed programme the question of effective management and supervision had to be addressed. In Malawi there was alrady considerable experience in this area with regard to the rural piped water schemes. In the final analysis the most important factor which contributed to the success of that programme was its organisation and management - both at central Government level and especially at the field level. The experience in Malawi with the piped water schemes showed that after the pilot project stage of development it was crucial to have a 'consolidated phase' which enabled a team of well-trained and motivated field staff to be developed together with the review and development of the organisational infrastructure at central/district level and in particular the management procedures at the field level. This phase was essential in order to ensure the continued expansion of the programme.

(e) The successful establishment of a new maintence structure was dependent on the development of a new pump. Prior to the integrated project the heavy, imported pumps had to be lifted by a truck mounted winch in order to carry out even the most basic repair. The most important feature of the new pump was the facility for the down-hole components to be removed through the pump head which remains in position over the borehole. This eliminated the necessity to use a winch and made it possible for the villagers to play a part in handpump caretaking and maintenance. A preventative maintenance programme involving a village caretaker and village pump committee was drawn up. Particular attention would have to be given to this important level of maintenance, together with the necessary district/regional back-up.

(f) The maximum involvement of the villagers in the selection of their own water point sites is essential - preferably through the democratic process of an elected Water Committee - to assist in the creation of a sense of waterpoint ownership. It was considered that during the preparation phase of the project the community should be alerted about the project. They should have formed Water Committees in each village. It is important that the Water Committee, and through them the whole village, are involved in the selection of sites. Well in advance of the planned construction work in a village the Project hydrogeologist visits the village (a second visit) to inspect all sites chosen by the community. Once a village approved site has been ratified by the hydrologist the community preparatory work can be started. This involves the cleaning of the site by the community, preparation of the access to the site; and for a dug well, the start of digging.

CONCLUSION

The experiences of rural water development in Malawi has emphasised that in the context of the present UN Water Decade and as a necessary prerequisite to a viable programme it is crucial to ensure that the proper administrative and management structures are in place and that a full appraisal of present programmes are conducted. Sound implementation strategies and viable programmes can only be devised on the basis of a candid appraisal of present in-country practices. The Malawi experience shows a country willing to learn from its experiences and one where rural development has proceeded at a controlled rate.

REFERENCES

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