

THE ROLE OF GOVERNMENT IN MAINTAINING RURAL WATER SUPPLIES: CAVEATS FROM MALAWI'S GRAVITY SCHEMES

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SUMMARY

Malawi earned a great deal of praise for its programme to build gravity-fed piped water schemes in rural areas, because the government limited its own role by turning over many responsibilities to the community. Unfortunately, the government has not been able to provide the supporting services and recurrent financing necessary under even this limited role. As a result, the schemes are functioning at about 50% of capacity. These problems did not arise because programme designers and implementers neglected to plan for operation and maintenance. Rather, they thought that a very good system was in place. However, both observers and those directly concerned failed to identify or act on flaws in the planned system for a number of reasons, such as the blinding success of the construction programme, and a willingness to accept rather than evaluate underlying critical assumptions. Copyright © 2001 John Wiley & Sons, Ltd.

INTRODUCTION

Over the past 10–15 years, a new strategy for rural water supply has emerged, now generally referred to as the 'demand-responsive approach'. A number of features distinguish this new strategy from its predecessors, among which is the limited role proposed for government. Under a demand-responsive approach, government is supposed to confine itself to providing certain backup services (e.g., legal regulations, hydrological information, training), and leave direct responsibility for constructing and maintaining water supplies to the beneficiaries and the private sector.

Sector specialists advocating this new strategy have repeatedly pointed to the Malawi rural gravity scheme programme as evidence that this new role for government will work and produce better results than previous ones. The Malawi programme had earned an extraordinary amount of praise during the International Water Decade for its participatory approach, based on a limited role for government and an expanded one for communities. Advocates of the new strategy found that the programme still represented a best case example of how governments should define their role in the future.

Examining the role of government in the Malawi programme thus becomes interesting from two perspectives: as an evaluation of one aspect of the participatory approach that dominated strategic thinking during the 1980s; and as an appraisal of this same aspect in current strategy. The present article focuses on the Malawian government's role in operation and maintenance: what responsibilities did the government take on and why; how well did it perform them; and what have been the sources of any problems.

BACKGROUND: CHANGING STRATEGIES FOR GOVERNMENT'S ROLE

Through the 1980s, governments and donors worked on the premise that they should play a very prominent and direct role in providing safe drinking water in rural areas. This meant that, first, government itself was supposed to construct the supplies, provide spare parts, do the difficult repairs, and so forth. Second, governments with donors'

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assistance would pay for all of this, i.e., subsidize the capital costs and probably part of operation and maintenance costs (World Bank, 1980).

Although nobody called it that at the time, this strategy has since been summed up as a 'supply-driven approach'. It might more fairly be called a basic needs approach as it derived from the argument that meeting basic human needs would promote economic growth by raising the productivity and incomes of poor people. The concern with meeting basic human needs dominated development thinking in the 1970s. This led, among other initiatives, to the United Nations declaring 1981–90 as the International Drinking Water Supply and Sanitation Decade, and calling upon governments and donors to increase their investment in water supplies.

Participation formed part of the basic needs strategy on the premise that this would help identify genuine needs, ensure that benefits were equitably distributed, and so forth. Therefore, most of the donors and governments implementing Decade water programmes paid at least lip service to adopting a participatory approach, although few had much success in the beginning (Kleemeier, 2000, p. 930). The Malawi programme stood out as the enormous exception to so much failure. The programme relied on community participation, yet achieved impressive physical results, e.g., 13% of the rural population served with piped water within 20 years (UNCHS, 1989, pp. 30, 931–934).

Ironically, just as the Water Decade was beginning, economic thinking had begun to move away from the strategy that underlay it. In the late 1970s economic crises had hit many developing countries. The World Bank and other influential donors argued that to restore growth governments would have to stop distorting prices and initiate a process of structural adjustment. Adjustment meant restraining public expenditure, removing subsidies, and letting the private sector and market forces take over many functions from government agencies (World Bank, 1981, 1984). Such a strategy was clearly incompatible with one recommending that donors and governments expand subsidized social services.

It was not until the late 1980s that discussion papers by senior World Bank staff articulated a strategy towards rural water supply in line with the principles of structural adjustment. Not surprisingly, this included a new and limited role for government. No longer should the government supply services itself. Instead, 'the ultimate goal would be for the central government to serve in the role mainly of educator, promoter, and regulator, and communities in league with the private sector, in that of provider' (Churchill, 1987, p. 15).

The new strategy towards water supply came to be known as the 'demand-responsive approach' on account of its principle that people should get the kind of water services for which they express an economic demand, i.e., for which they are willing and able to pay.¹

According to this principle, consumers should pay the full operation and maintenance costs of their water supplies, and in most cases the full capital costs as well. Government's role could be more limited under a demand-responsive approach, in large part because government would no longer have to foot the entire bill for providing water. Briscoe and de Ferranti pointed to the programme in Malawi as well as one in Columbia – each considered the outstanding success on its continent – as concrete illustrations of how to limit the role of government in rural water supply (Briscoe and de Ferranti, 1988, pp. 16–17).

