INFORMATION PACKAGE ON

OPERATION AND MAINTENANCE OF RURAL WATER SUPPLIES

compiled for Save the Children (UK) in Malawi

contribution to planned Workshop on Village Level O&M of Rural Water Supplies
Malawi September 1993

by IRC International Water and Sanitation Centre, The Netherlands

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1. INTRODUCTION

The present situation in rural water supplies

Maintenance is reported as the major problem in most water supply projects, both piped water supplies and point sources (boreholes and wells).
Operation and maintenance has been so badly neglected that many schemes no longer provide the services for which they were constructed (Ittissa, Ato Birru, 1991 - appendix 1). This results from the emphasis on capital construction and expansion and the tradition of offering water services as a free social benefit. Over the last decade the importance of O&M for building up sustainability of assets was indicated, but not translated into policies, strategies and practices. The result is that high percentages of installed systems do not function; figures up to 60% are reported, also for Malawi.

The expanding coverage

The Water Decade has increased the investments in the sector. Coverage figures have gone up for both rural and urban water supply. (Figures on investments and coverage (WHO, Water Supply and Sanitation Decade Review 1993, appendix 2) Funding for investments are relatively easily available from the international donor community while the organization of O&M remained the responsibility of the national and local governments. In an ever expanding coverage both in numbers of systems as in more communities, the burden for the governments to manage the O&M became too big. Furthermore, the actual income of the governments (due to local and global economic constraints) and so the funds for centralized O&M decreased over the years.

The problems:

Generally reported causes of poor O&M (from several studies):

- lack of maintenance capacities
- lack of finance
- lack of responsibility
- lack of spare parts, tools and materials
- lack of capable manpower
- poor financial management by local bodies
- lack of monitoring, feed-back, control and poor operation
- lack of water during dry periods
- inadequate communication
- lack of transport
- insufficient revenues
- poor construction quality of systems
- lack of fuel and power failures

The Working Group on O&M (Collaborative Council) reviewed and elaborated on the key issues and problems (appendix 3).

A summary of maintenance problems in existing rural water supply systems is added (Bastemeijer and Visscher, 1987) (appendix 4).

For reference the ranking of water supply sector constraints has been listed both the global and African list is attached appendix 5.

The challenge: possible solutions

Activities to be undertaken at national and lower levels (also at global level) to improve O&M performance (from Collaborative Council Working Group on O&M) (appendix 3 and 6)

- enhance profile of O&M
- improve management of assets
- develop data collection and monitoring system
- formulate policy and coordination

Kalbermatten (1990) (appendix 7 stated that "... it is of equal interest to ESAs and governments to ensure that systems they have financed, are properly maintained: a) to protect their investment, because without it does not make sense to continue investing in the sector and b) a malfunctioning system does not contribute to economic development.

Delhi Conference:

A statement was made by the Collaborative Council Working Group on O&M at the Delhi Conference in 1990 called towards a new philosophy on Operation and Maintenance (appendix 8).

Four fundamental changes to take place were indicated:

- The agencies should change their orientation and begin to perceive of their primary role as provider of a service to people and not the constructor of physical works;
- The agencies themselves should become autonomous in efficient and transparent management and financing of the services;
- The agencies should provide integrated water and sanitation services only in response to effective demand of the consumer.

The New Delhi Statement builds on the challenge: **SOME FOR ALL, RATHER THAN ALL FOR SOME.** The four guiding principles include: a) protection of the environment; b) institutional reforms and involvement of women; c) community management and backstopping; and d) sound financial practices and appropriate technologies (appendix 9).

The challenge is to change the common situation of high breakdown figures and downtime of rural water supply systems into sustainable systems adequately operated and maintained with minimized breakdowns, low O&M costs and optimal socio-economic and health benefits for users.

Community management is an element that may contribute greatly to the achievement of this goal, see also chapter 3.

The role of information exchange

Information is a most important management tool. Decision makers at community, agency and government levels need to know when problems are starting to develop and to have access to data from other projects, or even from other countries, where similar situations may have arisen. Collection and exchange of information should therefore be a priority in the organization of programmes. Guidelines on the establishment of simple project-level information exchange system is given in "Framework for Technical Information Exchange" (IRC, 1988). Agencies can help themselves to build up knowledge and experience of successful approaches by linking monitoring and evaluation of projects to the performance and use of installed facilities. These type of data help to steer planning and design of future programmes, and their collection can be initiated simply and cheaply. (Partners for Progress, IRC 1991)

In 1988 a Working Group on O&M was established (i) to give an overview to the problems and issues causing poor O&M; (ii) to identify possible remedial actions and (iii) to develop specific activities for implementation. This group has its secretariat at WHO and many ESAs are participating in the activities of the Group.

2. O&M ISSUES

Definition of operation and maintenance

Operation:

a. major operations: all operations required to get safe drinking water. E.g. pumping in piped water supply system.
b. control of water collection points: standpost, yard connections, handpumps. This includes the opening and closing of valves and correct use of taps/handpumps and standpost/handpump area.

Maintenance:

all activities required to prevent breakdowns and to repair broken parts. This will include three types of maintenance:

a. preventive maintenance
activities resulting in prevention of breakdown through good operation procedures, routine inspection and checking and timely servicing of equipment and facilities. This includes simple activities such as replacing washers, rings, seals, tighten nuts and bolts and lubrication.
b. corrective maintenance
the routine minor repair of equipment and facilities
c. emergency maintenance
the repair work when the system as a whole is affected.

If preventive maintenance is not practiced and corrective and emergency repairs are not properly organized, the "crisis maintenance" is undertaken in response of major breakdowns and public complaints. This type of maintenance leads to increasing frequencies of breakdowns, decreased reliability of supply, poor service levels, low appreciation of water services and low willingness to pay.
Types of maintenance

Common constraints in O&M as identified by CC O&M Working Group (see also appendix 3).

- inadequate data on O&M
- insufficient and in inefficient use of the funds
- poor management of water supply facilities
- inappropriate system design and technology choice
- low profile of O&M
- inadequate policies
- overlapping responsibilities
- political interferences

Technology selection

Most water projects need to involve a range of technologies. The aim is to match the needs, water resources, financial, technical and managerial capacities and willingness to pay of different community groups with an appropriate mix of technologies; for example house connections, yard taps, neighbourhood taps and public standposts. For groundwater the technology choices would be open well, improved well with windlass and bucket, borehole with bucket-pump or handpump well/borehole. A table for choosing an appropriate water supply system is appended (10).

Profile of O&M

More political value and government attention is to be given to rehabilitation and maintenance of existing systems. The O&M problem must be clearly defined and communicated to policy-makers, politicians and the general public. Alternative solutions for O&M problems must be sought. Data collection on benefits from improved O&M are to be collected. Benefits include financial, economical, health and social benefits.

Policies and legislation

In general there is need for sound and clearly-defined policies on issues including:

- responsibilities and autonomy of communities in water system management
- ownership of water systems
- technology choice procedure
- role of private sector
- cost recovery systems
- role of national and local government including government-controlled water agencies

3. MANAGEMENT OF O&M

Activities in O&M

To develop the best management model, an analysis of the O&M technical and financial requirements is needed for each water supply technology applied.
To facilitate the development of the management model the following systematic approach can be used:

- detailed description of the scheme (visualization)
- detailed description of O&M activities
- detailed description of O&M requirements
- detailed identification of tasks and responsibilities
- identification of actors for each task/responsibility

As an example lists of elements in a gravity water supply scheme and a borehole with handpump are appended, as well as systematized forms for identifying tasks and actors (appendix 11). A list of activities related to O&M of a gravity-fed piped water supply is attached (appendix 12).

Actors in O&M

A great number of actors may be involved in the various tasks and roles in O&M of the water supply system. Each has its own potential and limitations. They together create the enabling environment, one of the ten key elements for sustainability (see appendix 13).

Six main actors:

a.	Community:	Users, users' groups, caretakers, local craftsmen, community water committee, other committees, local leaders,
b.	Private sector:	Local entrepreneurs, local craftsmen, mechanics, local hardware store, cooperatives, spare parts wholesalers, spare parts producers, bankers

c. Public authority: Administrative bodies at local, district, regional and national level (legal and institutional framework)
d. Water agency: Maintenance team (major repairs etc.), training team (technical, bookkeeping, organizational), monitoring team
e. Local NGOs: Active in sector (funding, training, development issues, etc.)
f. External support agencies: Multi-lateral and bilateral aid agencies, international NGOs and Development Banks

See also appendix 20.

