Working Together

The sharing of water and sanitation support services for small towns and villages

A WELL study produced under Task 510
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Table of contents

Table of contents ..... **i**

List of tables ii

List of figures ii

Acknowledgements iii

Summary **1**

1. Introduction **2**

1.1 Sustaining systems 2

1.1.1 What resources are required? 2

1.1.2 Where do the resources come from? 2

1.1.3 Who manages the resources? 3

1.2 Support 4

1.2.1 Vertical supply 4

1.2.2 Devolved supply 4

1.2.3 Subsidiarity 4

1.2.4 Mutual support 5

1.3 Methodology 5

1.3.1 Shared resources 5

1.3.2 Identifying shared resources 7

1.3.3 Selecting case studies 7

1.3.4 Selection of schemes 8

2. Case study – Mulanje gravity water supplies, Malaŵi. **10**

2.1 History 10

2.1.1 Construction 11

2.1.2 Management 11

2.1.3 Resources 13

2.2 Present status 15

2.2.1 Resources 16

2.2.2 Future directions 20

3. Case study – Tereta gravity water supply, Ethiopia **21**

3.1 History 21

3.1.1 Construction 22

3.1.2 Management 22

3.1.3 Resources 23
3.2 Present status 26
3.2.1 Resources 26
3.3 Future directions 29
3.3.1 Tijo water supply 29
4. Working together 30
4.1 Sharing resources 30
4.1.1 Human resources 30
4.1.2 Financial resources 30
4.1.3 Physical resources 31
4.1.4 Natural resources 31
4.1.5 Social resources 31
4.1.6 Links 32
4.2 Roles and responsibilities 32
4.3 Participation 33
4.4 Accountability 33
4.5 Elements of success 34
4.6 Concluding remarks 35
References 36
Malaŵi 36
Ethiopia 36

List of tables

Table 1. WaterAid gravity flow projects in Arsi Zone, Oromia Region 22
Table 2. Human assets - trained staff 24
Table 3. Financial assets – construction costs 24
Table 4. Physical assets 25
Table 5. Financial assets – income and expenditure 27

List of figures

Figure 1. Resources for a large town 3
Figure 2. Resources for a rural area 3
Figure 3. Resources for a small town 3
Figure 4. Decentralisation 4
Figure 5. Subsidiarity 5

Figure 6. Sharing resources 5
Figure 7. Formation of communities around discrete and networked water supplies.....6
Figure 8. Schematic diagram of a gravity flow system.....8
Figure 9. Case study sites 9
Figure 10. Map of Malaŵi 10
Figure 11. Construction organisation.....12
Figure 12. Maintenance organisation 13
Figure 13. Map of Ethiopia.....21
Figure 14. Organisation of Tereta Gravity Flow Scheme.....23

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Summary

Decentralised schemes are an ideal model for water and sanitation projects, but they may require external support from outside the community. This report investigates how sharing resources and skills can enable projects to be locally based but still have access to the support they require. The report provides project planners and implementers with case studies on the sharing of resources and discusses some of the issues that need to be considered. The study looks at established water supply systems in Malaŵi and Ethiopia. It examines what resources are required and who is supplying them.

One factor contributing to the success of water supply schemes has been the involvement of the community. Community-led water supply and sanitation projects need to be managed as locally as is reasonable so they are based on local demands and are sustainable. The ability of the community to manage a system will depend on:

- the resources required to maintain the system;
- the resources of the community; and
- the resources it can draw on from outside the community.

The desire to devolve control to the lowest possible level can burden small communities with tasks for which they do not have the resources. Rural communities far from urban centres do not have easy access to central support services and these external resources are outside the control of the community. Rather than centralise responsibility at a higher level and lose the contact with local people, an alternative approach is to “cluster” projects together, so the support can be provided locally. This allows specific specialist tasks to be shared between neighbouring projects (e.g. accountancy or engineering expertise) or common resources used (e.g. a centralised facility for making pit latrine slabs) but the control of the separate schemes remains at the local level. The large umbrella user group required to co-ordinate activities can still be accountable to the community if there are suitable channels of communication.

The two case studies describe schemes that provide basic water supplies to thousands of people in rural areas. The Ethiopian scheme appears to have good foundations for continued operation, with strong human, social and financial resources. The Malaŵian schemes have proved to be very successful in the past but are reaching the end of their physical and institutional life, with both aspects requiring attention if these schemes are going to continue to be effective.

Different management models can evolve to provide a water supply scheme with the resources it requires. The details of the management structure appear to be less important than factors such as the availability of resources (physical, natural, social, financial and human) and the way in which the management systems operates. Transparency and accountability are important factors in the development and operation of the management system.

The focus of authority has proved to be an important factor in the sustainability of a project. The organization managing the resources controls the scheme. The control the community has over the resources required to manage their water supply can be maximised by designing the scheme around their existing human, financial, physical, natural and social resources. In order to distinguish between other community structures (such as local government) and the focussed management of the water supply, the term “user group” is preferable to “community”.

The design of management systems must recognise the need for effective incentives to keep the system operating satisfactorily. The greatest incentive lies with the users themselves, so they need to be given the authority and resources to carry out this role.

1. Introduction

Safe water supplies and sanitation are accepted as important assets for people to have healthy and productive lives. The provision of infrastructure is seen as a way of increasing people's options and reducing their vulnerability to events outside their control. The planning and construction of infrastructure forms only a small proportion of the life cycle of a project to supply watsan services. In one of the case studies examined in this report, the sustainable operation, management and repair of the infrastructure has lasted ten times longer than the construction period. When the physical components of the scheme reach the end of their working life, they need to be refurbished if the system is going to continue to provide a sustainable service. The infrastructure also has to evolve to meet the changing needs of society.

1.1 Sustaining systems

1.1.1 What resources are required?

Water supply and sanitation systems require a variety of resources in order to be designed and managed sustainably. These can be grouped into five categories[1]:

- Human (education, skills, health)
- Financial (credit, banking services)
- Physical (pipes, latrines, pumps, dams, spare parts)
- Natural (water, building materials)
- Social (community institutions and organisations).

The quantity of resources required will depend on the type of system used. Thus a traditional hand dug well does not require a large amount of inputs to keep it operating. A text book water system, with a dam, pumping stations, treatment works, chlorination, reservoirs, distribution system, billing system and wastewater disposal, will require significantly more inputs to keep it working.

The timing of the use of resources will also vary. The hand dug well will need most of the inputs during the construction stage and then very little input after that until the well needs to be cleaned out. The conventional water supply would require regular inputs of labour, parts, inspections and the money to pay for them.

1.1.2 Where do the resources come from?

A village may be able to provide the inputs for a traditional source, such as somebody who knows how to dig a well, the tools so it can be dug and the leadership to organise a collection to pay for the work to be done. All these are available within the village boundary. The same village would not be able to provide the inputs for a conventional water supply system from within their boundaries. The skilled staff, chemicals, spare parts and financial services would have to be imported from outside the village. An intermediate level of technology could be a handpump, where the villagers could provide manual labour, a management committee, money to pay for maintenance and a trained caretaker, but spare parts would have to be brought in from elsewhere. The area that these resources come from is called the *environmental footprint*. The people will have better control over the resources from near their village than the resources supplied from elsewhere.

[1] *Sustainable livelihoods: Lessons from early experience*, C Ashley & D Carney, DFID 1999

Different communities will have access to varying quantities of resources. A group of 50,000 people is likely to have access to more resources than those available to 500 people. The mix of available resources is also like to vary, for example a city of 50,000 may have good access to financial, human and physical resources, but there may be lower public input into the watsan services and natural resources may be constrained by population and pollution pressures.

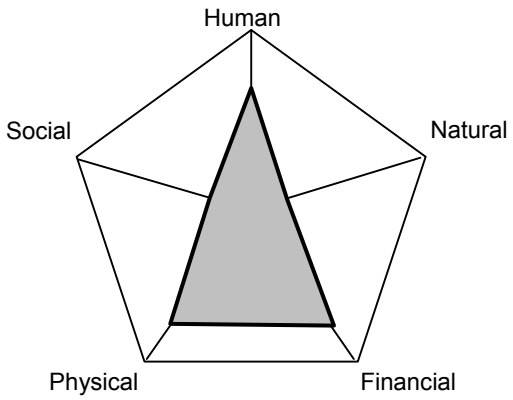


Figure 1. Resources for a large town

50,000 people living in villages and rural communities may not have the density of population and pollution problems restricting their natural resources, but they lack access to skilled workers, banking services and spare parts for maintaining the infrastructure. The stable community structure however may provide better social networks and opportunities for providing voluntary labour.

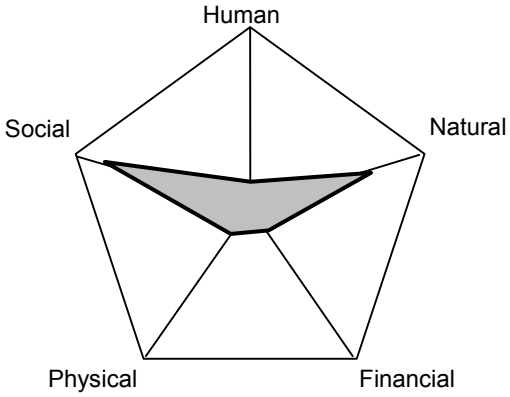


Figure 2. Resources for a rural area

Small towns show a transition between these two extremes. Population numbers and pollution can limit access to natural resources. The population size however may not be large enough to support the financial and professional services required to design and manage an effective watsan system. The social characteristics are in transition, with a mixture of cash and non-cash economies, and less sense of community.

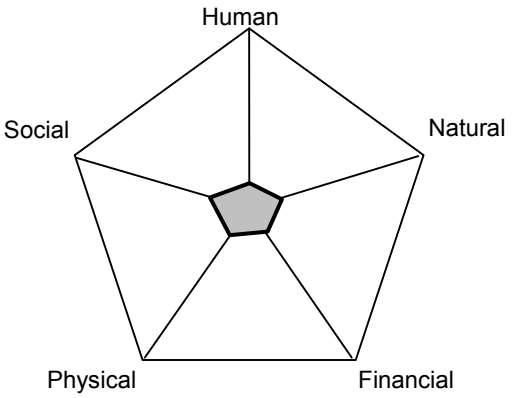


Figure 3. Resources for a small town

1.1.3 Who manages the resources?

Since the International Drinking Water Supply and Sanitation Decade it has become accepted that if water and sanitation services to the poor are to be sustainable, the community must be involved in the provision of these services. The extent of the involvement varies from a brief consultation before the infrastructure is delivered, to a full participative programme. The ultimate degree of community control would be a state of self-sufficiency, where the community had the resources available to manage their own services.

If the community is to be self-sufficient and manage their water system, there are two options:

- to restrict the technology and management options to match the available resources; or
- to increase the availability of the resources the users can access.

Traditional water sources have developed over centuries in response to the resources available to the local population. Although suited to the current resources of the users, traditional water sources can be a drain on the community, causing health problems, a burden for women fetching water and restricting water supply for economic activities, such as farming or manufacturing. An improved water supply may generate sufficient benefits for the community to be able to support a higher level of service and improve people's lives.

The resources available to a small town or village will be limited. They can be supplemented in two ways:

- support from local, national or international organisations (vertical supply route); and
- support from neighbouring communities (horizontal supply route).

1.2 Support

It has to be accepted that, apart from large communities (such as cities) or communities with very low levels of service (such as traditional water sources), watsan services will not be self-sufficient and will require resources from outside the community boundary.

1.2.1 Vertical supply

There are a variety of organisations that can provide support, including national governments, local governments and non-governmental organisations, with or without international multilateral or bilateral support. However, a reliance on external support can restrict local decision-making and reduce any sense of local ownership. The focus will still be towards the centre if the scheme is dependent on resources that are not available locally. The supply of resources is vulnerable to activities outside the control of the users and this can limit the inherent sustainability of the services.