Thus, the Malawi programme has enjoyed the unusual distinction of being held up as a model for how to implement both the supply-driven and the demand-responsive approaches, at least in regard to the role played by government.

OVERVIEW OF THE MALAWI RURAL PIPED WATER PROGRAMME

The Malawi piped scheme programme had its origins in a small scheme constructed by the government in 1968 on an experimental basis. After successfully completing a second larger scheme, activities expanded nation-wide, financed by various NGOs and donors (Glennie, 1983, pp. 11–16, 131–132; Warner *et al.*, 1986, pp. 5, 13, 170). USAID provided a major grant in the 1980s that kept the programme expanding. But it began to contract

¹The new approach was first called 'demand-driven', but by the mid-1990s the term 'demand-responsive' had become the dominant one.

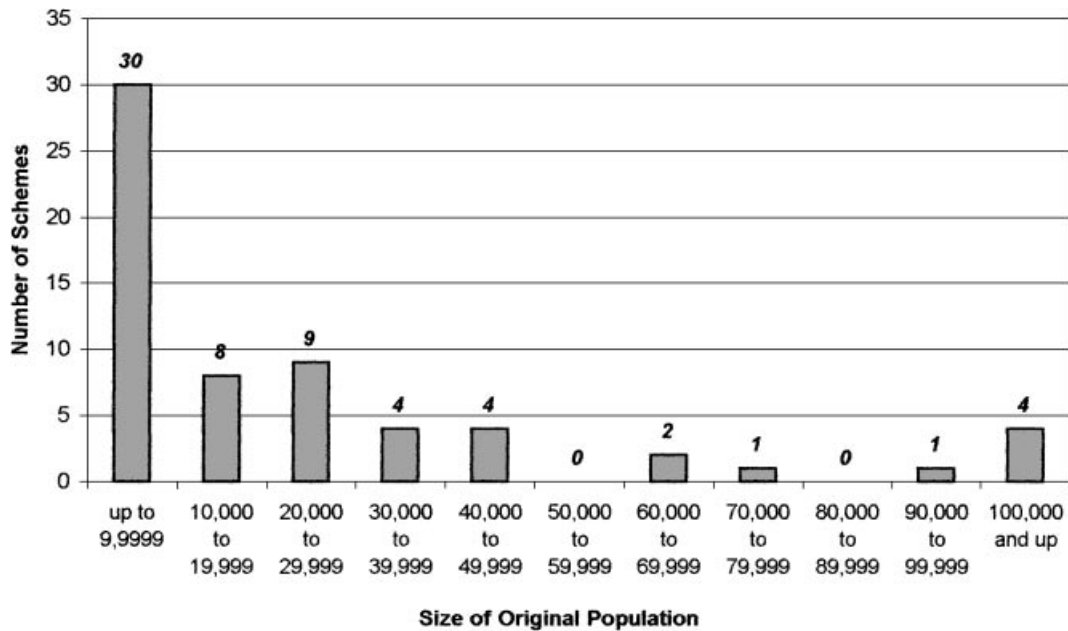


Figure 1. Distribution of rural gravity schemes by size of original population. Seven schemes could not be included due to insufficient data. An additional 10 schemes are under construction. Unfortunately the available population figures for schemes sometimes represent the original design population. Sometimes the population served at scheme completion, and it is not always clear which one. Sources: Glennie (1983, pp. 131–132); Warner *et al.* (1986, p. 17); UNCHS (1989, pp. 38–40); Roark *et al.* (1993, p. 65); World Vision (1993).

from 1989, when the American support finished. Today, rural gravity scheme construction has slowed to a trickle due to lack of finance.

By 1999, 70 schemes had been constructed and another 10 were under construction. The schemes vary tremendously in size. One mega-scheme serves over 350,000 people through thousands of kilometres of pipe. Other schemes serve 1000–2000 people using 20 km or less of pipe. Figure 1 gives some sense of the scatter in scheme size by grouping schemes based on the original design population, or in some cases the original population served.

The total population served by the 63 schemes categorised in Figure 1 is 1.7 million people. Seven schemes that could not be classified due to insufficient data might add another 100,000 persons to that number. The 10 schemes under construction will eventually have the capacity to serve 130,000 people. All these estimates are extremely rough, because sometimes the population figures for a given scheme represent its design population, but other times the population served by the scheme on completion. Since most of the design reports for these schemes have now been lost, it is not possible in many cases to establish the design capacities of the schemes.

Although most of Malawi's schemes are relatively small, the large schemes account for most of the total population served. Four huge schemes are to serve 40% of the total 1.7 million 'design' population. The 30 smallest schemes, serving fewer than 10,000 persons each, would in total only serve somewhere around 7% of this population.

The Malawi rural piped water programme attracted a great deal of international interest in the 1980s, partly just for successfully constructing low-cost gravity schemes on such a large scale. Donors and governments were gearing up to mount major programmes for the Water Decade, yet too many previous programmes had clearly failed because they used an inappropriate technology. New, improved hand-pumps seemed one likely option; the Malawi programme illustrated the advantages of gravity schemes as another option.