Community Management

To review the role of communities in the management of improved water supply systems, an international workshop was held in November 1992, at the IRC in the Hague. The principal findings on Community Management are that (appendix 14):

- Community management goes beyond the community participation, and equips communities to take charge of their own water supply improvements.
- Community management involves a long-term and changing partnership between communities and supporting agencies. It strengthens the capacity of each partner and enables their combined resources to be used more effectively.
- Community management can mean more widespread implementation of sustainable water supply systems.
- Community management means a new role for support agencies as facilitators rather than providers, demanding new skills and offering greater opportunities.
- Benefits of community management can extend beyond water into other development activities.
- The scope for community management extends beyond rural water supplies.
- Conventional progress indicators need to be adjusted to monitor and evaluate community management.

The seven case studies of the workshop presented a wide range of approaches and partnership arrangements. The community manages their own water system, not on their own but in partnership with others. Potential partners include: the community, other communities, the water agency, NGOs, the private sector, the government and donor agencies (appendix 15).

Involvement of women

In general women often play a highly influential and beneficial role in the community management of water supplies. In appendix 16 the potential involvement of women in O&M has been worked out.

"The adequate representation of women in community-managed water programmes can not be taken for granted and the advancement of women remains a development goal." (IRC, 1992 - Community management today). The appendix 17 shows a list with ten key steps

to enhance the involvement of women in water supply and sanitation programmes. The potential involvement of women in the management of water

Roles and responsibilities in O&M

Partnership: There should be a process of consultation between the agency and the community undertaken by both parties as equal partners. The partnership starts from the very beginning of the project cycle, i.e. with the identification of felt needs, up to the management phase with O&M. The principles of the partnership approach are given in appendix 18 (IRC, 1991).

The division of tasks and responsibilities depends on different factors (Roark, 1993):

- complexity of system, technology
- initial arrangements / agreements
- location of system (remote)
- capacity of community in organization and management (including leadership)
- capacity of private sector
- ability and willingness to pay
- cost recovery mechanisms

- strength of water agency and its staff
- logistics and transportation
- regional and district financial capacity
- regional and district local authorities formal responsibilities

- national/regional economics
- national policies and strategies

An overview of actors and roles/activities may give a good overview of the present and planned involvement of each actor. An example is attached from the Tunisian Rural Water Supply Maintenance System (appendix 19).

Preparing for checklists for caretakers and maintenance teams
example from Preventive Maintenance of Rural Water Supplies (WHO, 1984) in appendix 21.

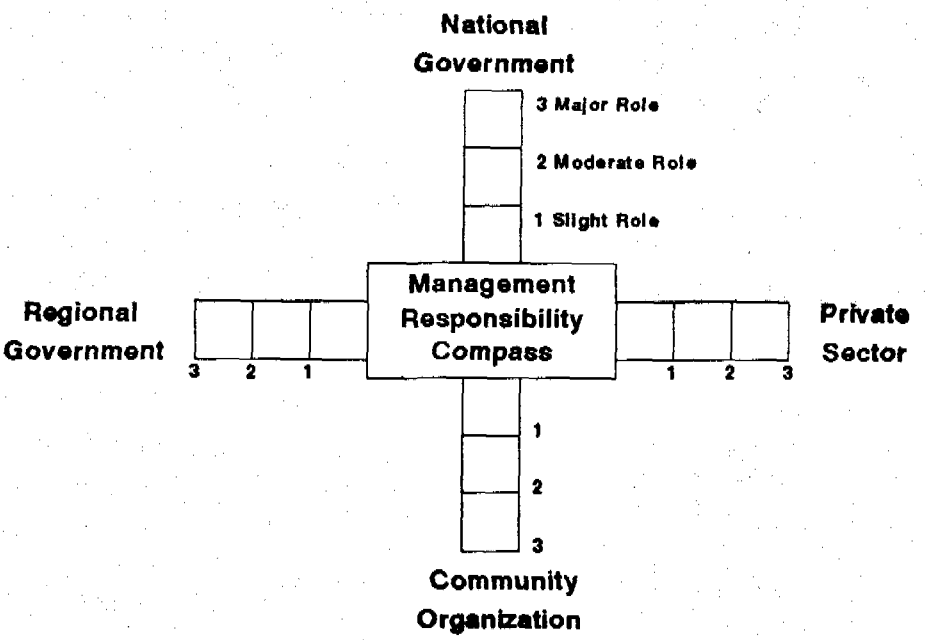
Other examples on technical requirements for O&M of gravity-fed systems and boreholes with handpump from (WHO/IRC, 1993 O&M training manual) have been appended (appendix 22).

Management systems

The management of a water supply system may have different models depending on the strengths and weaknesses of the factors mentioned above. The relative importance of each actor in the total O&M management can be graphically shown in a STAR diagram. The

four legs of the star are: the national government water agency, the regional government water agency, the private sector and the community organizations.

Star-diagram (after Roark et al., 1993)



Maintenance Management Systems (MMS): a series of techniques for planning, organizing, directing, controlling, monitoring, evaluating, and reporting on maintenance activities to ensure maximum project effectiveness at minimum cost.
Key elements are a) planning and organization; b) work order systems; c) equipment records; d) materials inventory controls; and e) monitoring, evaluating and reporting.
WASH report 63 (appendix 28).

Finance

Why should users pay for water services?
This controversial issue is discussed in "Paying the piper" (IRC, 1992). A list of reasons why they should pay is appended as well as some deliberations on these points, the dilemmas an whether all costs should be recovered or only part, thus cost recovery or resources coverage. Appendix 23 and 24.

Water supply is by its nature a decentralized activity. When planning for decentralization of the financial management some more questions could be asked. The Manual on O&M (WHO/IRC, 1993) has listed them (appendix 24).

Community financing is at the heart of community management. It is the key to the sense of ownership. The Community Management workshop found that it is less important that the community ownership is legally constituted than whether the community fully accepts responsibility for the care of the system. "Full cost recovery is not a prerequisite for effective community management, but as much of the recurrent costs as possible should be borne by the community". A table that summarizes the community contributions to capital and recurrent costs in workshop case studies is appended (25) Transparency of financial management is another key issue: so adequate book-keeping and regular review of accounts.

Demand and willingness to pay is clearly described in "Paying the piper" (IRC, 1992). Appendix 26 gives a list of important issues influencing willingness to pay and deliberation on these issues.

Options on community financing for O&M are listed in a table appended 27.

Financial requirements

Estimating operation and maintenance costs; WASH technical report 48 (1989). This book may be a useful guide for proposed and existing water supply systems in a) preparing the O&M budget; b) analyzing existing water supply systems; c) analyzing design alternatives; d) project redesign; and e) tariff design. (Appendix 29).

Monitoring

Monitoring of O&M aims to provide information for: a) maintaining and improving the O&M performance of the water system; b) ensuring or increasing the efficiency of the system; c) establishing favourable conditions for sustainability.
Monitoring should take place at two levels: at community level to support the community management, and at agency level for improved sustainability support and planning future projects.

Some background information from the O&M Training Manual (WHO/IRC, 1993) is appended (30).

4. BENEFITS OF SUSTAINABLE WATER SUPPLIES

The more benefits and the more direct and immediate these benefits are, the greater the prospects for resource coverage and sustainability. The motivation of the users to contribute to improved and sustainable O&M will increase when these gains are clear. The gains must be clear for both the users and the supporting agencies.
The benefits of improved water services can be split in two broad categories:

a. Benefits to health
b. Savings in time and effort, leading to economic and social benefits
   Detailed information on benefits given in Paying the Piper (IRC, 1992) is attached (appendix 31).

Potential economic benefits and an analytical framework are described in "Economic benefits from Improved Rural Water Supply" (IRC, 1991)

5. TRAINING MATERIALS

The CC Working Group on O&M developed the following O&M tools:

- Guidelines for the Management of Operation and Maintenance of Urban Water Supply and Sanitation Systems (WHO)
- Training Course Package on Leakage Control (UK Water Research Centre)
- Guidance Materials on Optimization of Drinking Water Treatment Plants (WHO, under development)
- Training Course Package on Management of Operation and Maintenance of Rural Water Supply and Sanitation Facilities (WHO and IRC)
- Models for Management Systems of O&M of Rural Water and Sanitation Facilities (WASH)
- Tools for Assessment of Operation and Maintenance Status of Urban and Rural Water Supply and Sanitation (WEDC and IWSA, under development).