1.2.2 Devolved supply

In order to give responsibility to those with the greatest motivation for ensuring the continuation of watsan service, power can be devolved and decentralised. This devolution of authority is promoted centrally (top down), with the mandate to manage remaining with the central government. This brings decision making closer to the users, but does not necessarily give them control. Decentralization of authority does not necessarily disperse the resources required to carry out the task.

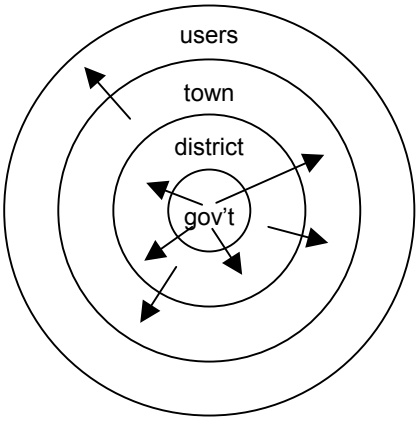


Figure 4. Decentralisation

1.2.3 Subsidiarity

A stronger user focus is given if the principle of *subsidiarity* is applied to the management structure. All activities that can be managed locally are the responsibility of the community and organizations at a wider scale only look after the issues that cannot be reasonably dealt with at the lowest possible level. Thus collecting revenue can easily be managed locally, but periodic water testing would need to be carried out by personnel working

at a regional or national level. The focus of the management systems changes as the people in charge are no longer those at the "top", but the users.

The management structure is still vertical and although the focus of those responsible has changed, the users are still dependent on external support. The amount of external support is now minimized however.

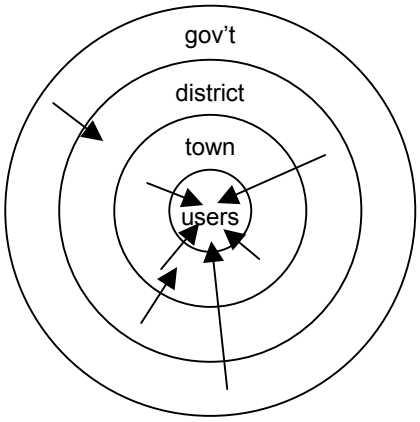
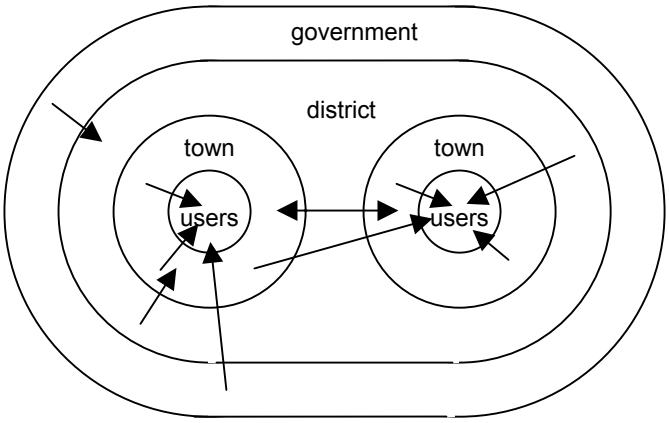


Figure 5. Subsidiarity

1.2.4 Mutual support

An alternative model is for communities to group together, sharing resources ("clustering"), rather than relying on external support. The support is therefore horizontal, co-operating with communities of a similar size. This bottom up approach ensures that the management remains at a local level, with the resources required from outside the immediate community coming from neighbouring communities. Effectively the size of community is increased and resources can be pooled. Control of the resources would be outside of the immediate social group, but is with people with similar interests and motives. Physical links such as transport and social links such as cultural similarity lead to a greater affinity with neighbouring communities than with a distant government centre.



This model would not provide all the resources, but would provide an alternative system to at least the lowest level of a vertically orientated management system.

Figure 6. Sharing resources

This report aims to look at two case studies to see what is required for sustainable local co-operation and what resources can be supplied internally by the local group and what still needs to be supplied by external organisations.

1.3 Methodology

The evolving sustainable livelihoods framework encourages an integrated approach to analysing how people manage their lives. Access to resources determines the options available to individuals, households and communities.

1.3.1 Shared resources

Of the five resources identified as part of a sustainable livelihood analysis, natural and social resources are inextricably linked to the community and its location. Human, financial, and physical resources are mobile and can enhance these local resources. However, these are often not available in rural areas. It is in these three subject areas that there is most potential for co-operation between communities.

Human resources

Human knowledge and skills are vital components for watsan systems, but small systems may not be able to afford employing people such as engineers, accountants and technicians full-time. Similarly the professional staff may be underemployed in small towns, preferring to live in larger urban areas. Sharing professional staff between several schemes on a part-time basis may be more cost effective and make it easier to recruit and retain staff.

Financial resources

Communities can pool financial resources to benefit in a variety of ways:

- bulk purchasing of supplies and other economies of scale;
- increased access to credit and banking services;
- potential for cross-subsidies; and
- increased financial robustness – when one part of a water supply system requires replacing, other associated systems can continue to provide a cash flow. Lower reserves are needed, as the risk of system failure is shared.

However, transparency and accountability are vital if communities are to be able to share financial resources on a large scale.

Physical resources

This is the most tangible form of community co-operation, whether it is bulk purchasing of spare parts or several communities sharing a dam or treatment works. Sharing a resource such as a pipeline or sanplat casting facility can make the scheme more viable economically, but can lead to disputes over sharing maintenance costs and allocation of scarce supplies. There are two types of shared physical resource; those that are linked, such as water supply network or sewerage scheme, and those that are discrete, such as a number of hand pumps in one area or pit latrines in one village. The discrete facilities do not rely on the rest of the facilities to operate; this can make them more robust, because if one fails, the others can still operate. However, if only one community is affected, there is no motive for neighbouring people to help mobilise resources to solve the problem, so as a system it may prove less sustainable. Physical infrastructure can become a focus for community if its influence is stronger than other social factors.

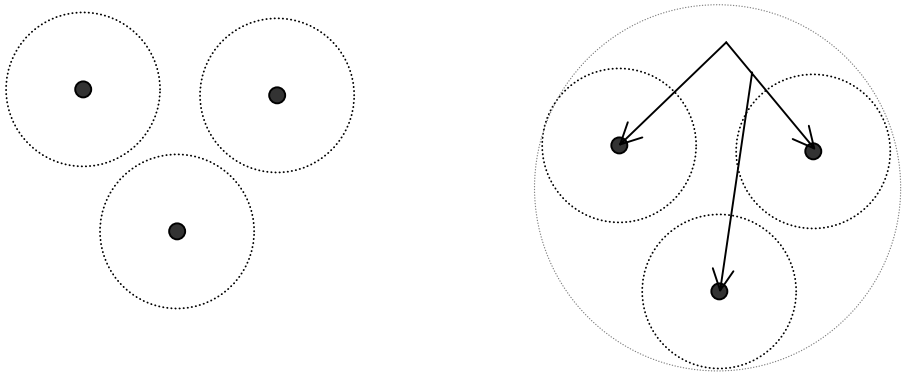


Figure 7. Formation of communities around discrete and networked water supplies

Natural resources

Although natural resources are normally defined locally, they can be shared between communities. Water is an obvious example, as, apart from point sources, it is piped from the source to the point of use. Thus urban communities often rely on water from rural areas, areas with insufficient water can pipe water from water rich areas, although this is normally over short

distances. A shared natural resource for a water supply defines the water supply system and therefore determines the community managing the system. The concept of sharing the resource between communities becomes blurred.

Social resources

Communities are defined by their sharing of a common social network. As with shared natural resources, shared social networks in a community-managed scheme can be viewed as a larger definition of the community, rather than distinct groups. Institutions, such as government departments, are examples of a social resource that do span communities, but this is a top down allocation of a resource, rather than one that is directly responsible to the users.

1.3.2 Identifying shared resources

The three resources that are often lacking in rural areas (financial, human and physical) are all important for the running of watsan services.

Physical resources are tangible and easy to quantify. Their physical presence allows issues such as ownership and maintenance responsibility to be discussed using concrete examples rather than abstract and theoretical concepts. Watsan services can share several physical resources, either fixed (such as common reservoirs or pipelines) or more dispersed (such as shared distribution networks for parts). To provide an introduction to sharing resources, it was decided to concentrate on the most concrete resources, such as pipelines or reservoirs. Whilst these may not be immediately replicable in discrete watsan projects (where sharing human or social resources may be more suitable), it does provide a simple introduction to the issues surrounding co-operation and shared management.

Financial data is sensitive politically; shared funds for replacement of watsan services need to be secure. It is however likely to be well recorded; only a limited number of people (i.e. the treasurers for each community) will need to be interviewed to ascertain the degree of co-operation, so this may be an option for study.

Shared human resources are dependent on the personnel involved and the quality is difficult to quantify in a short period. In order to gain an overview of this area, a number of case studies will need to be examined, as the factors involved are less visible and tangible than either financial or physical resources. The training and motivation of the staff involved are likely to have a great impact on the success of the management system. Thus good staff can make a bad system work and a good management structure may be hampered by inadequate human resources.

1.3.3 Selecting case studies

In order to assess the success of community management, the community has to have been managing their infrastructure for a reasonable period. Close involvement by an external agency will reduce the input from community. There need to be records of how the system was set up, so successes, failures and adaptations can be assessed. The infrastructure needs to be still functioning, so there is a management system in operation that can be assessed.

In order to assess the sharing of resources between communities, there have to be resources that need to be shared. Infrastructure that does not require regular support (such as robust handpumps) makes it difficult to assess the success of the management systems until it fails. These resources are easier to examine if they are tangible and have clear supply routes, such as physical spare parts or shared finances, rather than human resources. The success of the shared resources needs to be easily enumerated.

The scale of the technology is important. Sanitation in small towns and villages is a household intervention, operating as discrete entities rather than a physically linked system. Each household

would have to be visited and assessed. Variations in the operation are likely to be large and dependent on the individual householder rather than the management system. Successful sanitation also requires a high level of abstract inputs, in the form of hygiene promotion, rather than just recording the number of sanplats cast or pits constructed. Similarly, assessing the success of a large supply network for handpump parts would require a widespread review of individual sites to see how each individual installation is operating.

Gravity flow systems

As a networked physical resource is the most tangible form of shared asset, it was decided to concentrate on communities that have to co-operate because they use parts of the same item of infrastructure. The state of the physical asset would indicate the operation of other aspects, such as the institutional effectiveness and financial sustainability.

It was decided to look at watsan systems that were shared between several communities (i.e. not single point systems such as on-plot sanitation, handpumps or protected springs). The simplest systems of this type are gravity flow schemes, which do not rely on high technology, sophisticated spare parts or regular inputs of chemicals. This maximizes the ability of the users to provide the resources to manage the system.

Gravity flow systems consist of an intake, either a spring or an inlet from a river, and a pipe to the community being served. Because demand varies during the day, reservoirs are built to store water at night. A spring can provide relatively pure water, but siting the intake further downstream can increase the quantity of water available. This may decrease the quality and therefore some degree of treatment may be required, such as a settling tank or a filter.