Gravity-fed piped schemes, like hand-pumps, represent a simple technology for supplying low-income rural areas with drinking water. The type of scheme built in Malawi generally consisted of a small intake built on a

mountain stream, several concrete tanks, and pipelines to connect the intake to the tanks and hence to public taps located throughout the villages. Most schemes did not have any water treatment systems other than the tanks, which screened out debris and allowed sediment to settle.

The absence of treatment systems, and using gravity rather than some kind of electric or diesel pump, made the schemes relatively cheap and easy to operate and maintain. Similarly, the Water Department² kept construction costs down in a number of ways. One was designing schemes only for public connections, based on design criteria (e.g., a peak factor of 1.5) that minimised the diameter, and hence cost, of pipe required. Another way was by using simple, standardised designs for intakes and tanks, so that local masons and contractors could do this work after some training. A third means was through the future consumers contributing their labour without charge to dig pipeline trenches, lay pipe, clear sites for tanks and intakes and so forth.

This community participation component earned the Malawi programme an extraordinary amount of international praise. The community members did not just contribute their labour, they also took on many of the daily organisation and supervision tasks, and agreed to help maintain the schemes afterwards. The latter represented the complement to the new role defined for government. The government could play a more limited, supporting role because the community would play a larger role, including responsibility for operation and maintenance.

To this end, each public tap had a committee responsible for the tap and surrounding area. This responsibility included collecting money from users to repair or replace broken taps and aprons, and to contribute towards the honorarium of a caretaker appointed to keep the intake clean. Each scheme had a Main Committee to supervise the Tap Committees, two intake caretakers, and Repair Teams that did the routine repairs (e.g., on blocked or burst pipe). The Main Committee was also responsible for organizing community members for maintenance jobs such as cleaning tanks, or digging up broken or blocked pipes.

The Water Department discovered early on, though, that user committees alone were not sufficient to maintain the schemes at an acceptable standard. The department tried to get local governments to employ people to help with maintenance, but they refused (Glennie, 1983, p. 100). Therefore the Water Department introduced a hierarchy of government employees for monitoring operation and maintenance (Msukwa and Chirwa, 1981, pp. 22–23; Glennie, 1983, pp. 99–100; Msukwa, 1986, pp. 12–13).

On the bottom rung were Monitoring Assistants, who lived in the rural areas served by the schemes. These field technicians were to inspect the schemes regularly, help the community Repair Teams with any work beyond their competence, and distribute the tools and materials that the government would provide for maintenance. On the next rung up were Monitoring Supervisors, who supervised the Monitoring Assistants and assisted them with major repairs. Above these supervisors were Senior Monitoring Supervisors. Finally, engineers at the regional or central headquarters were to assist with problems and repairs that required engineering expertise (UNCHS, 1989, p. 24).

GOVERNMENT TECHNICAL SUPPORT TO OPERATION AND MAINTENANCE

Briscoe and de Ferranti praised the Malawi programme for limiting the functions of government to the following:

monitor system performance; supervise village repair and tap teams; provide technical services for tasks the villagers are not trained for, such as repair of asbestos-cement pipes; train community teams periodically. (Briscoe and de Ferranti, 1988, p. 17)

The following subsections briefly review how the government has performed in these areas.

²Up to 1979, the section dealing with rural piped water schemes was in the Ministry of Community Development and Social Welfare. In 1979, the government transferred departments from various ministries dealing with water to the Department of Lands, Valuation and Water under the Office of the President and Cabinet. Since then, the section dealing with rural piped water has changed ministry several more times. To avoid confusion, the generic term 'Water Department' will be used in this article in place of the exact name of the section and ministry handling the rural piped programme at any given time.

Monitor scheme performance

The Water Department developed a set of forms for Monitoring Assistants to use in reporting. The forms provided information to monitor the performance both of the schemes and of the Monitoring Assistants and communities who were supposed to be taking care of them. The Monitoring Supervisors had the responsibility to verify the information in these reports through field visits. The forms then went to the regional or subregional offices for review and summary. Ultimately an Evaluation Officer compiled the information into half-yearly performance reports. From these, engineers at central headquarters were supposed to spot chronic problems, diagnose their possible causes and remedies, and write a semi-annual maintenance report (Warner *et al.*, 1986, pp. 54–55; UNCHS, 1989, p. 29; Gearheart, 1990, pp. 7, 37–51).

The monitoring system seems to have worked fairly well in the beginning, and then gradually dissipated. A 1986 USAID evaluation team noted that the system worked well at the field level, but that follow-up from headquarters was weak (Warner *et al.*, 1986, pp. 21, 23, 47, 55). A USAID mission in 1990 found that the information from the forms was not being acted upon, and the schemes were no longer being properly maintained (Gearheart, 1990, p. 13). By 1997–98, a research team led by the author found that the system had more or less collapsed. Monitoring Assistants no longer submitted most of the forms, and those that were submitted were no longer verified for accuracy, nor compiled into half-yearly reports. The central headquarters relied for maintenance information on meetings with regional and subregional representatives, but the meetings were in fact held irregularly, and the information exchanged gave an incomplete and misleading picture of the condition of the schemes.