The Group's recommendations also include future efforts to develop new tools, to monitor O&M costs and performance and to develop indicators which reflect O&M requirements.

Other training materials include:

WHO/IRC (1993). Management of operation and maintenance in rural drinking water supply and sanitation. A resource training package. WHO/IRC.

IRC (1993) Manual on Community-based operation and maintenance of piped water supplies, Training Series, The Hague (forthcoming).

Carlsson, B. and Drake, E. (1990). Handbook for Village water supply operators. Unifed Local Government Services. Gaborone, Botswana.

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Madsen, Birgit. (1988). Community based handpump rehabilitation and maintenance programme: manual for instructors on community participation. DANIDA. Harare, Zimbabwe.

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Blair Research Laboratory. (1991). The Zimbabwe Bush Pump: A manual for the installation, dismantling and maintenance of the "B" type Bush pump.

6. SPECIAL EXPERIENCES

Handpumps

Handpump production and standardization: case study from India: "The development of the deepwell handpump programme in India" (appendix 32). The highlights of this programme are: a) development of the Indian Mark II; b) preparation of a national standard; c) establishment of a local manufacturing capacity; d) establishment of a quality control mechanism including vendor selection; e) installation of 1.5 million India Mark II deepwell handpumps; f) development of the VLOM India Mark III deepwell handpump.

7. CASE STUDIES

Malawi

- "Report on the workshop on national strategies for O&M of rural groundwater supplies, Mangochi, Malawi 1986" Water Department, World Bank (1988)

- "Malawi gravity-fed rural piped water programme: a case study", by UNCHS 1989

- "Technology choice, operation and maintenance in water and sanitation: the Malawi experience", by Kafundu, R. and Mhone, Y. in: Decade consultative meeting on water supply and sanitation 1981-1990, Harare 1990.

- "Malawi: lessons from the gravity-fed piped water system", by Hill, C. and Mtwali, K. in: successful development in Africa: case studies of projects, programmes and policies. 1989.

Southern Africa Countries

Lesotho: Technology selection for Lesotho's rural water supply programme (appendix 33).

Botswana (Roark) - Management Systems - appendix 34.

Zimbabwe:

- "A community-based handpump rehabilitation and maintenance programme", by Madsen, B. in Waterlines vol.8 no.3 (1990)

- "Community maintenance of handpumps", by Cleaver, F. University of Zimbabwe, Dept. of Rural and Urban Planning (1990)

- "Maintenance of rural water supplies in Zimbabwe" , by Cleaver, F. in Waterlines vol. 9 no. 4 (1991)

Eastern Africa

Tanzania
"Reporting and monitoring on operation and maintenance: Shinyanga region, Tanzania", by Min. of Community Development, Women Affairs and Children, Dar es Salaam, 1992

Kenya:
"The approach for sustainable rural water supply in Nyanza province, Kenya" by Odera, F. et al. Lake Basin Development Authority, 1990

Uganda:
"Community management systems for rural water supply", case study presented by Kiwe L. Sibunya, Unicef, Kampala (summarized in main points)

"Community-based water source maintenance systems: workshop report and papers" UNICEF Kampala, 1990.

Special cases

Sudan: National Corporation for Rural Water Resources Development (NCRWRD) in provinces of Kordofan and Darfur (appendix 35).

Togo: "Final evaluation of the USAID/Togo rural water supply and sanitation project", by Roark, P. et al. WASH report 228

Zaire: operation and maintenance of rural water systems in Zaire (appendix 36).

"Development of operation and maintenance strategy for rural water supply in Zaire", by Hall, R. and Malina, A. WASH report 273 (1989)

"O&M strategies for rural water supply in Zaire: phase II", by Hall, R. and Malina, A. WASH report 308 (1990)

West Africa: "Seven case studies of community management of rural water supplies" Regional Water and Sanitation Group Western Africa, World Bank (1991)

Nigeria: "A village level operation and maintenance (VLOM) system for "WATSAN Project" handpump equipped boreholes in Nigeria" by Donaldson, L. and Karim, M. UNICEF 1988

Indonesia: "Community Self-financing for water supply and sanitation systems. A promising approach to community management and financing of water and sanitation facilities" by Hadi Sucipto and Dan O'Brien, CARE, Jakarta, Indonesia. Summarized in main points (appendix 37).

Indonesia: Management System (from Roark et. al. (1993) appendix 38.

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APPENDIX 1

Towards a new philosophy on operation and maintenance

by Ato Birru Ittissa

The operation and maintenance of water supplies and sanitation systems has been so badly neglected that many schemes no longer provide the service for which they were constructed.

THIS SITUATION IS the result of two processes, the first and most important being the emphasis on capital construction and expansion, particularly of water services, by developing country governments and External Support Agencies (ESAs). A second crucial factor is the long-standing tradition of some governments and External Support Agencies of offering water and sanitation services as a free social benefit at no cost to the consumer. Investments in the water supply and sanitation sector increased steadily during the Water Decade, 1981-90, because of the recognition and acceptance of the fact that safe water and appropriate sanitation are crucial to an individual's health. Not much attention, however, has been paid to the fact that the sustainability of such benefits will depend upon the correct operation and maintenance (O&M) of these facilities. Even though adequate O&M has been recognized as one of the major constraints to water sector development, there has been no substantial progress in this field over the past ten years. The rural experience has been that where a water supply is provided through point sources fitted with handpumps, a high percentage of the facilities not functioning — figures of 40, 50 and 60 per cent are reported. In urban areas, ineffective O&M has resulted in more than half of the water produced in several large cities in developing countries being unaccounted for. In contrast to the high amounts of wastage and subsidized tariffs which are common features in the served city areas, the peripheries remain unserved and are forced to pay a premium for water from private vendors.

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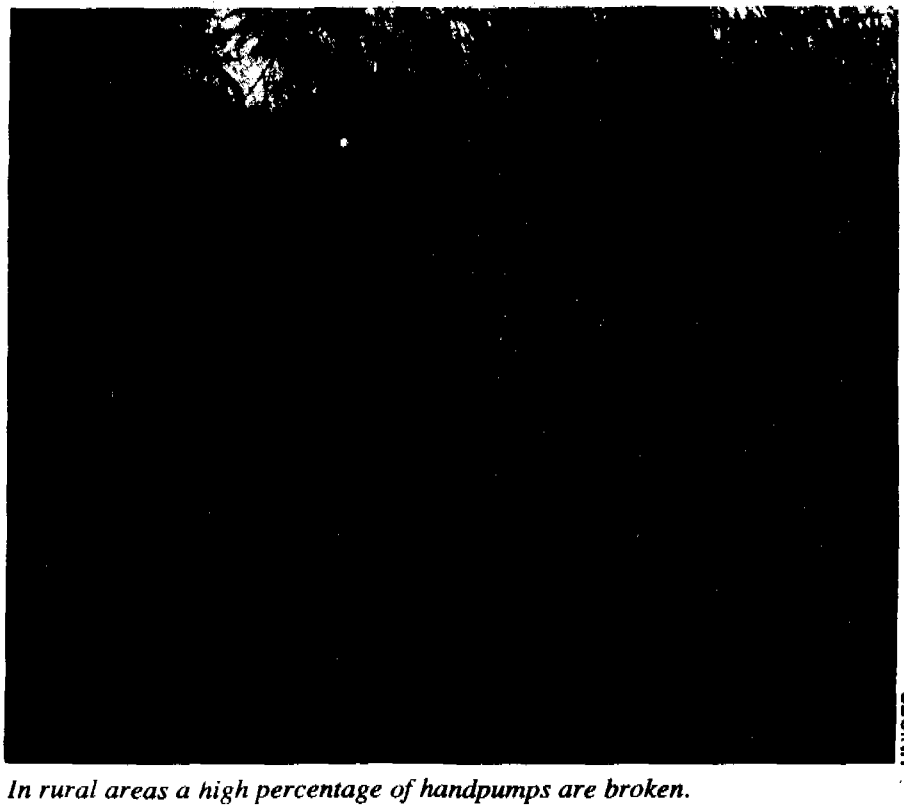
The international community sought to focus more attention on this issue through a one-day informal working session in November 1988 at The Hague, which was convened by WHO and assisted by the International Reference Centre for Community Water Supply and Sanitation (IRC), and which brought together representatives of various ESAs. This initial meeting concluded that special consideration needed to be given to the O&M aspects of rural and urban water supply systems. While recognizing that sanitation systems need to be approached in the same way, the meeting considered the O&M problem of the water supply systems as being more urgent. It stressed the need to establish clearly the scale of O&M problems, and for ESAs to support the development of country-level policies and strategies, and for case studies to be prepared to encourage and facilitate exchanges of experiences and related development strategies for improving O&M. A working group on O&M was established and its first meeting, organized by the WHO, was held in Geneva in February 1989, at which a list of key issues were identified and a methodology for joint co-operation adopted.