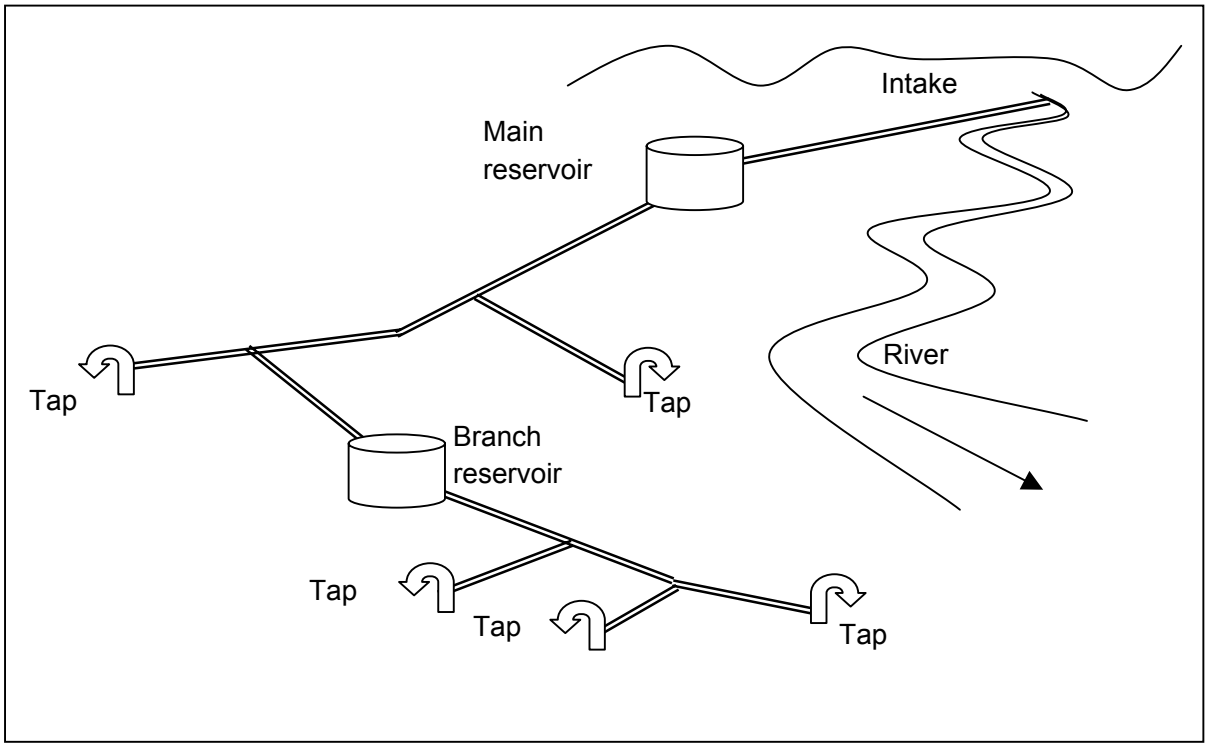


Figure 8. Schematic diagram of a gravity flow system

1.3.4 Selection of schemes.

One significant case study in community management of water systems was the programme in Malaŵi, dating from the late 1960's. This programme was well publicised by a variety of

organisations as a good example of people-centred provision of water[2]. Some of the schemes have been working for over thirty years. These have recently been the subject of a series of evaluations, promoted by the opportunity to examine the success or failure of a water scheme after a generation of use.

A more recent example of a large gravity flow project that has also been extensively written about is the Hitosa water supply in Ethiopia. This has also been regarded as an example of good practice in the involvement of people in the provision of their own water services. Although this is a more recent scheme, the system has been operating for long enough to require repairs and alternations to the physical infrastructure and so the scheme performance should indicate if the community has the financial and human resources to manage the tasks required.

As the Hitosa scheme is only one of several similar schemes in the same area of Ethiopia, it was decided to concentrate on a scheme at Tereta, partly to provide some confirmation that the Hitosa scheme is not a unique case that cannot be repeated elsewhere and partly because Tereta is further from the regional and national capitals and therefore has less access to external resources.

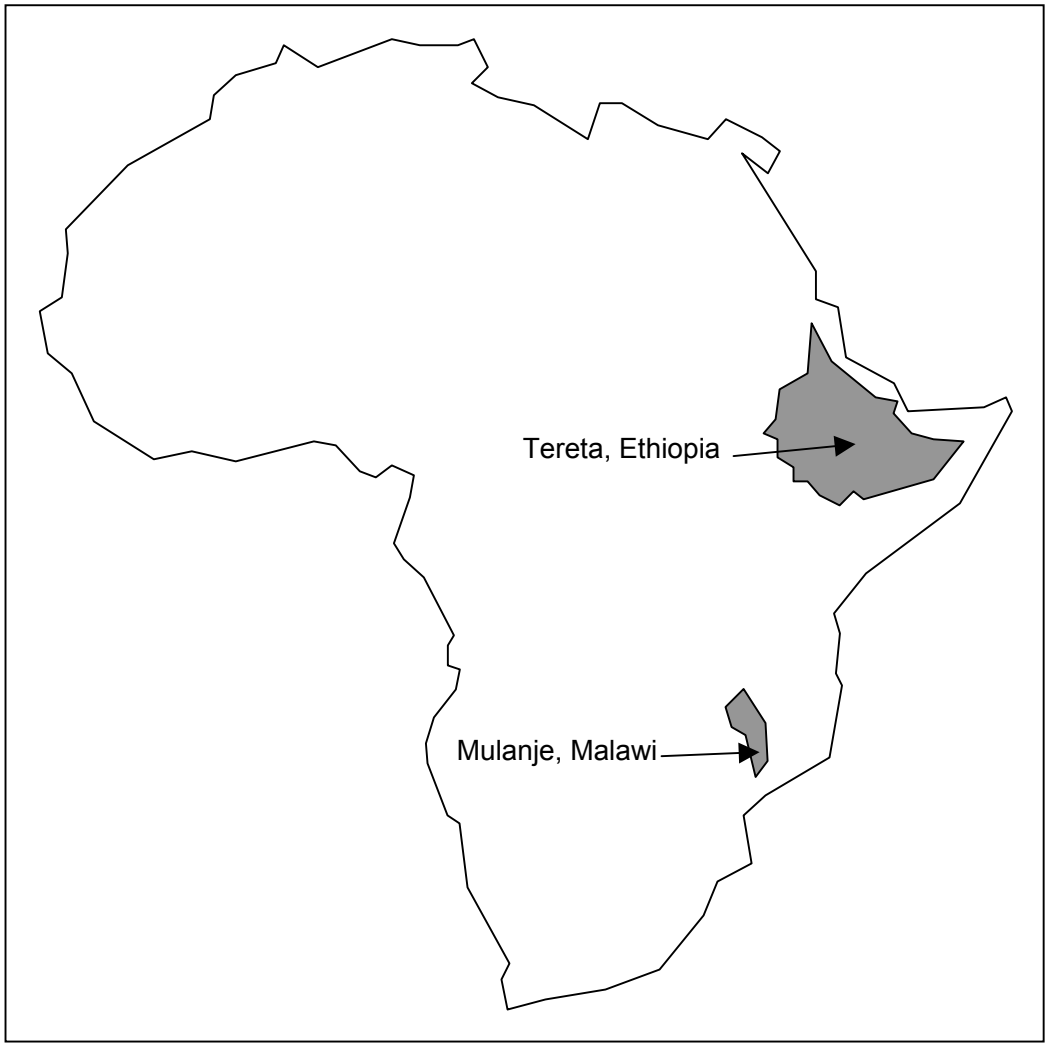


Figure 9. Case study sites

[2] e.g. United Nations Centre for Human Settlements (Habitat), (undated) **'Malawi gravity-fed rural piped-water programme – a case study'**

2. Case study – Mulanje gravity water supplies, Malaŵi.

The gravity water supply schemes in Malaŵi have been considered as successful examples of the provision of water to large numbers of people in rural areas in a low-income country. The statistics are impressive, with 30 schemes providing water for 618 300 people being constructed between 1968 and 1979 and at least 36 further schemes since that period. Malaŵi is poor – falling in the lowest 15 of the rankings for the Human Development Index. However the country was praised for its dramatic provision of water supplies for rural areas, using participatory methods and low-cost technology. Over the last 30 years, the context has changed, with institutional reform, structural adjustment, political change and population growth. Various surveys have shown that the majority of the water points have been functioning until recently.

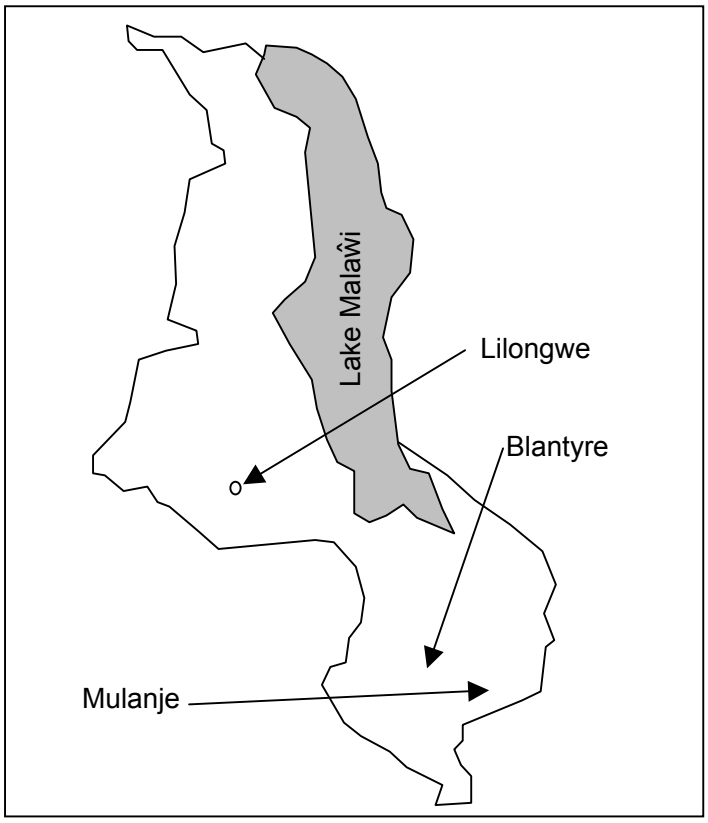


Figure 10. Map of Malaŵi

2.1 History

The development of the Malaŵi gravity flow schemes has been well recorded[3], with the planning, design, construction, maintenance and monitoring examined. The early schemes were mostly around the Mulanje Massif in southern Malaŵi, followed by groups of schemes throughout the whole country. The capital cost was funded through the government by a variety of donor organisations, with running costs shared between the communities and government. The first project in the Mulanje area (the Chambe project) was built for 30 000 people between 1969 and 1970. The scheme was a *community development* project, rather than a water project. Six of the seven gravity flow schemes in Mulanje are working to a greater or lesser extent.

The demand for water initially came from discussions between the committee for a community development project and the engineer who was working on a project to construct buildings for

[3] Glennie C (1983) **'Village Water Supply in the Decade – Lessons from Field Experience'** John Wiley & Sons

schools and clinics. The suggestion of a gravity flow scheme was greeted sceptically, but the use of pilot projects allowed community leaders to see a working project before electing to be involved in a similar scheme. In Mulanje, the District authority paid for the intake works and this sign of commitment enabled donor funds for the distribution system to be secured.

2.1.1 Construction

The water supply schemes started under the Ministry of Community Development and Social Welfare. A pilot project for 5 000 people in 1968 was followed by a larger scheme for 30 000 in Mulanje district. Features of the construction included:

- the provision of a supply in response to a request from the community;
- the setting up of committees to liase with the community ;
- a significant contribution of manual labour from the communities;
- a hierarchy of construction supervision and monitoring, with nationally centralised procurement and distribution of materials and supporting decentralised activities down to the level of village committees;
- the programmed development and training of technical staff with an established career structure and a planned maintenance regime;
- standard designs to enable local contractors to build tanks and tap standards;
- use of simple designs, that could be built and maintained using materials and skills provided locally; and
- a “balanced” distribution network, so the pipelines did not need to be actively managed to ensure that all parts of the system received water; reservoirs on the system would fill up overnight, with float valves to ensure that water overflowing from an upstream tank did not deprive downstream communities of water.

Although the initial impetus may have been from a community demand, the design catered for a supply to the surrounding villages and areas that could support agriculture in the future and a per capita demand of 27l/day, based on a 16 hour supply period. There was one tap per 160 people, with a flow of 0.075l/s. The design population was based on the carrying capacity of the land (100-300 people per square kilometre), rather than a population growth rate, as predictions were not felt to be accurate. This would also take into account population movement into an area that now had a water supply. The carrying capacity of the land would also effectively put a ceiling on the design population and therefore the main pipelines would not have to be upgraded to meet population increases.