Provide technical services and supervise user committees and teams

Monitoring Assistants are the backbone of the government's technical support to communities in maintaining their schemes. The Monitoring Assistants are supposed to perform two basic services: provide expertise and informal training in handling repairs and problems beyond the knowledge of the Repair Teams; and encourage and pressure the user committees and Repair Teams to carry out their maintenance responsibilities.

Evidence suggests that Monitoring Assistants are providing these services to varying extents. The author's research included a survey of 19 small schemes throughout the country, interviews with the Monitoring Assistants in charge, and observations on their performance. Out of the 15 Monitoring Assistants, eight appeared to be reasonably conscientious, and one of these showed exceptional dedication in the face of very difficult circumstances. The remaining seven Monitoring Assistants were not inspecting the schemes regularly, not seeing that routine repairs and maintenance were carried out, or both. The extreme example of this was the Monitoring Assistant who could not even find the tank and distribution line that he had supposedly been visiting regularly for the past several years. An almost humorous example was the Monitoring Assistant who stood beside a small stream and explained that the nearby tank did not fill due to low pressure. The survey team then suggested walking up the 'stream' and discovered its source was two pipe breaks on the line feeding the tank. A similar anecdote comes from Phalombe District, where a consultant investigating how to rehabilitate a tank found that the only problem was a pipe break, which for seven years had prevented the tank from filling.

Several factors lie behind this poor performance: lack of transport, poor pay, few opportunities for promotion and lack of regular retraining. One of the most immediate and direct factors, though, is poor supervision. In only a few cases had a supervisor visited any of the 15 Monitoring Assistants in the past year. In the cases where supervisors had come, it was for a somewhat special purpose, such as delivering pipes, and never to do a routine inspection. Similarly, Mandowa (1999a, p. 19) concluded in regard to Phalombe District, 'There appears to be no system of monitoring the performance of Monitoring Assistants . . . by their senior staff.'

Training

Originally the Water Department relied on participation in construction to provide on-the-job training to Main Committees and Repair Teams. Now the department has the provision to run courses for both groups. Not many of these seem to have been carried out, though, due to a lack of financing.

The department used to have a very strong programme for training and upgrading its own staff (Glennie, 1983, pp. 68–72). Again due to lack of financing, the annual refresher training courses have not been held since 1995, and

no supervisors have been sent for courses at the government water institute since 1992. No recruitment and initial training have taken place since the early 1990s despite the apparent need.

GOVERNMENT FINANCING OF OPERATION AND MAINTENANCE

In describing the Malawi government's operation and maintenance responsibilities towards the rural piped schemes, Briscoe and de Ferranti did not mention financing. This was an extraordinary oversight, in that it is one of government's major responsibilities *vis-à-vis* the schemes. Communities contribute in kind to the costs of routine maintenance, other than cash for taps and the caretaker. The government has to finance the other cash costs of routine maintenance and all the costs for major maintenance. The government also has to pay the salaries and associated costs for Monitoring Assistants and other staff who carry out the tasks listed by Briscoe and de Ferranti.

Recurrent budget allocations

For many years, the donors that were financing the construction of new schemes were in effect also paying the cash costs of maintaining existing schemes. Programme engineers would systematically over-order materials for schemes under construction, e.g., about 10% was added to the orders for small pipes, 3% for large pipes, and fittings and solvent cement quantities were generously estimated (UNCHS, 1989, p. 29). Materials were therefore available to meet requests from existing schemes. In addition, USAID provided US \$700,000 to pay for the costs of the monitoring system and to replace faulty transmission lines on three schemes (Warner *et al.*, 1986, pp. 21, 23, 41).

The government contributions to rural scheme operation and maintenance are difficult to quantify. First, the national recurrent accounts did not have separate votes for rural piped schemes prior to fiscal year 1987, and again from FY 1991 to FY 1993. Second, even when there were separate votes, these did not always include personal emoluments (basically salaries and wages).

Table 1 gives the available recurrent budget estimates for rural piped schemes. The figures indicate three broad trends. First, budget allocations have risen moderately albeit erratically over the past decade, taking into account

Table 1. Recurrent budget estimates for rural piped water schemes for selected years. FY 1999 figures are draft estimates. All other figures are revised estimates, approved by Parliament in December of the fiscal year.

Use of funds	FY 1987	FY 1988	FY 1989	FY 1994	FY 1995	FY 1996	FY 1998	FY 1999
<i>Personal emoluments</i>								
MWK total	122,306	123,083	262,428		Not available		7,495,370	9,857,524
Total in US\$	\$55,322	\$47,977	\$95,171				\$186,560	\$219,056
<i>Scheme materials</i>								
MWK total	328,668	350,000	470,000	2,468,428	1,460,628	962,015	978,075	5,118,928
Total in US\$	\$148,665	\$136,428	\$170,447	\$280,388	\$95,946	\$62,785	\$24,344	\$113,754
<i>Other goods and services</i>								
MWK total	23,600	153,316	464,355	1,082,533	1,213,419	2,217,113	2,749,218	5,294,903
Total in US\$	\$10,675	\$59,762	\$168,400	\$122,965	\$174,958	\$207,482	\$92,773	\$231,418
<i>Total O&M</i>								
MWK total	474,574	626,399	1,196,783	3,716,609*	3,094,119*	4,078,327*	11,222,663	20,271,355
Total in US\$	\$214,662	\$244,167	\$434,018	\$422,169*	\$203,197*	\$266,168*	\$279,333	\$450,475

*Operation and maintenance totals for FY 1994 to FY 1996 do not include salaries, but do include some wages for temporary employees and non-established staff.