Subsequently an informal meeting on O&M, co-organized by WHO and IRC and attended by representatives of WASH and the UNDP/World Bank Project, was held at The Hague on 20-23 February, 1990. Its main purpose was to contribute to the preparation of the meeting of the Working Group on O&M which was held at Geneva on 19-22 June, 1990, and was convened by WHO with the support of GTZ and IRC.

Identify the problems

These meetings have resulted in the concrete identification of problems and issues and have proposed desirable approaches to their solutions.



UNICEF

In rural areas a high percentage of handpumps are broken.

Christian Aid/S. Gupta

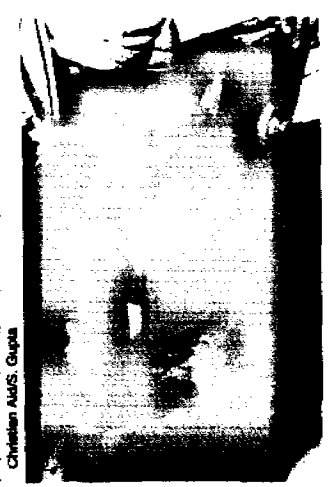
Lack of sufficient funds restricts the programme's ability to buy spare parts and train technicians.

These approaches constitute what will be the new philosophy on operation and maintenance. The deliberation of the February 1990 pre-Working Group meeting at The Hague identified the major constraints which influenced the current O&M situation in developing countries. The meeting described the effect of these issues on the effectiveness and efficiency of water and sanitation agencies, defined the aim of the proposed co-ordination of efforts, and discussed some of the key issues and activities to be jointly implemented. The June 1990 Working Group meeting was able to put these various factors together. The identified constraints and remedial approaches should now be the focus and substance of efforts to improve the O&M of the urban and rural water supply system in developing countries.

Under the three broad headings of Sector Performance, Institutional and Technology Performance, and Environmental Linkages, the Working Group identified the key issues contributing to the poor O&M of water supply facilities as the following:

- absence of data on operation and maintenance;
- insufficient and/or inefficient use of funds;
- poor management of water supply facilities;
- inappropriate systems design;
- low profile of O&M;
- inadequate policies, legal frameworks and overlapping responsibilities; and
- political interference.

The overall lack of data is a significant obstacle to any useful formulation or reformulation of systems and programmes. The kind of data one needs is, for example, the number of systems not working all over the world — a global figure — and information on why these are not working, or what kind of costs are involved for adequate O&M programmes in relation to various facilities in different countries. At the other end of the spectrum, we need data on the well-managed and maintained water supply systems on a global basis, and a breakdown of the costs and benefits of these operations. Another valuable input would be data on the rates of breakdown of different systems, such as handpumps, gravity systems, and treatment and distribution networks. In the absence of such hard data, it is difficult, if not impossible, to convince decision-makers of the need for and benefits of an improved O&M system.



Christian Aid/S. Gupta

Good system design includes a maintenance programme.

A second major constraint is the lack of and/or inefficient use of funds. The first restricts activities that are vital to effective O&M — the purchase of spare parts, the training of staff, and the provision of competitive salaries to attract the right people. External Support Agencies have tended to shy away from financing O&M activities, while national governments have accorded it a low priority, directing available cash to what they believe are more crucial sectors. Frequently, where the money is available, it is used inefficiently and contributes to poor O&M.

Poor management

The ineffective management of facilities leads to the wastage of resources, which in turn reduces the viability of the water-supply system. Overstaffing and poor organizational structuring are two major factors in this situation. Another factor leading to losses in revenue is the high rates of unaccounted-for water either through leakage or illegal connections; figures as high as 40 to 50 per cent have been mentioned. A case in point here is the study entitled 'Unaccounted-for water management in Greater Kathmandu' presented at the meeting of the Working Group, which highlights not only the problems of unaccounted-for water, but also the other financial constraints mentioned. Another case study, 'Financing the operation and maintenance of water supply systems: Experiences from the urban and rural water supply sector in Zambia and Malawi' offers further evidence of the lack of funds hampering effective O&M. This second paper also illustrates another issue, which is the unwillingness of the consumer to pay for an unreliable and unsatisfactory service. Evidence in support of the fact that consumers are able but unwilling to pay is surfacing in a number of countries. The failure to establish realistic levels of tariff which are linked to the service available results in diminishing levels of user support and a corresponding reduction in funds available for O&M, which in turn leads to a further drop in service levels.

Water-supply facilities range from community-owned and operated water-supply systems to government-owned and operated systems. Whatever the scale of the facility, however, ineffective management will render it useless. Some of the symptoms of this kind of management can be seen in inefficient organizational structures, lack of career structure for staff, inadequate salaries, and poor relationships between the users and management. This last feature is particularly true of government-run utilities, with all the negative implications of inadequate feedback and possible confrontations between the agency and the consumers.

Inappropriate system-design will almost certainly result in an inefficient water-supply system. There are, unfortunately, too many of these systems which have been badly designed, poorly managed, and which have used inappropriate technologies. The reasons for this poor system design vary. An ESA may send an unqualified consultant to design the system, or political pressure may result in a certain system, however inappropriate, being favoured. Here again one has to go back to the community that the system is supposed to serve, whether urban or rural, for support in identifying the optimal system. This area of community participation leads to community management and considerable work needs to be done if we are ever to realize the objectives of optimally functioning water-supply schemes in all developing countries.

Low profile

A further problem with the operation and maintenance aspect of water-supply systems is its low-profile, its virtual invisibility when compared to new construction and system extension. New constructions are fairly reliable vote catchers, while there is not much glory to be gained from a good O&M system. Moreover, engineers themselves seem to find new construction more attractive than routine O&M activities.

Because of its low profile and its relatively low status, not much attention has been paid to the need for establishing clear sector policies, compatible legal frameworks, and a clear division of responsibilities and mandates within the O&M sub-sector. An example of this is the nature of the relationship between the agencies for water supply and sanitation — quite often they have virtually no contact with each other, even though their interaction is crucial to the reduction of disease. We have not been successful in establishing the links between an effective WSS programme, a healthy individual, and an increase in the nation's productivity. Organizationally, one also finds that the approaches of ESAs and national governments differ with regard to O&M; better co-ordination here is an obvious necessity.

The last serious inhibiting factor in successful O&M is that global issue of political interference. When a political decision has been taken to provide free water, the chances of running a self-financing water-supply system are remote. Political interference may also result in inappropriate and wasteful water-supply systems, not only in terms of inappropriate technology but also, for example, in the quality of the facilities constructed. The working group's recommendation therefore makes eminent sense: devolve the responsibility for the management of systems from government to autonomous agencies which will be guided — technically, administratively and financially — by government guidelines.

O&M principles

Having defined the constraints to an effective O&M system, the working group then established the linkages between the conceptual and the implementation aspects of a new order O&M philosophy. While outlining the activities which would serve as the vehicles for the theories discussed, the group suggested that these activities be guided by four basic overriding principles for operation and maintenance. These are fundamental to any sustainable O&M activity in the water supply sector.

- Agencies involved in the provision of water should be service-oriented. If water is to be treated as a long-term commodity, its sustainability will depend on the adoption of a sound and cost-effective approach subject to the same legal and regulatory controls as other resources.
- The principle of effective demand must be the normal basis on which water is supplied to consumers. In other words, the community must define the stan-

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Good relationships between users and managers are essential.

Christian Aid/Maggie Murray

Women are the main users of pumps and must be consulted when operation and maintenance schemes are proposed.

dards of service it is willing to operate, maintain, and pay for in order to ensure adequate public health standards.

- The principles of good business practice must govern the establishment, operation, and maintenance of water systems. While forms of management may vary depending on local realities, the responsible agency will be autonomous but will still be guided by the government's guidelines. More important, the agency will be fully accountable to its consumers.
- New programmes must seek to establish the importance of the sanitation sector and establish closer links between water supply and environmental sanitation.