2.1.2 Management

The management structure during construction had two parallel streams, one technical and one community based. These were allied to, but independent of, other local government structures, such as the District Assembly. The technical structure evolved to meet the needs of the programme, with a career path. The management levels reflected other government grades but revised the qualifications required, to place more emphasis on practical experience and willingness to work in rural communities. These qualifications were instead of the usual educational standards, which were biased towards theoretical knowledge and gave a preference to those people living in urban areas with better access to education. Motivation of the technical staff enabled them to take on high levels of responsibility with relatively little training. Selection procedures and training courses were supported by on the job training, to develop skills through experience. Refresher courses enabled peoples’ skills and enthusiasm to be sustained, the team

spirit enhanced and promotion prospects assessed. On the job training also enabled technicians to be recruited locally, rather than town-based engineers who had been trained in higher cost technologies and expected higher levels of remuneration.

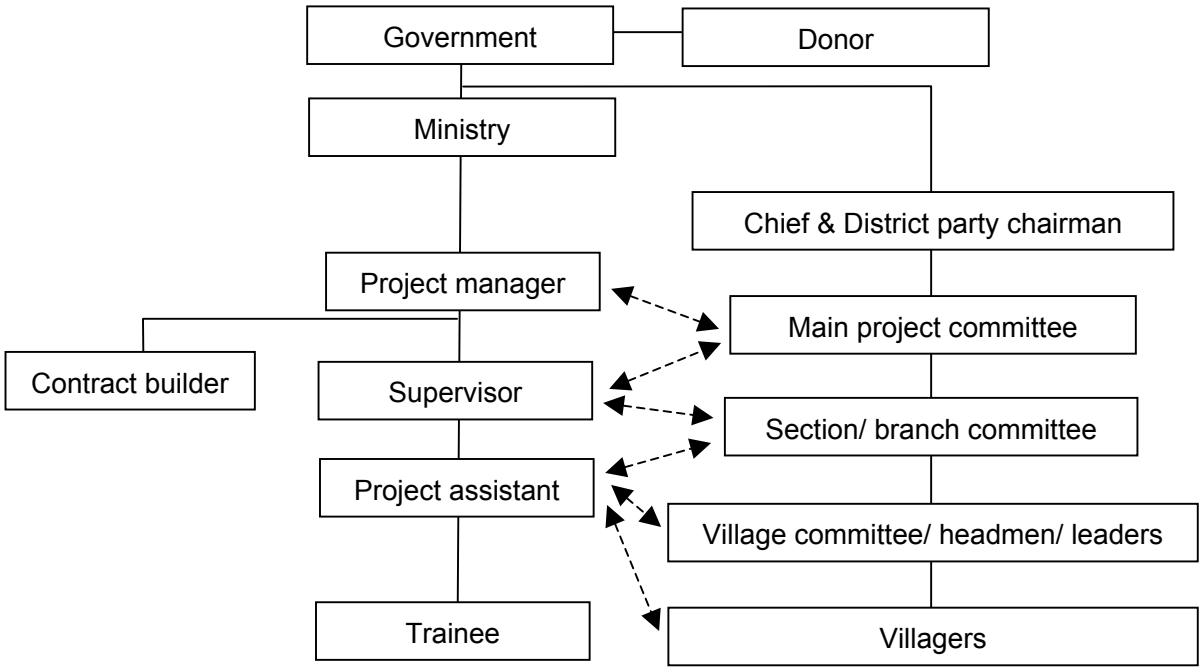


Figure 11. Construction organisation

The community committees' role was to set-up and maintain the self-help labour programme, co-operating with the technical staff. The power of the committees came from the existing political and traditional leadership and they were responsible to this authority. During construction the committee structure was used to organize labour, give political acceptance to the project and ensure all villages and people contributed to the scheme.

Tasks that could not be carried out by community labour were contracted out to local builders. Standardizing many of the dimensions of reservoirs enabled builders to construct a series of structures with minimal changes to the design and thus dispensing with the need for complex specifications. This simple approach to design was also used for the pipelines, with aerial photographs used instead of maps, as these were easier for the technicians to interpret.

Planned maintenance

The gravity flow schemes did not only consider the construction phase of the project cycle, but also ensured that the project could be run after the project team had left. Again a parallel pair of systems was set up, with community and technical responsibilities.

The village committees were responsible for their own taps and aprons, although there would be assistance in procuring replacement taps. The scheme committee would have an overview of the whole project – employing a part-time caretaker or watchman to look after the intake and main reservoirs. The maintenance of the shared main and branch pipes would be the responsibility of the scheme committee, using trained volunteers from each village to carry out the work.

To ensure that work is carried out, especially on the communal aspects of the pipeline, each large scheme had a government appointed Monitoring Assistant, whose task it was to inspect the whole system every year. The technician would oversee any repairs and report failings of the village tap committees to the main committee. The inspections would be recorded and reported to a supervisor, who would look after several schemes in the same area and in turn report to the

ministry. The supervisor would request materials from the Ministry to carry out repairs. The technician would have the use of a bicycle to visit all on one large or a few smaller schemes (e.g. 100 to 200 taps or up to 40,000 people in total). The supervisor would have a motorbike to enable him to visit all the projects under his control (e.g. nine monitoring assistants, reporting to the supervisor monthly).

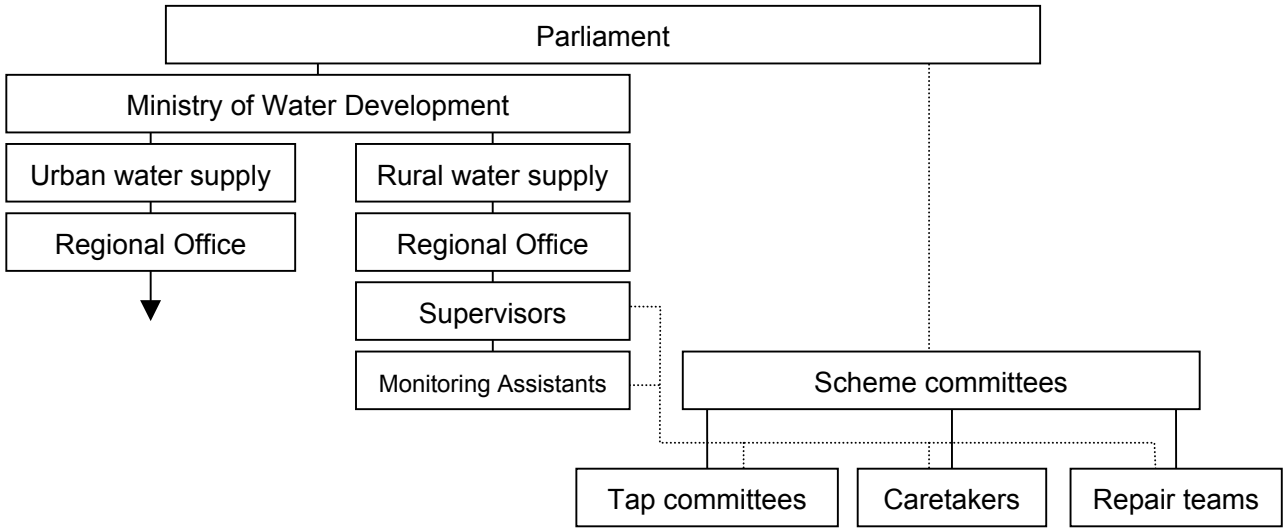


Figure 12. Maintenance organisation

2.1.3 Resources

The early stages of the scheme did address all the five areas of resources that are brought together in the sustainable livelihood framework.

Human

The development of human resources to both implement and maintain the schemes was given a high priority. Other aspects of the schemes (such as rate of implementation, specification of designs and construction monitoring) were tailored to fit the available resources. The use of the construction stage to provide career pathways and create a pool of people able to carry out the maintenance tasks ensured that the required human resource was available in sufficient numbers and skill levels. The training was technically focussed, with community aspects concentrating on the need to persuade people to take part in work activities. The community committees were also provided with initial training, but a support structure for their role was not provided.

Financial

The financial resources for the construction phase were supplied through a variety of international donors (USAID, Christian Service Committee, UNICEF, DANIDA, ICCO, CEMEBO and CIDA). These were supplemented by considerable contributions of unskilled labour from the community. Maintenance funding came from the Ministry. Limited funding came from the community – for specific items such as replacement taps and for contributions to the salary of the caretaker. The water was not sold. The finances for the running of the system are overwhelmingly dependent on the national government.

Physical

The schemes are very simple technically, with a screened intake from a mountain river leading to a concrete settling tank and service reservoir, that in turn leads to a system of smaller tanks and branch pipelines with air valves and washouts as necessary and minimal use of valves. Tap stands with concrete aprons and rubble soakaways were sited to minimise walking distances within each village. Main pipelines were built with asbestos cement pipes, which was later phased

out due to technical problems. Galvanised steel was used at the intake and PVC was used for the smaller branch lines.

Spares for the system were supplied from government stores to local depots. Materials for core services (pipelines, intakes etc.) could be requisitioned by the supervisor and used by the repair teams to mend any breaks. Taps would be sold at a subsidized amount to village committees so they could replace broken taps. Concrete and aggregate to repair the tap stands could be procured locally.

Transport is important to both deliver materials during construction and repairs and enable staff to supervise the building and running of the systems. Trucks, pick ups, motorcycles and bicycles were provided and maintained by the Ministry.

Natural

The gravity water schemes' fundamental resource is the plentiful, perennial mountain streams that begin on the Mulanje Massif and similar upland areas in Malaŵi. Many of these are steep sided kopjes (an exposed igneous formation common in southern Africa). The steep slopes limit land use on the edges of the mountain. The plateaux on the tops of some of the kopjes in Malaŵi are used for forestry, both harvesting natural woodland and exotic plantations. This limited land use ensures a relatively clean catchment area and enables water to be supplied with minimal treatment. The streams do carry a high sediment load in the rainy season, but this can be managed by using a small settling tank and the main service reservoir, which have to be de-silted when the settled material has accumulated to a sufficient level. Where silt loads are higher, a slow sand filter can be used. This was to enhance the physical quality of the water, rather than provide biological treatment, which was not deemed necessary given the opportunities for contamination at later stages of the water supply (e.g. during collection or storage at home).

Quantity of water was based on ensuring a year-round supply based on a ten-year drought. Flow analysis of the rivers allowed the minimum ten-year flow to be calculated and therefore determine the maximum number of people that could be supplied with water from this source.

The water resources of the plains were seasonal and prone to pollution, hence the need to transfer water 50 km from the edge of the massif.

Adverse environmental impact was limited. The scheme committees were given responsibilities to protect the catchment areas for the water supplies – restricting the land use to prevent erosion and pollution upstream of the intake. The basic service level restricted the quantities of water used and so prevented large quantities of wastewater being generated. The assessment of the water source ensured that in most years there was excess water, thus ensuring that the rivers were not depleted.

Social

The social context of the project was an important aspect in the development of the project – partly due to its original institutional home in the Ministry of Community Development and Social Welfare. The community management structure was developed to suit the existing political and traditional power structures, based on the single party government in power at the time. The management systems built on existing institutions, both for the community and technical aspects of the water supply. One of the early pilot projects had problems with social unrest, partly because the design population was too large for the project staff to communicate effectively with the community leaders and the people. The majority of the projects were restricted to a single traditional authority area, to avoid dealing with two social groups, but of the seven Mulanje schemes, two schemes did involve two traditional authorities and one scheme involved three. In neighbouring Phalombe, the six schemes involved two traditional authorities between them.

The projects also found that the social support required to provide labour and prevent disruption required that the momentum of the project had to be maintained, with supplies of materials arriving on time, when the community were expecting them.

Women are represented at lower levels of the community structure, with three women and two men appointed to each tap committee, but they are in the minority at scheme level and do not appear to have any paid role (caretakers or technical staff).

The designs had a poverty focus, in that the water was free and the consumption was restricted to public taps only. The “some for all rather than more for some” philosophy was used to maximise the provision of water. Private connections and the use of water for irrigation using a hose was forbidden, as higher water consumption levels would restrict the total number of people who could be served by the scheme.

2.2 Present status

The about half the water supply points are functioning to a greater or lesser extent, although before the floods of 1999, the percentage of working taps was higher.

Trends

The lifetime of the schemes have seen a variety of trends that change the state of the resources.