Notes: (1) 'Personal emoluments' covers mostly salaries and temporary employment. 'Scheme materials' ('maintenance of water supply' in the budget documents) covers the cost of materials, parts, fittings, tools, etc. used on the schemes. 'Other goods and services' covers things such as transport, office costs, and field allowances. (2) The fiscal year before 1997 started on 1 April. From 1998, the fiscal year starts on 1 August. FY 1997 covered 15 months, from 1 April 1997 to 31 July 1998.

Sources: Exchange rates are the average of the buying and selling rates for the first calendar year in the fiscal year, as published in Reserve Bank of Malawi (1998, p. 89). Budget figures are from Malawi Government (1988, 1989, 1990, 1995, 1996, 1997, 1999a, 1999b).

the devaluation of the kwacha. In 1998, the recurrent budget for the rural piped schemes was about US \$30,000 higher than 10 years earlier. However, there have been some dramatic vicissitudes in this period. The budget was at its highest in FY 1989, principally because salaries and vehicle costs shot up. Spending was also high in FY 1994, as it was in all ministries that year: a severe drought and a new incoming government caused the budget deficit to reach over 15% of GDP. The recurrent allocation to rural piped schemes then sank to an all time low in FY 1995, as the government cut spending and embarked on a stringent structural adjustment programme with the IMF (Economist Intelligence Unit, 1998, p. 14). The FY 1999 looks quite high, but these are only draft estimates, and will likely be revised downward at least once.

Second, more and more of the maintenance budget for rural schemes has been going to cover personal emoluments. In FY 1987 and 1988, these accounted for 20% and 26% respectively of the overall operation and maintenance budget. In FY 1998, this had risen to 67%. In the draft budget for 1999/2000, personal emoluments drop to 49% of the operation and maintenance allocation. But as just mentioned, one can expect these draft figures to be cut more than once in the course of the fiscal year, and the percentage taken by salaries and wages to rise as a result.

Third, less and less of the maintenance budget is being used for materials to repair the schemes. In FY 1987, 70% of the total operation and maintenance budget for the rural schemes went to this. By FY 1998 and FY 1999, the percentages were 9% and 25% respectively. From FY 1996, fewer dollars were being spent annually on scheme maintenance than during the 1980s. The exception to this trend came in 1994, when the worst drought in living memory hit the country. Figure 2 illustrates these latter two trends graphically.

Budget figures tell only part of the story, though. In fact, the money allocated for scheme maintenance is not always used in full for this purpose. For one, materials purchased for maintenance may be issued from the government stores for another purpose, such as construction. For another, the monthly cash allocation for maintenance may be deposited in the account of a different vote. The Malawi government now operates on a cash budget, meaning that banks will only honour a government cheque if the account on which it is

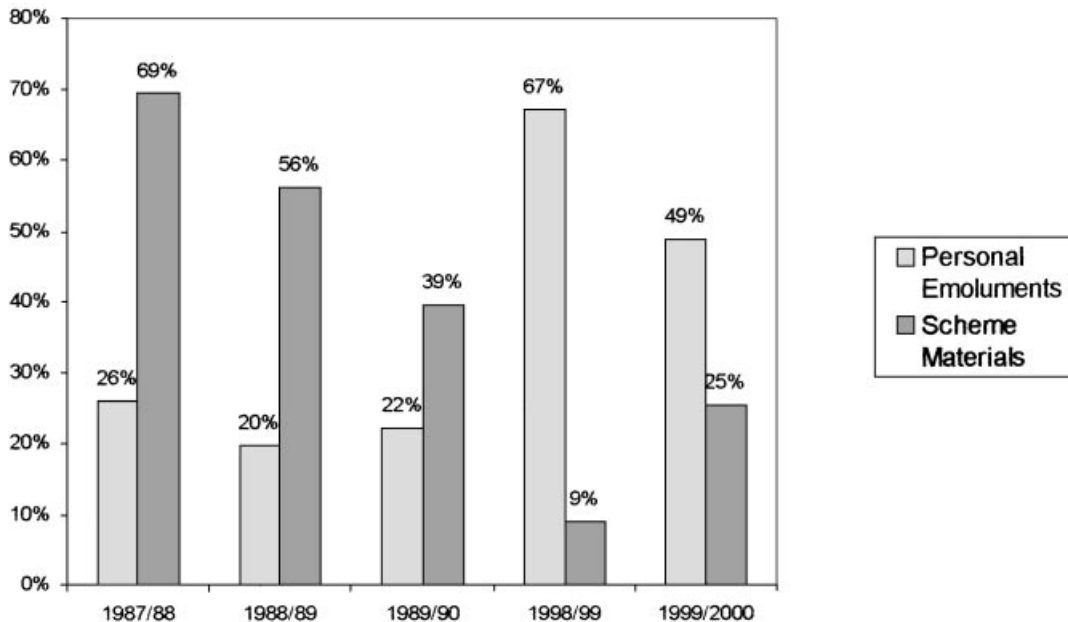


Figure 2. Personal emoluments and scheme materials as percentages of the government recurrent budget for rural piped schemes in selected years. Source: Table 1 data.