While emphasizing these principles, the group does recognize the legitimate concerns of national governments to satisfy the basic needs of the disadvantaged segments of their populations. These concerns could take the form of services at 'lifeline tariffs', minimum tariffs, or temporary subsidies.

Action plan

Within the framework of the principles I have just mentioned, certain activities were identified for implementation. These fall into four broad groups:

- Enhanced profile of operation and maintenance at global and national levels.
- Management improvement.
- Data collection and operation and maintenance monitoring.
- Policy formulation, collaboration and co-ordination.

The activities under the first group include activities such as: the preparation of a global position paper on O&M aimed at decision-makers in national governments and ESAs to prioritize O&M at the highest level; the holding of workshops, seminars and conferences at the national and other appropriate levels to raise awareness regarding O&M; the maximum exchange of experiences regarding O&M to raise the profile of O&M among professional associations, training establishments and other organizations; and the preparation of guidelines to be issued by ESAs to engineers so that O&M concerns can be included in system designs.

Proposed activities relating to management improvement include the promotion of a range of autonomous agencies spanning the rural-urban sector which will manage water and sanitation systems on a fully self-financing basis for O&M and the encouragement of ESAs and national governments to strengthen agencies so that they can function optimally, especially regarding O&M activities.

Under the third heading, Data Collection and Monitoring, the group has set out a number of activities, such as the development and implementation of monitoring systems for O&M costs and national-level performance; the implementation of programmes at the global/national levels which will collect financial and performance data on O&M using standard guidelines; and the development of international methodologies to establish performance indicators and review WHO evaluation guidelines for compatibility with adequate O&M.

There will also have to be a global-level programme to determine as accurately as possible the costs of adequate O&M for various types of water and sanitation systems, and studies to establish extents of savings and/or improvements to efficiency that will result from improved O&M and the use of locally or regionally manufactured spare parts.

To back these up, the group has suggested that ESAs assist with the data collection and monitoring programmes and participate in the exchange of technological experiences between countries.

As regards policy formulation, collaboration, and co-ordination, the group suggested that ESA sector policy documents should be reviewed and a set of policy guidelines established which address O&M issues. Also that national government sector policies and practices on O&M should be reviewed, and national government policies and legal frameworks should be established which ensure that O&M concerns are included in project design from the very outset of the process. Legislation restricting the discharge of pollutants and restricting the use of materials causing O&M problems should be passed, and a forum established where ESAs and national governments could more effectively collaborate in achieving common policies, unified approaches, compatible technologies and standardized equipment within the scope of national policies. The working group also strongly recommended that an international institution act as a focal point and forum to promote, co-ordinate, and reinforce O&M concerns. It felt that the appropriate institution would be WHO, operating with the support of other UN agencies, ESAs, and national governments, with the ESAs supporting WHO as a professional advisory group.

This is the core of the new philosophy of operation and maintenance. The recognition of the crucial role that efficient O&M must play in the development process by local associations, national governments, and the international community can prove to be a vital factor in the decade ahead of us. In this respect, the recommendations of the Working Group gives us clear directions in which to move, the goals we should set ourselves, and the objectives we must attain if the global community is to benefit.

waterpoints

Aluminium alert

Groundwater in Malawi, and other tropical countries in Africa, may be contaminated with aluminium and other metals, contrary to tests which have always shown their presence to be below WHO recommended levels. Marty McFarlane from the School of Geography at the University of Oxford found that 'the standard procedure of water treatment before analysis — filtration followed by acidification — could hardly be better designed as a system for masking the aluminium that is present in the water'. He found 'that the shallow wells, usually dug by local people, are the most heavily contaminated with aluminium. Almost every household in Malawi's rural areas draws water from one of these wells'.

'We think that the source of the aluminium is a clay mineral, kaolinite, which is broken down by the tropical weathering of Africa's bedrock'. Aluminium is not very soluble in the neutral Malawian water, so the researchers believe 'that it is organic binding that allows aluminium to be carried in groundwater'. Says McFarlane, 'We need to know more about the extent of the problem and, at the same time, develop water treatment methods that can reach individual households in remote rural areas where poverty prevails'.

New Scientist, 3 August 1991.

5th Rainwater Conference

'Rainwater Catchment for Future Generations' was the theme of this year's conference which was held in Keelung, Taiwan, 4-10 August. Delegates from more than 30 countries contributed papers on a wide variety of topics from 'Rainwater harvesting for farming families in Malawi' to 'The economic appraisal of rainwater cistern systems for high-rise buildings in Singapore'. The number of papers from industrialized countries such as Japan, Singapore and the UK that explored the possibility of using rainwater in urban environments for secondary uses such as toilet flushing etc., indicates that direct rainwater collection is a technology whose applications are not limited to remote, rural or poorer communities only. The fact that during the 1980s rainwater collection for domestic supply clearly proved itself as a viable technology in countries like Thailand, where over 10 million two-cubic-metre rainwater jars were constructed, has clearly helped to give rainwater catchment systems (RWCS) the credibility they deserve.

Among some of the key issues raised during the conference were the need for:

- the establishment of water quality standards specifically for rainwater stored in cisterns;
- software applicable for use on PCs for the design and the sizing of tanks;
- more attention focusing on the social and community aspects relating to both the implementation, operation, maintenance and water contamination of rainwater systems, with particular regard to the role of women in these;
- clear definitions of terms such as rainwater catchment, rainwater harvesting, rainwater cistern, etc.

The failure of the Water Decade even to approach the targets set in 1977 in most developing countries was noted by some speakers, although the Decade was recognized as a period in which rainwater catchment systems technologies spread rapidly, particularly in parts of East Africa and South-east Asia. The enormous potential for RWCS technology to continue to spread and provide water to the one billion people still lacking adequate access to clean and convenient supplies was also pointed out.

The wide geographical spread of the papers presented demonstrated the truly global interest in RWCS technology, with reports from projects and research from the Philippines, Brunei, Bangladesh, Tanzania, Brazil, UK, Kenya, Mali, Zambia, Sri Lanka, Malaysia, Nepal, Japan, Iran, South Africa, Guam, Thailand, Hawaii, Canada, China, Botswana, US Virgin Islands, Vietnam, Sudan and Taiwan.

During the plenary session the venue for the 6th IRWCS Conference was agreed as Nairobi, Kenya, probably in August 1993. Further details about this will be publicized in future issues of *Waterlines* or may be obtained from Mr John Mbugua, PO Box 56, Nakuru, Kenya.

It was also agreed that the International Rainwater Catchment Systems Association (IRCSA) should be formally registered. This will probably be done in Taiwan, where it is expected that a base for the association will be established. Professor Yu-Si Fok of the University of Hawaii was unanimously re-elected President of the Association, and other key officers and the constitution were given the mandate of the conference. A formal membership drive will be organized in due course. For further information about the Association and its activities write to the author, Mr John Gould, Department of Environmental Science, University of Botswana, Postbag 0022, Gaborone, Botswana.

Copies of the conference proceedings, price US$50, are available from Mr Show-Chyuan Chu, National Taiwan Ocean University, Keelung, Taiwan 20224.

WEDC in Africa

The 17th WEDC Conference, held in August at the Habitat Centre, Nairobi, was about 'Infrastructure, environment, water and people', and attracted 224 participants — a record for Africa. In all 57 papers were presented in plenary sessions and small groups, but much of the week was devoted to discussion. Sessions on community participation, rural water supply and low-cost sanitation aroused the greatest interest, for many of those who attended are fieldworkers in Kenya, Tanzania, Uganda and other nearby countries.

Next year's WEDC Conference — the 18th — will be in Kathmandu, Nepal. It takes place from 30 August to 3 September 1992, and is co-organized by the Nepal Engineers Association. The title will be 'Water, environment and management. Offers to prepare papers based on personal experience may be sent to John Pickford at WEDC, Loughborough University of Technology, LE11 2TU, UK.

APPENDIX 2

TABLE A.3.2.3 - GLOBAL 1990
COMPARISON OF COVERAGE AS OF 1980, 1985 AND 1990 - RURAL WATER SUPPLY.