- The human resources have aged, with people moving away, retiring or dying.
- The population has changed; there have been changes both numerically and in terms of location, affecting both water demand and the pressure on other natural resources such as agricultural production.
- For a variety of reasons, the area has a food deficit and there is a food security programme to support local communities.
- Commodity prices of major exports have fluctuated; Mulanje is a tea growing area with some people dependant on wages rather than subsistence farming.
- The physical infrastructure has aged; the oldest schemes are now 30 years old, three times the original design life.
- Socio-economic conditions; “urban” settlements and cash economies are now operating within the traditional rural economy areas.

Shocks

The schemes have also experienced some more defined impacts on the resources.

- Physical damage due to flooding in 1999 washed away several intakes and river crossings.
- Financial situation; Malaŵi has gone through a structural re-adjustment process, reducing public expenditure, not just on water, but also on fertilizer subsidies, increasing costs to the rural community.
- The political conditions altered, with the one–party system being replaced by multi-party politics. This is now changing again, with de-centralisation of previously national roles to more local government organisations.

Context

The wider context of the schemes has also altered.

- International donors fund capital works rather than maintenance costs. Rehabilitation would be viewed as a maintenance activity rather than a capital investment.

- The “community” involvement has changed from requiring contributions to full participation. Small schemes, such as individual boreholes, are viewed as being closer to the grass roots and having better community ownership than large schemes. Thirty years ago, large schemes were favoured to reduce cost per capita.
- The role of a water supply system is changing; is the provision of water sufficient or should strategic community and health developments be included?

2.2.1 Resources

Human

The human resource legacy has been valuable. The knowledge and skills of the staff trained during the construction stage is still available. However, natural wastage, retirements and deaths have necessitated the appointment of new staff. Not all the posts have been filled and some new staff have been transferred from the urban water sector, without the requisite skills and experience for the task in hand. Although the technicians in the Mulanje area have the knowledge to carry out their work, the motivation and supervision of the staff has dropped. The scope of the work that now might be expected of this level of operative has also changed, as their training was restricted to technical water issues and encouraging the community to provide labour, rather than tackling some of the more holistic approaches to health and community development such as hygiene promotion and sanitation provision. The technical tasks that they were trained for were routine maintenance and repairs. The rehabilitation and adjustments required to restore the water supply would require a higher technical level of understanding than that available at present. This would include replacing parts of the system that totally broken at the moment, refurbishing parts that worn out but working to some extent and updating the systems to meet present day demands.

At a higher level in the technical management structure, the corporate knowledge of how these schemes worked is being lost and the records of the designs and operational procedures are not readily available.

The human resource in the committee structure has also changed. People have died or moved. Where replacements have been re-appointed, they have not been provided with the training supplied during construction. Thus, although the human resource is still available and valuable, there are trends showing that it is declining and that there is no mechanism to support this resource. One committee had been active for 17 years, replacing people as necessary, but has had no further training.

Financial

There are four flows of finance required for the general maintenance of the water supply schemes:

- materials and transport for the maintenance of the core components of the scheme;
- materials for the maintenance of tap stands;
- wages for technical staff; and
- funds for the rehabilitation of ageing schemes.

The first flow of finance does appear to be erratic at best. The lack of money for materials for central maintenance (which are procured nationally) is often quoted as the main reason for the poor state of repair of the system. Transport provision is also less than the designed level, with implications for the supervision of the schemes. Budgets are being de-centralized to the regions, with the allocation within the region decided at that level.

Collecting cash from local communities to repair taps does occur, carried out on an ad hoc basis to address problems with the water supply. Low priority given to repairing aprons and soakaways.

Technical staff costs do appear to be covered, as these are linked to the government payroll. Caretakers do not appear to be present at the intakes.

Funds for water supplies are still dependent on international donors. However, the target is new water sources rather than addressing existing systems. In one town a new borehole has been drilled metres from an existing, working tap stand. The tap was being used as it is less effort and the water is preferred. In other areas donors are providing new point sources to replace or supplement failing gravity systems. Politics is influencing the distribution of new water supplies, with boreholes being provided irrespective of demand.

There is a lack of cost recovery in the present system. The 1992 Dublin Principles do acknowledge the economic value of water but thirty years ago the promoters of the early schemes decided that the administration and bureaucracy required to collect and distribute money was overly complex and too expensive for the community at that time. The schemes have managed to last for a significant length of time, but did require flows of money from outside the project to cover the running costs. Now these sources of funds are restricted and additional finance is required to rehabilitate the schemes if they are to continue operating in their present form. Funds will also be required to rejuvenate the community management structure. The national water policy does recognise water as an economic as well as a social good, but no mechanism for cost recovery seems to be in operation.

Physical

The size and condition of the water supply schemes is still impressive 30 years after the first scheme was built. A study in 1998[4] found that of the 17 smaller schemes surveyed throughout Malaŵi, between 41 and 96 per cent of taps were working, with no clear relation to either age or size of the schemes. Since that study, floods in 1999 damaged several intakes and river crossings, so the downstream systems are non-operational. The local staff have carried out essential repairs in the past, replacing intake pipes, taps and manhole covers, but non-essential activities, such as apron repairs, soakaway restoration and keeping the pipe routes clear of vegetation have not been carried out to the same degree. Operationally, the main tasks do seem to be carried out (such as de-silting reservoirs), but probably not at the frequency required. The reinforced concrete elements of the systems have survived well.

The physical infrastructure has been extended to provide private house connections and water for urban areas and trading centres. This has been facilitated by the operation of the valves to favour the flow of water to the more politically and economically active urban areas. The presence of trading centres will mean that the land will be able to support more people per square kilometre than the original design criteria allowed for. However, measured use of water has been recorded as 16l/c/d, rather than the 27l/c/d allowed for, leaving some margin for increased population. On some schemes, work had taken place to improve or extend the intake.

The institutional division of water supplies separates urban and rural systems. The situation on the ground however is less clear. During the design, some rural areas were supplied by water drawn from urban piped systems (e.g. the Nalipiri rural area supply is a branch of the Mulanje town supply). Conversely some urban areas and institutions had agreements to use branches of

[4] Kleemeier, E (1998) **'The operation and maintenance of small rural piped gravity schemes in Malawi'** Centre for Development research, Copenhagen, Denmark/ Centre for Social Research, Zomba, Malawi (Draft).

the rural supplies. These were either set out in agreements at the design stage or have been subsequently added (e.g. Likubula town has a supply that branches off from the Mulanje south-west rural scheme). In addition, the population pattern has changed over time and some trading centres have more in common with urban areas than the surrounding rural economy. The increase in urban population and in urban per capita demand (e.g. flush toilets) has placed a strain on the water supply system, with water going to the urban areas at the expense of (poorer, less politically cohesive) rural areas. This disparity of allocation is either passive – as the branch to the urban area is upstream of the rural area, or active, with urban water officials closing valves so water flows to the town.

Excess demand due to population growth and private connections have been quoted as reasons for water not reaching the lower ends of the distribution system, but pipe breakages and operational failures also contribute to the problem. The distributed branch line storage tanks are designed to fill in turn overnight. However, the float valves in some tanks are reported to be broken, with the effect that tanks at the top of the system fill and overflow, rather than filling and then the valve closing to direct water downstream. Leakage is also likely to be adding to the lack of water downstream.

Although the maintenance system was designed with a nationally centralised procurement, most of the spare parts required to maintain the system are available for purchase locally – either in Mulanje or Blantyre. Local procurement of supplies however does not take place due to lack of local finance. (It was noted that parts for handpumps were not available locally). Supplies are still provided, but they take a long time to appear. A river crossing washed away in 1999 is being repaired by the local staff, but this has taken over two years, in which time the downstream communities have been without water and their committees have lost interest. The technical performance and the community involvement are reported to be closely linked.

Natural

The natural resources do not seem to have changed much over the lifetime of the schemes. In terms of quantity, lack of water in the system is usually due to limits in the infrastructure of the system, rather than an absolute water shortage, although four out of 17 small schemes throughout Malawi have reported source limitations. Alternative uses for the water are likely to cause competition, as irrigation is being practised in the area, especially on the large tea estates. The original scheme designs did take into account the available dry season flow, so increased use of water for non-domestic use downstream of the water supply intakes may limit river flows. A problem appears to be too much water during the rainy season, with intakes and river crossings being washed away.

Water quality has only been addressed in the available reports in its impact on the technical performance of the systems. High levels of silt during the rainy season require the intakes to be temporarily shut during floods. Settling tanks and reservoirs have to be de-silted more often during the rains and the pipelines flushed to remove solids. Where sand filtration was used, the frequency of cleaning the filters has to be increased. The catchments are used for forestry and tourism and there are limited reports of cultivation, sometimes halted by the scheme committees.

Social

The two parallel institutional systems mirror the condition of the physical infrastructure. Both the technical and community systems are still present, but their effectiveness could be markedly improved. The technical management system has problems with communications, due to transport limitations in the field and breakdowns in the monitoring and reporting system. The lack of materials is indicative, not just of a lack of finance, but also the institutional impetus to maintain the systems.

The community system has suffered from the trend of declining human resources, but also is working in a different political climate. Nationally and internationally, the previous appointment systems that operated under the one-party/ traditional authority system do not fit with the multi-party democratic system now in place. The authority to motivate people to maintain the systems and prevent private connections is not being wielded. There is a lack of cohesion between urban and rural areas, with disputes over the allocation of water. The lauded "participation" of the community of the past would be considered as a contribution in kind to the project, akin to taxation, rather than any real involvement in the planning and management of the schemes. The "demand" assessment could be similarly viewed as a top down approach through community leaders, rather than a true demonstration of a felt need of the population.

The role of the community committees was not clear, as most of the technical work was effectively managed by the scheme monitoring assistants and supervisors. What was a government monitoring and support role has become active responsibility for maintenance. The ad hoc raising of funds was not sufficiently attractive to maintain interest in the committee or an active enough role to ensure continuity of involvement. The technical staff report to the Ministry and receive all financial and material support from this source, rather than the community. This deprives the committees of any real responsibility or decision-making and in turn transfers more action to the government.

The introduction of multi-party politics has lead to infrastructure being a political issue. Water supplies have been used as electoral pledges. Large donor schemes have been used to increase coverage of water supply, based on indicators of the number of sources provided. However, boreholes have been sited either for hydro-geological reasons or to promote political capital (e.g. an equal number per district). This has lead to hand pumps being sited adjacent to existing, *working* tap stands, or expensive boreholes being drilled for one village in preference to providing limited supplies of materials so the scheme supervisors can repair damaged pipe work for the benefit of many.

Community development thirty years on

There is currently a German-funded integrated food security programme operating in Mulanje, operating in two Traditional Authority areas. This programme has a water supply element (along with agricultural, poverty reduction and communications elements, with food for work activities to improve the rural infrastructure). Although rehabilitation of the existing gravity flow scheme was considered, point sources have been preferred to date, for various reasons, including:

- restricted areas of operation that did not coincide with the larger piped water supply area;
- initial high estimates of rehabilitation costs;
- the capital cost of individual water supply to each community (which have been considered as separate entities);
- lack of understanding of how the piped scheme worked, due to the complexity resulting from the scheme's size and the lack of original design information;
- perceptions of enhanced community ownership for point sources (boreholes and shallow wells); and
- restricted capacity within the local organisation.

Some work has been carried out to repair branch lines, as part of a food for work exercise, provide training/ capacity building and carry out many minor improvements.

In a parallel study to a 1998 evaluation of the gravity flow schemes[5], an assessment of a borehole scheme concluded that the impetus for maintaining a water supply starts when the supply fails, rather than carrying out preventative maintenance. However, the boreholes were repaired because the point source committees are motivated and have the authority to mobilise the resources to carry out the repairs. A tap committee on a gravity flow scheme had limited authority and so when a system breaks down, the local people suffer but do not have the means (socially, financially and technically) to carry out a demanding task. The people at the upstream end of a pipe system have alternative sources of water and so have less motive to repair main pipelines, whilst the people on the plains do not have alternative options but do not have the means to access the resources (including the contribution of people near the source) to carry out the repairs.