drawn has sufficient cash in it. Every month the Treasury sends enough cash to each Ministry to cover its estimated cash flow for that month. A portion of that cash in the Ministry of Water Development is intended for rural scheme maintenance. However, Treasury often sends too little cash, or particular activities may require more than their monthly allocation. In these situations, the officers in charge may deposit cash intended to provide for maintenance expenditure in another account where they feel the need is more pressing.

Evidence of inadequate financing

One way to evaluate the level of government financing for scheme maintenance is to compare the estimated requirements for this at the time of construction with the levels subsequently achieved.

A Malawian consultant reviewed actual operation and maintenance expenditures on five schemes for 1985, and found that the government had spent about 8 US cents per capita (Msukwa, 1986, pp. 51–53). About 4 cents of this went for routine and major repairs, another 2 cents for salaries, and the rest for various other costs connected with the monitoring system (e.g., allowances, housing, supervision). A USAID team evaluating the piped scheme programme the following year took these amounts as the minimum required per capita expenditures by the government directly on schemes (Warner *et al.*, 1986, pp. 42–44).

Msukwa based his estimates on Water Department records of expenditures on each scheme. These accounts are no longer maintained. The only available data are the national budget estimates, presented in Table 1. Dividing these estimates by an estimate of scheme design population gives the per capita expenditures presented in Table 2.

The figures show that the government is spending less than half of the projected requirement for scheme maintenance. For instance, in FY 1998 the Water Department budget for rural scheme maintenance amounted to about 3 cents per capita in constant prices, compared to the 8 cents per capita that the department had spent in 1985 on Msukwa's sample of schemes. The budget for 1994, the drought year, came closer to the estimated requirements, but subsequent budgets sunk down to near the 1998 level.

In fact, per capita expenditures on scheme maintenance have been even lower than the figures for the 1990s suggest, for the following reasons:

- The budget figures include all kinds of overhead costs that were not included in Msukwa's estimates, e.g., building and vehicle maintenance, transport and allowances not directly related to scheme maintenance, external travel.
- The estimates for design population are undoubtedly well below the number of people actually living in supply areas. In some cases, the so-called design population represents the number of people served by a scheme on completion.
- Money expressed in 1990 constant values, as are the budget figures, has significantly less worth than the same amount in 1985 current values. So, for example, not only did the Water Department have only 3 cents per capita

Table 2. Government per capita expenditures for rural piped scheme operation and maintenance, selected years (US current dollars, 1985; US constant 1990 dollars, 1994–1998).

Government expenditure	5 Schemes 1985	National budget revised estimates			
		1994	1995	1996	1998
Total per capita	\$0.08	n.a.	n.a.	n.a.	\$0.03
Total per capita, excluding salaries	\$0.06	\$0.05	\$0.02	\$0.02	\$0.01

Notes: Per capita estimates were calculated assuming a served population of 1,346,000. This excludes the population served by Mpira–Balaka scheme, where some consumers pay for water. For these calculations it is assumed that this revenue is used for the maintenance of that scheme. In practice, some of that revenue may be used for operation and maintenance, or government budget funds used for Mpira–Balaka maintenance and extension.

Sources: Population figures from sources listed for Figure 1; national budget data from Table 1; 1985 expenditures from Msukwa (1986, p. 52); exchange rates and National Composite Price Index from Reserve Bank of Malawi (1998).

Table 3. Major maintenance problems and their consequences for rural piped schemes in Phalombe and Thyolo districts.

Scheme name	Scheme size (design, populations, number of taps)	Problems requiring major maintenance	Dry taps	
			No.	%
Phalombe Major	140,000 pop. 560 taps*	1. Broken, rusted pipes 2. Tanks leaking 3. Tanks need relocation	368	68%*
Sombani	40,000 pop. 300 taps	1. Source changed course (need intake on new source)	300	100%**
Muloza East	32,000 pop. 198 taps***	1. Source inadequate (need intake on new source 2. Broken, washed away, untraceable pipes	134	100%
Phalombe Minor	78 taps	1. Washed away pipes	51	65%
Didi	54 taps	1. Washed away pipes	31	57%
Migowi	6,000 pop. 59 taps	1. One line needs realignment 2. Broken pipes	15	25%
Chiringa	2,000 pop. 25 taps	1. Intake too small given (illegal) private connections 2. Broken pipes	9	36%
Taps visited	1,112	Overall percentage dry taps	908	82%

*462 taps visited; **2% got night flow; ***134 taps visited.
Source: Mandowa (1999a, pp. 10, 25–28; 1999b, pp. 10–11).