Region	1980 Population (000)	1980 Coverage (000)	1980 (%)	1985 Population (000)	1985 Coverage (000)	1985 (%)	1990 Population (000)	1990 Coverage (000)	1990 (%)	Number of reporting countries 1980	1985	1990
Africa	82 935	17 981	22	275 538	68 096	25	225 494	72 158	32	20	34	24
Americas	115 289	48 628	42	117 076	55 437	47	91 280	47 313	52	20	24	20
South-East Asia	787 360	241 664	31	850 751	402 718	47	990 476	656 021	66	9	9	10
Eastern Mediterranean	115 109	34 532	30	117 615	32 550	28	164 824	84 408	51	12	12	9
Western Pacific (Excl. China)	98 656	40 075	41	107 549	51 312	48	122 942	65 379	53	17	12	23
Western Pacific	-	-	-	-	-	-	1 073 159	713 556	66	-	-	24
TOTAL (Excl. China)	1 199 349	382 880	32	1 468 529	610 113	42	1 595 016	925 279	58	78	91	86

Source: For 1980, International Drinking Water Supply and Sanitation Decade; Review of National Baseline Data (as at December 1980), WHO Offset Publication No. 85, WHO, Geneva 1984.

For 1985, International Drinking Water Supply and Sanitation Decade; Review of Mid-Decade Progress (as at December 1985), CWS/87/5.

Table 1.2.1 Urban water supply service coverage

	1980	1980 (Actual coverage)	1990 (Target)
Urban population estimate (millions)	82.70	147.62	147.62
Estimated % service coverage	66	79	88
Estimated population served or to be served (millions)	54.58	116.60	129.91

Table 1.2.2 Rural water supply service coverage

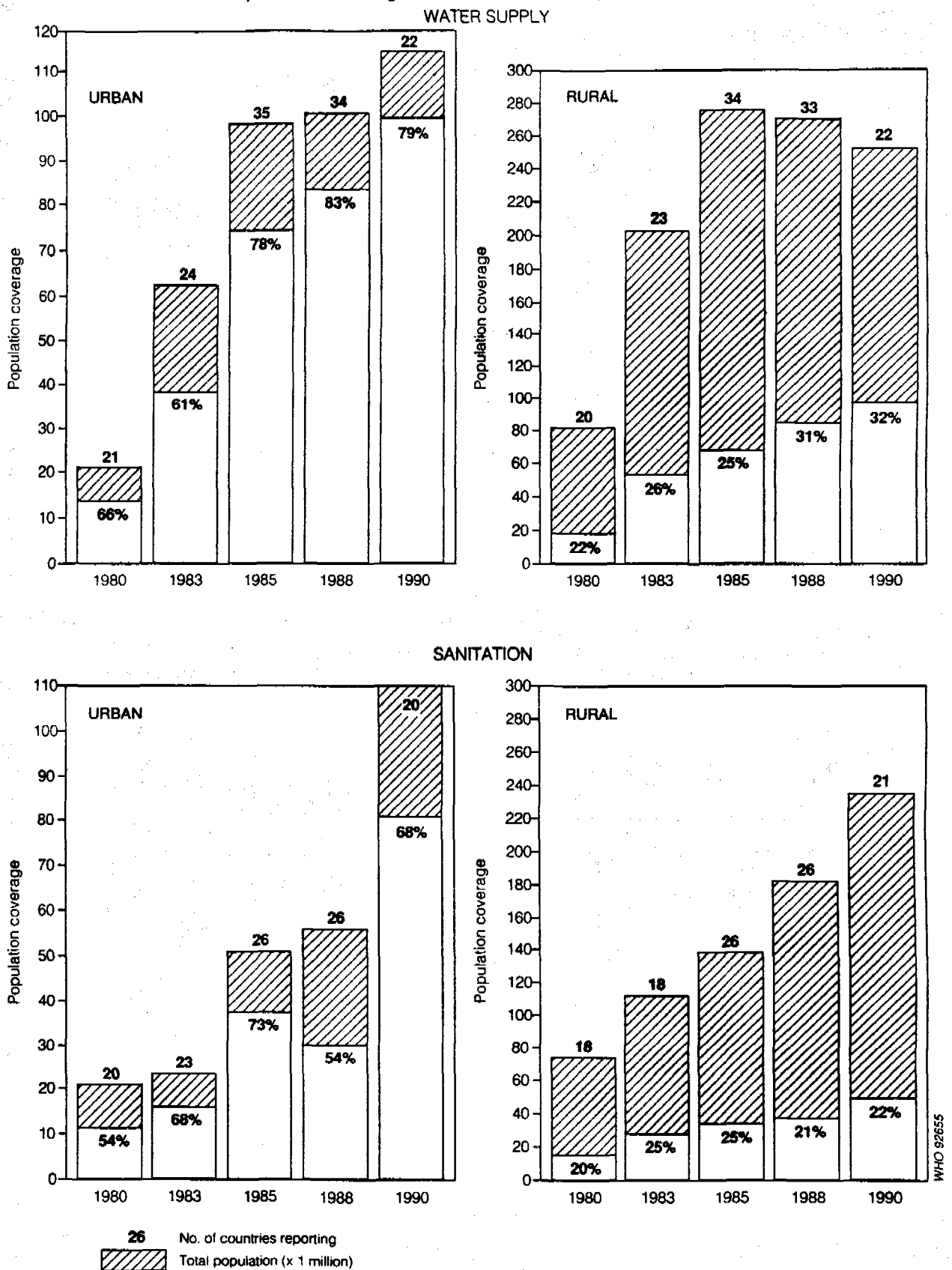
	1980	1990 (Actual coverage)	1990 (Target)
Rural population estimate (millions)	275.25	339.39	339.39
Estimated % service coverage	22	32	54
Estimated population served or to be served (millions)	60.56	108.60	183.27

Table 1.2.3 Overall (urban/rural) water supply service coverage

	1980	1990 (Actual coverage)	1990 (Target)
Total population estimate (millions)	357.95	487.01	487.01
Estimated population served or to be served (millions)	115.14	225.20	313.18
Estimated % service coverage	32	46	64

Fig. 1.1 African Region

Population coverage in 1980, 1983, 1985, 1988 & 1990 [a]



[a] See Tables A.3.2.1 to A.3.2.4.

1.3 Staff and training

Lack of sufficient adequately trained professional personnel at the end of the Decade was considered by reporting countries to be the fifth most serious constraint to sector development, while lack of sub-professional personnel was considered the sixth. At the start of the Decade, reporting countries tended to consider the issue of lack of personnel as more serious, which could indicate that during the Decade some progress was made in alleviating the problem.

Information provided by countries on sector staffing was seldom complete and few conclusions could be reached. However, the total staff in the sector employed per million population ranged from 64 in the case of Ethiopia to 1725 in the case of Mauritius and the Central African Republic.

Of the 20 reporting countries, 15 reported the employment of community-based workers, although the numbers of those employed was in no case indicated.

Of 21 reporting countries, 14 reported the existence of a human resources development plan, while 13 out of 22 countries indicated that a specific budget existed for this purpose. Of these latter, only three felt that the funds allocated were sufficient, Botswana, Nigeria and Senegal.

1.4 Financial resources

Funding limitations has persisted throughout the Decade as the most serious constraint to Decade progress identified by governments in Africa, with inadequate cost recovery being perceived as the third most serious. The importance of cost recovery as a perceived impediment to progress has increased significantly since the start of the Decade, possibly because of the attention directed towards better sector planning and management.

Table 1.4.1 Unit costs of water supply and sanitation facilities (US$ per capita)

	1980	1985	1990	Average
(a) Urban water supply by house connection	100	106	91	99
(b) Urban water supply by stand post	46	55	55	52
(c) Rural water supply	32	40	44.5	38.8
(d) Urban sanitation by sewer	150	150	120	140
(e) Urban sanitation by other means	53	116	100	89.7
(f) Rural sanitation	15	25	24.5	21.5

Thirteen countries provided information on the annual sector investment during the Decade and on the proportion of this provided from external sources. The median value for the proportion of funds from external sources was 85%, somewhat higher than the values of 75% reported at mid-Decade, 1985. However, the weighted average by population of the proportion of funding coming from external funding for the Region as a whole was calculated to be 74%.

Table 1.4.2 Breakdown of population served 1981-1990 (during the IDWSSD)

	Number served 1980	Number served 1990	Number additionally served
Urban water supply	54.58	116.60	62.02
Urban sanitation	44.66	100.38	55.72
Rural water supply	60.56	108.60	48.04
Rural sanitation	55.05	74.67	19.62

Based on the number of people served and the fact that 65% of the urban population served with water was through a house connection (HC), and 30% of the urban population with access to appropriate sanitation was connected to a public sewer (SC) or had a house connection to a septic tank, the following calculation of investment during the Decade has been calculated.