2.2.2 Future directions

Assessments of the current state of the system accept the need to update the physical assets, but concentrate on the social and financial status of the schemes. The physical assets only require rehabilitation; the social and financial assets need to be re-built to reflect the changes in the political context. There is a need to make the schemes financially more secure and socially more accountable. Schemes will have to be grouped to make them financially viable, but this needs to be balanced by the need for small schemes that are culturally and politically homogenous and small enough to enable financial transparency. Payment needs to reflect the resources available to the community (e.g. crops rather than cash). The scope for financial self-sufficiency will have to be maximized to reduce reliance on external support.

Additional demands may be placed to extend the system, provide private connections and also contribute to food security through irrigation, rather than the original remit of a basic service level of domestic water supply.

Although the current trend is for small, community-based schemes, the gravity flow schemes have demonstrated a successful rural water supply operating for 30 years. The designs did maximise the natural asset of the perennial mountain streams using a large investment of both capital and human labour. The financial and social resources have declined over the lifetime of the project but the schemes are still providing a valued service.

[5] Kleemeier, E (1998) **'The sustainability of participatory projects'** Community Water Supply and Sanitation Conference, The World Bank, Washington D.C.

3. Case study – Tereta gravity water supply, Ethiopia.

3.1 History

Water shortages had been a problem in the valley of the Tereta area of the Shirka district in the Arsi Zone of the Oromia Region, Ethiopia. It was estimated that women were spending up to one third of their productive time fetching water. The government was requested to provide a water supply for this area and, working in partnership with the donor organisation WaterAid, the scheme was started in 1992 and finished in 1995.

A smaller water supply had been built for the local Gobesa municipality with Red Cross funding in 1987, serving the urban area. This scheme had provided infrastructure only, so the management of the system was handed over to the WaterAid project to provide management development and the tap attendants for this scheme were included in the larger rural scheme.

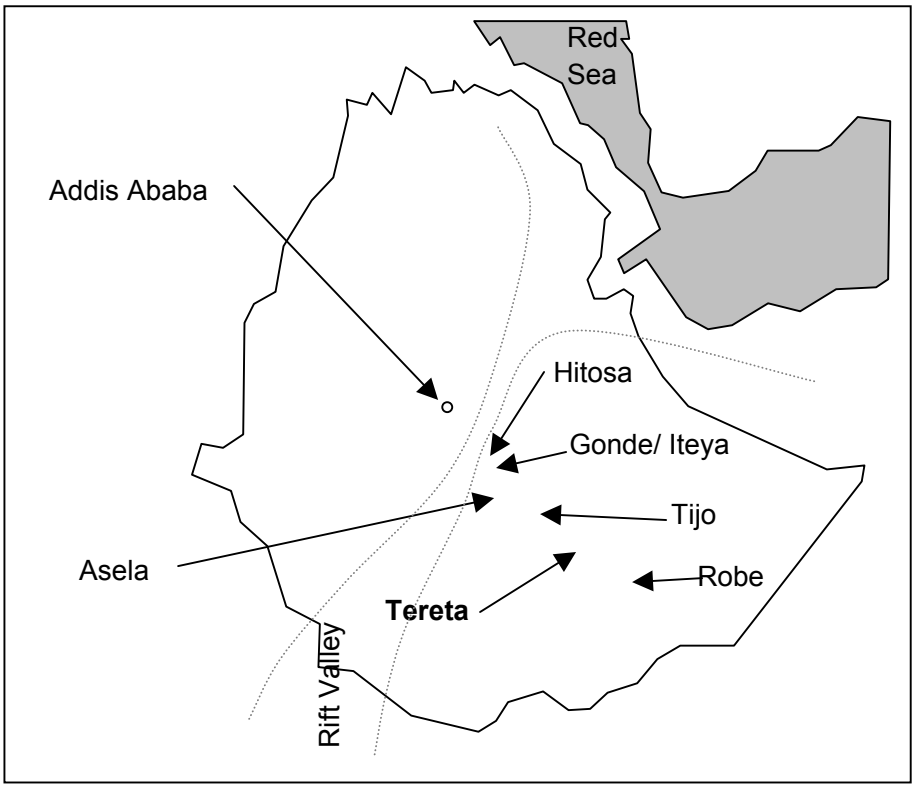


Figure 13. Map of Ethiopia

The water system serves 52,000 people in 15 villages. The water supply in Tereta is one of a series that WaterAid have been working on in Ethiopia. The scheme at Hitosa has been well documented as a success story, providing water for 72,000 people. The Tereta scheme is of a similar size and age, but is further from the capital, Addis Ababa and so has less opportunity to receive outside support. A small scheme at Tijo (Ticho) serves 9,000 people. A scheme has recently been completed in the twin towns of Gonde and Iteya, which neighbour Hitosa). A new scheme is being designed for Robe town (population 30,000) and the surrounding rural area (13 villages, population 96,000). Lessons from these other schemes are also included in this analysis.

Table 1. WaterAid gravity flow projects in Arsi Zone, Oromia Region

Location	Date	Population	Cost	WaterAid contribution	Partner
Hitosa; Hitosa woreda	'93-'96	71 843	£1 084 213	79%	Oromia NRDPD
Tereta; Shirka woreda	'92-'95	52 000	£498 425	75%	Oromia NRDPD
Tijo: Tijo and Digelu woredas	'94-'95	9 600	£109 160	73%	Oromia NRDPD
Gonde and Iteya; Hitosa and Tiyo woredas	'95-'00	65 248	£848 150	84%	Water Action
Phase II (construction, health, sanitation, training, management, spares, evaluation, supervision)	'98-'01	133 443	£167 648	85%	Water Action
Robe		*126000*	*Planning stage*		

NRDPD – Natural Resources Development and Protection Department
Woreda – a local government unit

WaterAid are working with the community on a second phase, to add sanitation and hygiene education to the existing water supply projects and to make the present schemes more sustainable. This involves an assessment of the existing schemes (especially the non-technical areas) and providing additional training for the staff. WaterAid work with a local NGO, Water Action, to implement some of these initiatives.

Technically this scheme is as successful as the Malaŵi schemes in providing water supplies. A significant difference however is the design of the management system and the financial independence and success of the project.

3.1.1 Construction

There was a great deal of community support when the scheme started, with the contribution requested from the community being viewed by some people as too small. There was however doubt that the scheme would work. The high level of interest allowed the planned three to five year programme to be finished in two to three years.

Both men and women took part in providing labour. Traditionally women do not take part in such construction activities, partly because it is normally carried out by young men, working for cash, rather than women and older men who work on the land.

The scheme is a simple gravity flow scheme, with water from a protected spring being piped from the hillside to the drier valley areas.

3.1.2 Management

Financial and technical training was carried out during the implementation period, with village committees being formed. There are four skill groups:

- Village committees; a team of seven volunteers (at least 4 women) responsible for the water point in their area and any pipelines within their boundary. They provide a male and female representative to the management board.

- The volunteer management board, which is responsible for the whole scheme, polices damage to the infrastructure, reprimand defaulters and approve budgets and tariffs. They have an executive to monitor day to day operations.
- The salaried administration team, who run the scheme, plus support staff (guards, store keeper, cashier and meter readers).
- The paid tap attendants or village health educators/ communicators, who look after the water points, collect payments and have a health education role. They have rolling 85 day contracts.

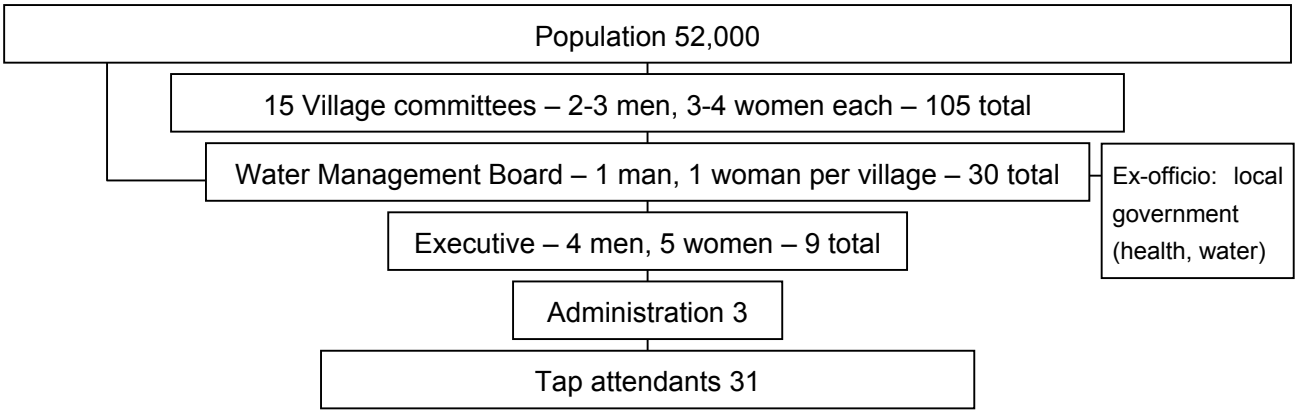


Figure 14. Organisation of Tereta Gravity Flow Scheme

There are over 44 taps in 15 villages, so some of the attendants have two or three taps to manage. The taps are metered. Each tap is fenced in a locked compound, with access only at certain times of the day, when the attendant is present. There are also private connections, especially in the urban areas, where a connection charge and a standing charge to cover water meter expenses are levelled, as well as a volumetric charge.

3.1.3 Resources

Human

The construction involved 57 417 days of unskilled labour from the community, plus 75 people (five per village) who took part in training courses in technical, accounting and management issues. This enabled a pool of skilled people to be created, who could in turn be employed as tap attendants or given further training for more skilled work (e.g. administration team). Women were well represented in the training and employment figures. The administration team were all given the same training, which has allowed them to take on a variety of roles and cover for colleagues when necessary. There were initially 27 permanent staff (8 men and 19 women).

The zonal water bureau seconded technical staff to the project as part of the government's contribution to the scheme. They provided the original surveys and designs, which were then checked by WaterAid.

Table 2. Human assets - trained staff

Town	Trained			Employed			Education status			
	Men	Women	Total	Men	Women	Total	0-3	4-8	9-10	11-12
Terata	16	63	75	16	28	44	4	21	13	6
Hitosa	24	145	171	17	51	68	17	28	12	11
Tijo	4	10	15	2	8	10	1	6	1	2

Source: Fassil Consult (2001) 'Hitosa/ Tereta/ Tijo Community Managed Water Supply and Sanitation Service – systems operation and maintenance guidelines' Consultant's report for WaterAid, Ethiopia

Financial

The scheme cost £498,425 to construct. WaterAid provided the bulk of the capital cash cost of the scheme, with local people providing 102 000 Birr (≈ £10,000 at present day prices) and 57 417 days of labour (estimated at ≈£50 000 equivalent). The government provided technical staff and vehicles. The budgeted cash cost was £600,000.

Table 3. Financial assets – construction costs

Item	Actual cost (£)	Per cent of original budget
Office	4 341.20	0.7
Vehicles (capital)	36 600.00	6.0
Vehicles (operation)	47 326.95	7.9
WaterAid staff	25.77	0.5
Partner staff	60 859.00	10.2
Materials	320 667.49	54.0
Freight	28 604.98	4.8
Total	**498 425.39**	**84%**

Source: WaterAid

The pipes and fittings constituted 64 per cent of the material cost and 40 per cent of the total expense (£204 360). £240 962 of the costs were for imported items (including vehicles).

Physical

The water scheme has over 70km of pipeline, 20 masonry reservoirs leading to 44 water points in the rural areas, plus one free water point by the source. There are 10 private connections on the rural scheme. There are also 30km of access road, built with a grader provided by the zonal bureau and community labour.

The physical infrastructure constructed by the Red Cross municipal scheme is separate, but managed by the same board. This has 11 public water points and 186 private connections.