(in constant 1990 dollars) to spend on maintenance in FY 1998, but those 3 cents bought less than they would have in 1985. Unfortunately the only published price index covering recent years begins in 1990, and so current dollars could not be converted to 1985 dollars.

- As explained at the end of the last section, funds budgeted for scheme maintenance are regularly spent on something else. The figures in Table 2 are only budgeted expenditures, not actual ones.

Whatever the actual amount being spent on scheme maintenance, it is insufficient compared to need. A study in two districts and the author's research provide evidence of this.

A census of improved water points in Phalombe and Thyolo Districts determined the condition of the seven rural piped schemes located in the two districts. Table 3 summarizes the relevant data. The four largest schemes have virtually stopped functioning for lack of major maintenance, a government responsibility. More than half the taps are dry in a fifth scheme for the same sort of reason. The two remaining schemes are functioning *relatively* well. Nonetheless, 25% or more of their taps will remain dry unless the government carries out major maintenance.

Findings from the author's research paint a somewhat better, though far from satisfactory, picture. As Table 4 indicates, a greater number and percentage of taps were working on the 14 schemes for which reliable data were obtained compared to schemes in Phalombe and Thyolo. Out of 922 taps, 43% were dry on the day of the survey and 57% were unreliable for at least part of the year.

As in the Phalombe and Thyolo schemes, lack of major maintenance was a significant factor behind dry taps. However, in the 14 schemes, other factors were equally important. One such factor is poor routine maintenance. Inadequate government financing is in large part to blame for this. The government is supposed to supply community Repair Teams with the necessary materials for doing routine repairs. But most of the teams have not been supplied with the solvent cement, pipes, tools, and so forth that they need to do their job. Consequently, routine repairs are done poorly or not at all.

Table 4. Major maintenance problems and their consequences for 14 small rural piped schemes in five districts.

Condition of taps	Number	Percentage of total taps
Dry at time of survey	394	43%
Dry due to lack of major maintenance	240	26%
Reported as unreliable at time of survey	525	57%
Unreliable due to lack of major maintenance	391	42%
Total number of taps on 14 schemes	922	100%

Source: Author headed a survey team that gathered data July–August 1997, with follow-up visits to five schemes March–April 1997. The 14 schemes were Naungu, Ndala, Chilumba, Kalitsiro, Chipoka, Ng'onga, Iponga, Chagwa, Zumulu, Nkhamanga, Mirala, Liwonde, Hewe and Nanyangu.

Case study of financing needs

The following case history of one scheme illustrates more concretely how current levels of government financing for maintenance affect scheme functioning.

Chagwa scheme was built in 1976. The original population served was 7700 people, but based on the original number of taps it was probably designed to serve around 15,000 people. Presently, about 20,000–25,000 people live in the supply area.

Chagwa is one of the schemes that works relatively well. At the time of the survey, 76% of the taps were working. However, the non-working taps had all been dry for a long time, and many so-called working taps were unreliable. Overall, the scheme suffers from the following five types of supply problems, all partly the result of inadequate government financing.

Dry taps

About half of the non-working taps (11% of the total taps) are dry due to washed away or stolen distribution lines, and design or construction errors. Under the present division of responsibilities between government and communities, the government is supposed to supply the necessary pipes, or correct the errors.

About 1993, the government began to do just that for five tap sites that were at too high an elevation for water to reach them. Unfortunately, the government could not provide sufficient pipes and other materials, and so a distribution line was simply left uncompleted and open, with water pouring out of it.

Unreliable taps (dry season)

Another 30 taps (28%) provide water fewer days than not during the dry season. Basically the problem is that too many people are drawing water from the pipeline meant to serve the perimeters of the supply area, and consequently not enough water reaches the taps there.

The solution is to lay a parallel transmission line, with no connections on it, to take water to the more distant taps. (Ideally, the leaking storage tank on this line would be repaired at the same time.) In fact, the Ministry provided 500 90 mm pipes for this purpose in 1995, but the Monitoring Assistant never laid them because he felt that he should wait for fittings, which up to mid-1998 had not arrived.

Unreliable taps (rainy season)

During the rainy season, the whole scheme suffers from frequent supply interruptions because several distribution lines receive water directly from the intake, which gets blocked up every time it rains heavily.

Partly this is the community's fault, because the consumers no longer pay a caretaker to clean the intake. However, the problem would disappear or be less severe if all the distribution lines were fed from a storage/sedimentation tank, which is the standard design for a gravity-fed system with so many connections. This implies that the government is also to blame in part, for not financing the construction of a new tank at the intake.

Unreliable taps (frequent pipe repairs)

People reported that it could take a month or more for service to be restored in an area when a pipe burst or became blocked. Again, this results from problems both in the community and with government financing. On the

Table 5. Partial costs for supplying five dry taps, adding 10 new taps and generally improving water supply reliability, Chagwa scheme (as of July 1998).

Activity ^a	Partial cost (US\$) ^b
Complete distribution line to 5 dry (plus 10 new) taps	5,060
Lay transmission line to improve dry season supply to 30 taps	380
Build tank at intake to improve rainy season supply to 106 (all) taps	10,820
Total	16,260

^aThese activities do not cover all the necessary maintenance tasks prescribed in the test. For instance, these costs do not include repairing the leaking tank on the new transmission line, installing air valves and wash-outs, or replacing distribution pipes. Also, serving the present population in the supply area would require adding several more distribution lines and numerous tap sites.