Table 1.4.3 Estimated water supply and sanitation investment 1981-1990

Sub-sector	Number served (millions)	Unit costs US$	Total investment US$ (millions)
Urban water (HC)	40.3	99.0	3989.7
Urban water (SP)	21.7	52.0	1128.4
Urban sanitation (SC)	16.7	140	2338.0
Urban sanitation (OM)	39.0	89.7	3498.3
Rural water	48.0	38.8	1862.4
Rural sanitation	19.6	21.5	421.4
Total			13238.2

APPENDIX 3

1.0 INTRODUCTION

The operation and maintenance of water supply and sanitation systems is a complex issue with linkages and interrelationships to water resources, environmental sanitation (solid and liquid waste management) and the environment in general. Operation and maintenance cannot be discussed in isolation or by ignoring these interlinkages. The relationships between water supply, waste and water resources are illustrated in Figure I.

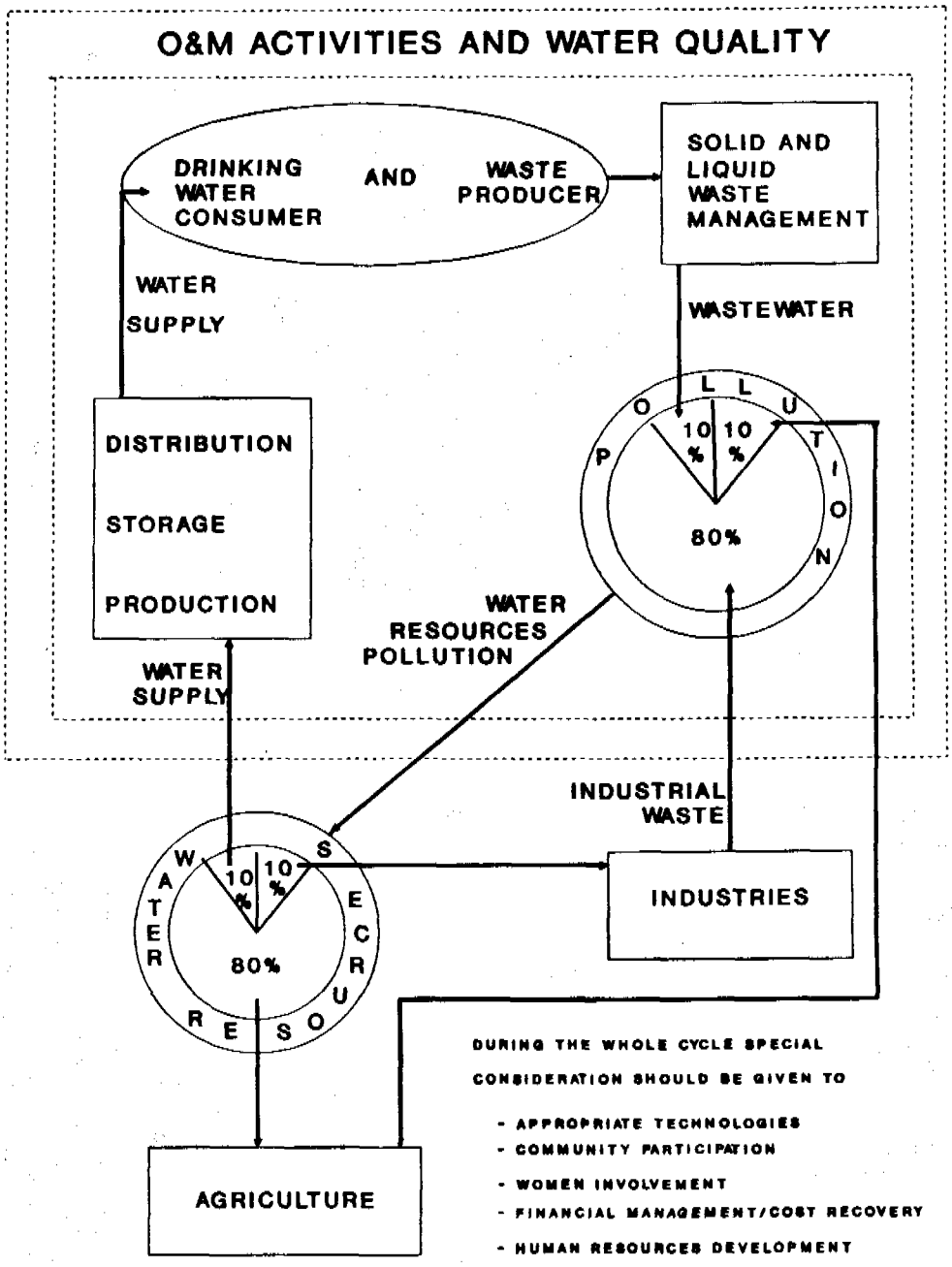


FIGURE I

The operation and maintenance of a water supply system affects and in turn is affected by the water resources which are the basis of supply. Raw water quality influences treatment requirements, available quantity determines amounts which can be provided to users and which need to be disposed of after use. Because most urban domestic water use is non consumptive (except where lawns are watered), the more water is supplied, the more polluted water is being discharged, leading to the contamination of water sources of the community in question or, more likely, of other communities. Conversely, lack of sufficient water makes the operation of a waterborne human waste disposal system impossible.

In the absence of sewage disposal systems, the local environment is being contaminated in direct relation to the amount of drinking water supplied, potentially causing more health problems than presumed resolved with the supply of water. Inadequate drainage and solid waste collection practices aggravate wastewater disposal problems in the absence of sewer systems. As the quantity of potable water supplied increases, this is true even for on site systems because the quantity of sullage water increases to the point that on-site soil absorption capacity is exceeded and excess wastewater flows to public streets and drains.

Operation and maintenance suffers if the issues described are not resolved at the design stage and if there is insufficient coordination and cooperation between the various agencies with responsibilities in water resources and for the environment.

Fortunately, the relationships between water supply water resources and the environment are increasingly being recognized. The activities of agriculture, forestry and industry are important. Both agriculture and industry require water and are often the major users. They return the unconsumed water to the environment often in a very polluted state containing a range of industrial and agricultural chemical contaminants. This pollution of water resources in the developing world by agriculture and industry is well documented and in many developing countries has reached alarming proportions. To combat these harmful pollutants water supply systems must install sophisticated treatment methods which are costly to operate and maintain and require advanced technical skills.

Uncontrolled timber cutting has an unenviable record of causing accelerated erosion and dramatic increases in the sediment loads of streams. This increase in sediment poses problems to the operation and maintenance of water supply systems because the sediment must be removed to prevent damage of water equipment. If it is not, the lifetimes of the equipment are much reduced and operation and maintenance becomes more costly.

Projects in the water supply and sanitation sector of developing countries have traditionally received strong support from donor organizations. Needs have been so great and of such a varied nature that national governments have had little difficulty in identifying project packages in accordance with the development wishes of the different types of external support agencies. Thus commercial loans have been attracted for large scale "bankable" projects, mainly in the urban water supply and sanitation subsector, soft loans and grants have been made available from bilateral agencies for work in the smaller urban and the rural areas, whilst donations in cash and in kind have been forthcoming from a host of non governmental agencies for development in areas of special interest such as refugee camps, resettlement areas etc.

Since the mid-1960s investments in the water supply and sanitation sector have steadily increased, reaching a peak during the International Drinking Water Supply and Sanitation Decade 1981-1990. The principal objective of this development effort was to extend the provision of safe and adequate drinking water and appropriate sanitation to as many people as possible as this is recognized as an essential prerequisite to the control of water-related diseases and is therefore accepted as being indispensable for the good health upon which rests personal well-being and national productivity and wealth. Such benefits will, however, only accrue if the water supply and sanitation facilities provided operate correctly and are maintained so that they continue to function and are utilized to their full potential by the beneficiary communities.

There is widespread evidence that though Operation and Maintenance is recognized as one of the major constraints for sector development, inadequate support has been provided to water agencies for improvements in this field during the past decade. It is discouraging that in the rural areas, where supply is frequently provided through point sources fitted with handpumps, a high percentage of facilities are reported as being out of order. Figures of 40%, 50% and 60% have been reported but this is an area where reliable data, perhaps not surprisingly, is not readily available. In urban areas, poor O & M has resulted in unaccounted for water being reported as more than 50% of produced water in many large cities in developing countries. In the served areas of these cities, wastage is very high and tariffs are often subsidized whereas the inhabitants of fringe areas remain unserved and pay the market price for insufficient and unsafe water from private vendors.