Table 4. Physical assets

Town	Springs	Reservoirs	Public taps	Private connections	Pipeline (km)	
					Main	Distribution
Terata	3	21 (16@25m^3, 3@10m^3, 2@6m^3)	55	196	27	46
Hitosa*	4	19	122		30	109
Tijo	1	2	14		5.4	2.7

Source: Fassil Consult (2001) 'Hitosa/ Tereta/ Tijo Community Managed Water Supply and Sanitation Service – systems operation and maintenance guidelines' Consultant's report for WaterAid, Ethiopia

** Hitosa is currently being extended*

Natural

The key asset for the water supply is the presence of perennial springs at Ferekesa, with an altitude that enables water to flow by gravity to the valley floor. Piping the water not only brings the water closer to people's houses than using rivers, but prevents the water from being contaminated. Land ownership is with the government, which enables land use around the springs to be controlled. The area about 20-30m around the spring is fenced off. Ploughing is forbidden in this area and the water-demanding eucalyptus trees have been cut down, leaving only native tree species. The separate water source for the municipal area is not so well protected as the fence and diversion ditch requires refurbishment.

Another not so obvious natural asset of the water supply is the agricultural productivity of the area. The land can produce surplus crops, which can be sold and provide a cash income for the local population, which enables them to buy water.

Natural materials have been used to provide fencing around the tap stands, which are used to control access to the water and keep cattle away from the area.

Social

Institutionally there were several changes through the development of the present water supply system. The original water supply system was to be carried out in partnership with the Red Cross who had been involved in the Gobesa town scheme. This was changed to the local government leading the scheme. A change on a larger scale was the overthrow of the Dergue (governing party) and the replacement with a more democratic system of government.

During construction there was a minor dispute between people living near the spring, as their water source was being "removed" and restrictions placed on the land use upstream of the source. They were compensated by having a standpost and cattle trough provided downstream of the source and they are not charged for water. The municipal scheme that was built before the WaterAid project does not have a similar arrangement and local people have to use the reservoir overflow to get access to the water. This only operates at periods of low demand downstream and so they do not have access to water when they want it.

The administration team are full time paid staff. The tap attendants are part-time paid staff. The executive meet monthly to review operations and the main board meet four times a year.

The village committees were able to exempt vulnerable people such as widows or the elderly from cash or in-kind contributions.

3.2 Present status

Trends, shocks and context

Compared with the Malaŵi experience, there has been less time for long-term trends to have any major impact on the operation of the system. Similarly there have been no adverse shocks to restrict the availability of any resources. The context is changing, as the original infrastructure-led approach that characterised the municipal scheme has evolved into a community-focussed project and the water supply operation is now being expanded to include sanitation and hygiene promotion. This change in the scope of the project does require increased demands on the human and financial resources of the community.

3.2.1 Resources

Human

The large pool of trained tap attendants has enabled people who have left work to be replaced easily. The administrative staff have been promoted from existing posts (e.g. cashier to finance officer), but it is not clear how any of the existing staff would be replaced if they were to leave. This is an issue the main board would need to address.

The administration team's multi-disciplinary training has not only enabled them to be flexible and cover for each other when necessary, but also enabled a career path to develop and reduce reliance on the expertise of a single person. The staff on the sister scheme at Hitosa have tended to specialise in their area of responsibility due to the larger size of that scheme.

The staff have benefited from additional training as part of a second phase of WaterAid's work. The three administration officers have been sent on courses to expand their range of skills (a technical course in Addis Ababa, an administrative course in Awasa and finance course in Debrezit).

Expertise is also available from the local government, with an annual financial audit. Bacteriological analysis and a technical audit were carried out once the system was complete, but there have been no visits recently.

Financial

Water is sold at a bulk price of 1 birr per m^3. Coupons are sold for 10 Ethiopian cents, which is for 4 containers of water – about 20l each, a total of 80l rather than 100l. The coupons are valid for a month. The balance of water from unredeemed coupons and the additional 20l from each coupon is used to cover washing containers, washing the tap stands down and general wastage around the distribution points. The water meters are read monthly and are used to cross check the receipts from the tap attendants.

In the first three years, the scheme sold 7.8 million insera (15-20l pots) of water (96 374m^3). The first year only served 10 villages. The 57,745Birr expenses were covered by the 106,869Birr collected as revenue (expenses were 54 per cent of revenue).

The water scheme is a legal entity, with a bank account in the neighbouring town of Bekoji, 34km away, where deposits are made every month. Currently the scheme has 120,000Birr in a savings account (≈£10,000). The Zonal Water Bureau provides an annual audit of the finances.

Although all the water has to be paid for, exclusion due to lack of money was not deemed to be a major problem, due to the prevailing cultural and religious practices. Family relationships were seen as being adequate to ensure water was made available to all. The village committee, together with the wastage allowance in the supply also would help ensure a basic level of water was available to vulnerable people.

Table 5. Financial assets – income and expenditure

Item	Year 1	Year 2	Year 3	Total
Income (Birr)				
Village	9 102.90	25 344.77	28 750.50	63 198.15
Gobesa town		4 632.75	6 180.75	10 813.50
Private connections (42)		8 391.75	14 921.00	23 312.75
Technical service (private connections)		5 400.00	1 616.85	7 107.55
Water meter rent (standing charge)		1 360.00	1 168.00	2 528.00
Sub total (Birr)	9 102.90	45 129.95	52 637.10	106, 869.95
Expenditure (Birr)				
Salaries	(3 340.00)	(20 505.00)	(32 260.00)	(56 105.00)
Wages		(100.00)	(362.00)	(462.00)
Bank charge	(3.30)	(16.50)		(19.80)
Stationery		(30.00)	(459.50)	(489.50)
Other			(669.25)	(669.25)
Sub total (Birr)	(3 343.30)	(20 651.50)	(33 750.75)	(57 745.55)
Balance (Birr)	**5 759.60**	**24 478.45**	**18 886.35**	**49 124.40**

(spares taken from stock provided during construction)

A recent assessment of the tariff policy for the larger Hitosa and neighbouring new Gonde/ Iteya schemes show the tariff to cover operational costs only, at present consumption rates, should be over 2birr/m^3. Increasing consumption would reduce this to 1.3birr/m^3 and increasing consumption and increasing private connections would reduce the tariff to 1.16birr/m^3. The same figures for full cost recovery would increase the tariff to 3.34birr/m^3 with tariffs of 2.1birr/m^3 and 1.85birr/m^3 respectively if consumption or consumption and private connections increase. The ability to pay is estimated to be 1.9birr/m^3 in rural areas and 2.7birr/m^3 in urban areas. The proposed tariff for Hitosa and Gonde/Iteya is planned to be 1.5birr/m^3 for public taps, 1.8birr/m^3 for domestic connections and 2.0birr/m^3 for non-domestic connections. The increase will allow sanitation initiatives to be cross-subsidized. Consumption will be increased through:

- increasing the number of tap stands;
- increasing the operation time of tap stands;
- promoting vending with donkeys;
- enabling seasonal payments; and
- controlling the overflow from reservoirs, which is used for non-potable uses

Costs will be reduced by sharing human and physical resources in Hitosa and Gonde/ Iteya. Preventing or repairing systems failures will safeguard income.

Physical

The system is working well. There are some leaks at some of the reservoirs and the reservoirs and spring boxes do require cleaning. The cattle fencing at the water points, reservoirs and the spring could be refurbished. There are some design problems with overflows, river crossings and valve chambers, but the system operates satisfactorily.

Some spares are still in stock from the construction phase, but parts can be purchased privately in Asela, the capital of Arsi province. The Zonal Water Bureau provides some stationery for no charge. This included the coupon books and account books.

The meter readings are taken monthly and are double-checked if income from particular taps is low. Some meters have been found to be blocked by solids but experience and past records have enabled problems to be overcome.

Natural

Consumption varies seasonally. In the dry season, people in the valley do use the water supply for livestock. People on the hillside have access to more perennial water sources. In the rainy season ponds and rivers can provide an alternative, if less safe, source of domestic and agricultural water. Water consumption varies but is estimated at about four or five containers for a ten person household (about 8-10l per person per day). The low per capita consumption may lead to the tariffs being raised but this could reduce consumption further and thus further reduce revenue. A consultant's report is examining ways of increasing consumption to improve the use of the scheme's resources. Consumption in Hitosa is 5l/c/day for rural public taps and 37l/c/day for rural private connections (although this includes vending). In the urban areas the respective consumption figures are 10 and 39l/c/day. The low consumption is related to:

- good access to alternative sources of water, including rainwater (seasonal);
- poor access of tap stands (opening time, distance etc.);
- willingness and ability to pay (including timing of payments – lump sums after harvest are an option);
- traditional low use of water – people have not changed their habits, even though water provision has improved;
- available domestic storage;
- transport – consumption is higher where donkeys are used for transporting water; and
- education levels.

Social

There does not appear to be any social problems with the scheme operation. Relations between people in the upstream and downstream and urban and rural parts of the system are apparently good, with leaks being reported. Neighbouring villagers outside the scheme area do come and buy water (for the same price as villagers covered by the scheme). There are plans to extend the distribution system, with inputs from both the water scheme and the villages to be included. The lack of social problems has been ascribed to the fact that the people in the area are all similar culturally, with many family links.

The tap attendants do not only collect payments and maintain the water point, but they are to be trained as health communicators. This is designed to both increase the health impact of the water supply and also promote sales. Increased use of safe water for washing will also boost the revenue of the scheme.

The partnership with local government does have problems as the water, agriculture and health departments are separate and yet this has been planned as an integrated project. This is mainly a problem in managing water quality, as the testing and disinfection responsibilities are split.

3.3 Future directions

Financially the schemes are successful. Hitosa, which is larger than Tereta, has 250 000birr in savings. (≈£25 000). Both Hitosa and Tereta are using this to extend their systems to provide water to villages that currently travel to collect water from public taps. Other uses being discussed are building shower blocks or using the funds for micro-credit. The design life of the system is estimated to be 15-20 years, and the board are aware that replacement of parts of the system does have to be provided for.

WaterAid is supporting the schemes at a high level (i.e. some limited finance or materials to finish parts of the original systems, but concentrating on developing strategies). WaterAid have commissioned a series of reports to assess the management structure and to provide procedures for human resource management and tariff setting. Methods of improving the impact of the water through sanitation and hygiene promotion are being planned.

The Gonde/ Iteya scheme has had a different management system, at the instigation of the Zonal Water Bureau. The committee that is equivalent to the Terata management board provides the executive, but this group are also the administrators. They are paid an allowance rather than a full-time salary and do not have the same day to day responsibility for the scheme. As Gonde/ Iteya is adjacent to the Hitosa scheme, there has been some confusion about which water points belong to which scheme. In order to improve the management of the Gonde/ Iteya scheme, there is a proposal to merge the management with the Hitosa scheme. This would draw on the experience of members of the community and share costs, vehicles and technical staff, but keep an office in Gonde/ Iteya so there is a local focal point and sense of ownership. Administratively, there would be no problem as the two schemes are in the same woreda and culturally the people are from the same background.

The new schemes are evolving from the experience gained so far. In Robe, the community water board will serve the rural areas, but will provide bulk water supplies to the municipality, which will manage the urban distribution system.

3.3.1 Tijo water supply

The Tijo scheme was built at the same time as the Tereta and Hitosa schemes, but for only 9 000 people. The scheme is not flourishing financially, as there is not enough cash flow to support full time staff. There are also alternative water supplies, so demand is low. The tap attendants are not paid a wage, but are given a proportion of the income.

4. Working together

This study provides case studies of two projects that have been recognised as successful examples of community managed water supply schemes. Both schemes demonstrate the need to share resources at the various levels of the organisation, but there are differences between the two case studies that can provide some lessons for future projects.

4.1 Sharing resources

Examination of the two groups of water systems shows that the schemes do require a variety of resources to keep them operating. Deciding what resources are being shared between communities does require the boundaries of the community to be defined. In both Malawi and Ethiopia there were several levels of "community":

- taps (village committees in Malaŵi, village committees and tap attendants in Ethiopia);
- branch lines (committees during construction in Malawi);
- scheme (main committee, caretaker and monitoring assistant in Malawi; board, executive and administration in Ethiopia);
- cluster of schemes (monitoring supervisor in Malawi, local NGO and zonal government in Ethiopia); and
- national and international (Ministry and donor).