^bThese estimates exclude the costs of detailed design, transportation of materials to site, and fittings and builders' charges for the tank.
Source: Survey team (Wellington Mandowa).

community side, the problems are that too few people are willing to serve on or assist the Repair Team, and the Main Committee does not do anything about this. The government, for its part, failed to install washouts that would reduce pipe blockages and bursts. The tank that should have been built at the intake would have had the same effect.

Lack of taps

In the 22 years since Chagwa was built, the population has increased and redistributed itself within the geographic area where the scheme lies. Naturally, people in the unserved areas would like distribution lines put in. The required works that have been mentioned in the previous paragraphs would help expand the scheme's capacity in order to serve more people. In addition, more distribution lines and of course taps are needed.

Table 5 gives partial costs for rectifying some of these problems. It indicates that as of July 1998 the government needed to spend at least US \$20,000 to correct the major problems on Chagwa scheme. This figure is actually quite low relative to the work to be carried out, because a few years back the government already supplied a huge number of large-diameter pipes, and began construction on one line. The costs would be much higher if these materials had to be purchased.

Nonetheless, the financial requirements for maintaining Chagwa are out of all proportion to the available recurrent budget. In FY 1998, the total budget for materials to maintain all 80 some rural piped schemes came to US \$24,344 (*cf.* Table 1). In the draft estimates for FY 1999, this amount has risen to US \$113,754. Even so, the Water Department is clearly in no position to spend US \$20,000 on a single, small scheme where most of the taps at least supply water sometimes.

REASONS FOR INADEQUATE GOVERNMENT FINANCING

Broadly, there have been three reasons behind government's failure to allocate enough funds for maintenance.

First, the government does not have much money, and piped scheme maintenance is an easy area in which to make cuts. The government is trying desperately to cut down expenditures in order to balance the budget, but declining prices and markets for the main export, tobacco, and misuse of government funds make this an uphill battle. In a struggle for scarce resources, the piped water programme does not have a strong backer or constituency to fight for it. Kamuzu Banda, the country's dictator for 30 years, had used schemes as pork barrel projects, to win and preserve popularity among rural people. Maintenance is never quite as good as construction for these purposes. In any case, a new regime has taken power and prefers to use boreholes with hand-pumps, primary schools, and clinics to promote itself in rural areas. Donors have recently also shown much more enthusiasm for boreholes than piped schemes in rural areas, or for other sectors such as urban water supply, education, health and the environment.

Second, the government for a long time refused to consider transferring part of its financial responsibility to the consumers, even after USAID commissioned Msukwa and other consultants to make clear the costs involved.

More research would be required to establish exactly why the government held this attitude for so long. Perhaps it was because asking consumers to pay more would undermine the political use that Banda and the ruling party got from the schemes. It also may be that people in the Water Department simply did not believe that rural people could or should pay more for water, given the tremendous labour contributions required during construction and maintenance. The attitude and policy of the Water Department have now changed, but changes on paper will not be easy to implement after so many years of a different approach.

Third, most implementers and observers were naïve or vague about the costs and requirements for maintaining gravity schemes. In 1980, the engineer in charge of the Malawi programme was quoted as saying that the schemes would last a 100 years before a major component required replacement (Liebenow, 1984, p. 22). Despite prolific literature on the programme very little effort was made to quantify the costs of maintenance. The government did not even introduce a maintenance vote into the budget until 20 years after the programme began.

CONCLUSIONS AND CAVEATS

The Malawi rural piped scheme programme aimed, among other things, to limit the role of government in scheme maintenance by increasing the role of the consumers. The programme enjoyed so much success in this respect during its expansion phases that even advocates of the demand-responsive approach held the programme up as a model for their new strategy. But once construction began to wind down, problems in the maintenance system gradually became apparent. The central factor behind the breakdown in maintenance has been the government's failure to allocate enough funds for it. A secondary factor has been poor management of the monitoring system, a problem only in part attributable to inadequate finance. Today less than half the taps are believed to supply water, and even that level of service is surprising in light of the poor current condition and maintenance of the schemes.

These problems did not arise because programme designers and implementers neglected to plan for operation and maintenance. Rather, they thought that a very good system was in place. A USAID team perceived the cracks in the façade – the rising cost to government – but the team still recommended that construction go forward.

People at the time did not anticipate the future problems with maintenance for basically four reasons. First, resources, enthusiasm and motivation generated by the construction programme masked the points of weakness within the maintenance system. Second, it went largely unnoticed that the system's success hinged on critical assumptions at odds with experience up to that point, most notably that the government would allocate large amounts of the budget to operation and maintenance, and that most maintenance would largely be routine. Third, the programme's strategy fit the received wisdom of the day so perfectly that people accepted these assumptions without sufficient review. Fourth, no one foresaw the dramatic changes in the economic and political environment that would further undermine assumptions about government financing and management. These errors of perception serve as caveats to us all.

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