The level where "community" stops and institutions start is not clear, but the routes for involvement do seem to play an important role. In Tereta, individuals participate in the scheme in a number of ways. They took part in the construction, they receive water, they pay money, they have a committee structure and they are now involved in hygiene promotion. These activities span the variety of resources used in a livelihood analysis. In Mulanje, individuals took part in construction and receive water, but the government provided the finance and institutional support, leaving the community without a clear role once the labour had been organised for construction. The only focus for the users was the physical resource, rather than social or financial links.

4.1.1 Human resources

Both case studies showed how human resources could be successfully shared between communities. Human labour significantly contributed to the construction of the schemes. The use of trained staff, both for the technical operation and management of the schemes was only possible due to the sharing of human resources.

Setting up a structure where the community is the employer and paying a proportion of the professional's wages enabled control and responsibility to stay with the community rather than an "expert". In Tereta the community employed the technical and administrative managers of the scheme. One of the issues with the Malaŵi experience was the parallel management structures, with the monitoring staff reporting to the Ministry, who in turn provided the monitoring staff's wages and materials to maintain the water supply system. The users' management structure had no input into the management of these human resources.

4.1.2 Financial resources

The sharing of financial resources was the biggest contrast between the two case studies. Apart from some very localised funding of replacement taps, the Malaŵi schemes were entirely dependent on external funding. This meant that the community did not have any direct control over the finances of the water supply. Major decisions about repairs, extensions and refurbishment are controlled by external organisations.

In the Ethiopian schemes, the finance is controlled locally, with budgets set by representatives of each village. The availability of these financial resources does come at a cost. Not only do people have to pay for the water, but they also have to support the bureaucracy and administration required to collect the payments. The setting of tariffs less than the poorer members of the community's ability to pay ensures that this burden does not exclude people. The present operation of the system seems to demonstrate that the benefit in terms of financial independence does outweigh the costs and increased vulnerability to external factors.

The scheme at Tijo shows that the size of the community is an issue. Although technically sound, the scheme cannot generate enough resources to be as financially successful as the neighbouring schemes. The scheme may still be sustainable if it can generate enough income to cover its expenses, but the lack of money to employ professional management does leave the scheme poor in terms of human resources.

4.1.3 Physical resources

The operation of the Malawi schemes for over thirty years does clearly demonstrate that physical infrastructure can be shared between communities.

In Ethiopia, the lack of awareness by people on the border between Hitosa and the Gonde/ Iteya schemes showed that other factors were more important to the community than the physical connection of pipework. Both the Hitosa scheme and Tereta use more than one spring, supplying separate networks but under the same management. In both Malawi and Ethiopia there are examples of different management bodies sharing the same gravity system, where a supply to a rural area is also providing a bulk supply to an urban area that is managed in a different fashion. There were difficulties in Malawi, due to management failures rather than a technical problem.

4.1.4 Natural resources

The sharing of natural resources is very obvious, with the communities in the lower areas benefiting from the natural resources of the people living in the higher areas. It could be debated who owned these resources, the people living close by or the wider society? In both case studies, the people living close to the source had their livelihood options restricted, with controls on land use. In the case of Ethiopia the people were compensated by the provision of a free water point for them and for their cattle, making access to the water more convenient.

4.1.5 Social resources

The social resources of a community define the community, so they cannot by definition be shared between communities. An institution, such as the Tereta water board is not a shared resource of 15 villages but a single resource of the community of people in that area. In Malawi, the presence of a traditional leader is not a shared resource, but a focus of a wider community than the localised perspective of a village. The creation of a user group becomes a social resource for the group of people it represents. This does not mean that a user group can be created irrespective of the social conditions of the area. Trying to group people into user groups will only work if their motives for working together are stronger than any other factor that may make them prefer to work separately. Thus some of the urban/ rural divides experienced in Malawi appear to have been addressed in Ethiopia, where the new scheme in Robe will provide water for the town and countryside. Here it is planned to have different management systems at the distribution level and only coming together to share the management at the higher level of bulk water supply.

The co-operation between communities, such as the urban and rural areas of Tereta, is not a mutual sharing of resources in a horizontal fashion but another layer of management. What has

made it different from similar vertical layers of local government is its focus. The receipt of money, the election of representatives and the provision of water all involve the users.

4.1.6 Links

This analysis of the shared resources of community water supplies highlights the integrated approach promoted by a sustainable livelihoods framework. The shared resources are dependent on each other, for instance:

- the natural resource of water can only be shared by using a physical resource, such as the gravity flow pipelines;
- the physical resources are dependent on the human resources to maintain them;
- the human resources are dependent on the financial resources to pay staff for their work and to buy the tools and materials to carry out the maintenance;
- the financial resources require trusted institutional support to collect and manage the money; and
- the social sense of the community water management is focussed around the water supply, providing a common identity for the community.

4.2 Roles and responsibilities

Both case studies have broadly similar roles and responsibilities for groups at various levels of organisation. Although they were conceived under different social and financial contexts, a hierarchy of roles, both designed and self-selecting, has occurred in practice .

Community level

The communities have several roles and responsibilities:

- the appointment of representatives to management committees (one ad hoc, or selected according to traditional leadership; one elected);
- the collection of finance to maintain the systems (one ad hoc, one institutionalised); and
- participation in construction.

Scheme level

In both case studies, there were management committees and professional staff looking after specialist areas of the schemes. Both management committees were responsible for the running of the supplies, although they did receive support from the regional or national level. In Malaŵi, the main committees were not responsible for the provision of materials or routine monitoring of the scheme.

National level

At a national or regional level, the ministry or regional bureau had major involvement during the construction stage and duty of oversight during the operation stage. In Malaŵi the operation stage involved a close relationship with the management of the scheme, procuring and supplying materials, employing monitoring assistants and receiving regular maintenance reports. In Ethiopia this was limited to annual financial audits and less frequent technical audits.

International level

In both schemes the international community had provided the majority of the cash funding for the construction. In Ethiopia the donor had revisited the scheme to assess its success and had commissioned reports on how to improve its impact and sustainability.

4.3 Participation

In both Malaŵi and Ethiopia, the water schemes were constructed in largely rural areas. Both have dispersed populations, with no obvious village structure. These rural areas had existing social links before the construction of the water supply, with communities focused on cultural, economic or natural resources. The term “community managed” has been used to describe both systems, but the existence of any community appears to be centred on the water scheme, with the infrastructure providing the links between people, irrespective of other social ties. This is not to say that the schemes are not managed by a community, but that it is a community of users, rather than a pre-existing social group. A more precise term than “community” would be “user groups” – a distinction that enables a hierarchy of groups to be established around the management of the infrastructure. Both schemes were “participative”, but to different degrees.

Strategic planning

Although both schemes met demands, the involvement of the community does not appear to be apparent in the development of either water supply, unless a problem was raised (e.g. conflict over the protection of the spring site in Tereta). The planning and design tended to be the responsibility of a technical team. This does not appear to have had a major impact on the *technical* operation of the scheme (although in Malaŵi there were reports of poorly sited taps stands that did not meet the needs of the community, even though they were in the “centre” of the village and thus minimised travelling distances).

Construction stage

Both schemes had a high level of community contribution to the construction process in the form of unskilled labour. Anecdotal evidence from Ethiopia states that this had a high level of support from the community. In Malaŵi, there is some evidence of coercion, but this may be regarded as similar to paying taxes – an activity that is very rarely voluntary! The question of unpaid labour for construction projects does raise concerns about forced labour (cf. the International Labour Organisation’s Fundamental Declaration of Principles and Rights at Work, which includes “the elimination of all forms of forced or compulsory labour”) and the degree in which the rich take part in “voluntary activities”.

Operation and maintenance

In Malaŵi the schemes were meant to be totally maintained by the community, with support from the national level in terms of technical advice and the supply of materials. In Ethiopia there was no direct participation in the operation and maintenance, as this was paid for by the water charges and carried out by trained tap attendants and administrative staff.

Management

In Ethiopia, community participation in the management of the scheme filtered through the professional administration to the board executive, to the main board then the village committees and finally the people. In Malaŵi the committee structure did not appear as robust and the key resources were held outside the committee structure, so the route for influencing policy was via the parliamentary system.

4.4 Accountability

As discussed in the introduction, the focus of authority is important when the management of water supply schemes is devolved. Whereas the participation and responsibilities were broadly similar in both case studies, the area of accountability does offer a marked contrast.

Community level

In Ethiopia the focus for the community was on their tap stand, their committee and, through the payment and maintenance systems, the administration. In Malaŵi, the focus was on the tap stand, but there was very little identification with the wider scheme. The prevailing political structure (traditional or parliamentary) was a stronger route of accountability than the scheme committees.

Scheme level

At scheme level, the Water Board in Ethiopia was the centre of accountability; the village committees, the executive and the administration all reported to the board. In Malaŵi the scheme committee relied on the local political establishment for their authority, whilst the monitoring assistants and supervisors looked to the national level for their wages and the resources they required to carry out their role.

National level

The Ethiopian scheme had very little accountability to the regional level; there was a dialogue and periodic audits, but the day to day operation was at the scheme level, once the construction phase was complete. In Malaŵi on the other hand, the national level had a continuing role and so the scheme was part of the national administrative structure, dependent on the national ministry for materials, finance and technical support.

International level

Both schemes depended on donor money for construction, but whereas in Malaŵi the money was routed through the ministry, in Ethiopia there was a closer link with the NGO providing the funds. This has lasted beyond the construction phase, with a review of the impact and long-term operation of the scheme currently being carried out.

4.5 Elements of success

Although both schemes have been run by the users, direct comparisons between the two countries should not be made, due to the difference in the age of the schemes, with one at the start of its operational life and the other requiring refurbishment.

Infrastructure

Both schemes provided the infrastructure to deliver adequate water to large numbers of people. The Malaŵi experience has shown that the system was simple but reliable and has been sustained for over thirty years. The Ethiopian scheme was successfully constructed and is being extended due to demand. The technology choice has proved to be sustainable, provided there are the (relatively limited) resources available to keep the system operating. The transfer of water from areas with plentiful supplies to areas in need has proved to be effective.

Planning

The vision to implement these schemes and the organisation to provide water to relatively large numbers of people is commendable. The preparation for construction and the development of management structures and career paths required considerable inputs, but have laid good foundations for a vital resource.

Support

Both schemes received the support they required to run the system. In Ethiopia the external support required since construction was minimised through training, selection of suitable technologies and ensuring financial sustainability. In Malaŵi, the support was present for many years, but has been subject to factors outside the communities' control. This reliance on external

resources has proved to be a weakness due to the institutional changes since the scheme's inception.

Accountability

The differences in accountability between the two case studies does point to the success of the Ethiopian scheme and an inherent, if not originally obvious, weakness in the Malaŵi management structure. The Ethiopian management model places the control with people who are motivated to keep the scheme operating. The effective authority in Malaŵi was with people outside the area served by the scheme, with little direct motive to ensure the water scheme operated satisfactorily.

Incentives

In Ethiopia, the management structure was in the hands of the users. These people had a direct interest in keeping the system operating, as well as the influence of their neighbours who also depended on the water supply. This was not the same case in Malaŵi. The people who were in charge of the resources that are required to keep the system operating were not directly accountable to the users. Measurement of the performance of the system did not appear to influence decisions at a higher level, where the main indicator of coverage of safe water sources was the provision of new supplies, irrespective of the condition of existing schemes.

4.6 Concluding remarks

The sharing of resources required to support low-cost water supplies has been shown to have worked satisfactorily in both the Malaŵian and Ethiopian case studies. The natural resources, physical designs and construction methods of both schemes were broadly similar. The management systems were different, but both have proved to work over significant periods of time. The way in which the management system works is more important than the management model selected to operate the system, as human and financial factors can support a scheme and make up for some institutional weaknesses.

Social factors however, such as the facts that management needs to be accountable and also be *seen to be* accountable to the users are required for the sustainability of the system. The routes for sharing resources are less important than the people who control the resources. This reaffirms the importance of focussing on users, with people at the centre of the scheme, managing their own physical, social, human, natural and financial resources.

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