A shift in this situation is in progress. This can be deduced from conclusions and recommendations of Regional External Support Consultations and International Consultations which have recently taken place in association with the International Drinking Water Supply and Sanitation Decade (IDWSSD). Several external support agencies have been increasingly supporting Operation and Maintenance projects. The approach developed for Community Water Supply and Sanitation in the Eight General Programme of the Work of the World Health Organization, covering the period 1990 - 1995 emphasizes the importance of Operation and Maintenance for a better institutional performance.

Operation and Maintenance is frequently undertaken at the project level on an ad hoc basis. It is rarely implemented with any lasting success and there are many associated problems and constraints. There is a clear need for a number of actions to be taken in an effort to improve the situation. The implementation of these actions will be facilitated if a participatory approach involving developing countries and external support agencies is adopted. The present meeting has been convened by WHO and co-sponsored by the Federal Republic of Germany through the German Agency for Technical Cooperation (GTZ) in an attempt to consolidate a Working Group on O & M to strategize the integration of current efforts in this field.

This strategy will allow the development of realistic O & M policies and programmes from existing experience and will lead to the promotion of an adjustment of the balance between the allocation of project resources for construction and for O & M to ensure that facilities operate correctly and continue to function for the benefit of the communities which they are designed to serve.

2.0 BACKGROUND

The necessity of adequate operation and maintenance which will ensure the long term sustainability of water and sanitation investments has become a key concern in the water sector. In 1988 to focus attention on this issue WHO assisted by IRC held a one day informal working session in the Hague with ESA representatives. A working group on operations and maintenance was established with the objective of improving the performance of operations and maintenance and held its first meeting in Geneva February 16 - 17 1989. This meeting was organized by WHO and a list of key issues were identified and a methodology for joint cooperation adopted.

A second meeting of this working group was held in Geneva from June 19-22nd 1990 following a preplanning organizational meeting of sector professionals from GTZ, WASH, IRC, WHO and the WORLD Bank/UNDP project in February 1990 in the Hague. The February 1990 meeting identified major constraints which influence the current situation of O and M in developing countries. It also:

- described the effects of these issues on the effectiveness and efficiency of water and sanitation agencies;
- defined the aims of the proposed coordination of efforts; and
- discussed some of the key issues and activities to be jointly implemented.

The Geneva meeting was attended by some 40 participants from 25 different countries. (Appendix I). The attendees were all water and sanitation sector specialists, involved in operations and maintenance in their respective countries. The objectives of the Geneva meeting were to seek ways and propose concrete initiatives to improve the operation and maintenance of water and sanitation supply facilities in the developing world.

The participants' tasks were to review the key issues and problems resulting in inadequate operation and maintenance, suggest possible solutions and propose activities for implementation by ESA's, national governments and others to enhance operation and maintenance activities.

A background paper reviewing issues and suggesting possible actions and activities was prepared prior to the meeting by Mr. John Kalbermatten. This paper served to focus attention on the more important general concerns in the sector. During the first two days of the workshop a series of case studies were presented from a number of developing couintries describing specific operations and maintenance problems and strategies. These papers illustrated and elaborated many of the ideas expressed in the Kalbermatten document. The final two days of the conference were devoted to discussions by the participants of three major key issues:

1. Sector performance;
2. Institutional performance; and
3. Technology performance and environmental linkages.

The participants divided into three separate discussion groups. Each group identified the major problems associated with one of the three issues and proposed solutions and specific activities to improve operation and maintenance.

This document is a report on the deliberations and conclusions of the Geneva meeting. It reviews the key issues and conclusions reached and presents the specific activities suggested together with the major recommendation of the meeting.

The case studies presented to the workshop have been edited and are available in a companion volume which is obtainable upon request from WHO. These studies describe a variety of operation and maintenance strategies and approaches which are being applied in the developing world.

3.0 ISSUES

The failure of water supply systems once constructed is a serious threat to the provision of water. Generally systems fail because of inadequate operation and maintenance often associated with the employment of inappropriate water system technologies which the government or agency responsible is unable to maintain. Operation and maintenance of water systems in the developing world has been badly neglected and systems have fallen into disrepair. This has resulted in the serious deterioration of assets and the wastage of limited financial resources. In some countries rehabilitation has become, de facto a form of operation and maintenance. External support agencies are unwilling to contribute to on going operations and maintenance but are more agreeable to rehabiliting systems which are non-functioning. The argument is that it is usually more cost effective to rehabilitate a broken down system than build a new one.

Accurate data on the magnitude of systems failure are not available. Obviously the percentages of inoperative systems vary from country to country. In the literature a figure often quoted is 30-40% of systems inoperative at any one time while for individual countries and facilities percentages of 60 and 70 have been reported.

These rates of system breakdown give lie to the gross figures frequently quoted of people served and coverage at national and global levels. The actual numbers of people served are actually much less than those reported based on the number of systems constructed and their purported coverage levels.

A myriad of reasons have been identified as contributing to or causing the failure of water supply systems. These range from poor organizational structures in the responsible agency, lack of spare parts, inappropriate technology, lack of trained staff, tied aid, absence of career opportunities in the O and M sector, insufficient funds, legal framework problems, lack of motivation by sector personel, non-involvement of the users, the low profile of operation and maintenance in the sector in general, inadequate

tariff and collection systems and political interference. These causes tend to be interrelated and intertwined.

The workshop which had the specific objective of identifying and proposing concrete activities to improve operation and maintenance performance concentrated on identifying the main reasons for poor operation and maintenance. Three broad headings: (1) Sector Performance; (2) Institutional Performance; and (3) Technology Performance and Environmental Linkages

were adopted as locii to focus the discussions.

The key issues contributing to the poor operation and maintenance performance of water supply facilities were identified as:

1. Inadequate Data on Operation and Maintenance
2. Insufficient and Inefficient Use of Funds
3. Poor Management of Water Supply Facilities
4. Inappropriate System Design
5. Low Profile of O and M
6. Inadequate Policies, Legal Frameworks and Overlapping Responsibilities
7. Political Interference

3.1 Inadequate Data.

There is an overall lack of data regarding operation and maintenance. Precise, accurate data on the number of systems which are not working throughout the world are needed together with information on the main reasons why. Detailed figures are also necessary to determine how much it costs to undertake an adequate operations and maintenance programme for various types of facilities in different countries.

A number of well managed and maintained water supply systems exist throughout the world. The costs and benefits of adequate operations and maintenance for these systems need to be collected to provide baseline information on how much adequate O and M actually costs.

Data are also required on the rates of breakdown of different systems such as pumping stations, distribution networks, treatment plants in urban systems, small gravity systems, and diesel motor pumping systems.

Until this information is forthcoming it will be impossible to accurately assess the overall performance of the operation and maintenance subsector and compute the financial losses due to poor operation and maintenance. These exact financial data are urgently needed to demonstrate to decision makers the advisability of implementing good operation and maintenance programmes in order to reduce losses to national economies.

3.2 Insufficient and Inefficient Use of Funds

Insufficient funding has been identified as a major contributor to poor operations and maintenance performance. This lack of funds hampers the operating and maintaining of water supply facilities as money is not available to buy spare parts, properly train staff and provide competitive salaries to attract high calibre personel. External support agencies have traditionally been reluctant to finance operation and maintenance activities while national governments have often given it a low priority. National governments are frequently stressed for cash, especially hard currency which is needed to pay for spare parts and the water supply agencies usually lose out to other, judged more important higher profile sectors.

The users are a potential source of finance for water supply systems. They are often unable or unwilling to pay. Usually it is that they are unwilling to pay rather than unable to. Evidence is mounting that even in the poorest and most underprivileged segments of the community people are willing to pay for a reliable, adequate supply of clean water but unwilling to be charged for an unreliable and unsatisfactory service. It is a vicious cycle. As the service level drops due to a lack of operation and maintenance the users withhold support and become less willing to pay which further constrains operation and maintenance activities.

Sometimes it is the inefficient use of funds rather than a lack of money which contributes to poor operations and maintenance. The poor management of facilities results in the squandering of resources which then reduces the viability of the water supply system. Those responsible for managing water supply facilities need to look carefully at their operations to ensure that they are operating efficiently. Common problems are too often many unskilled staff and poor logistical and organizational structures.

Losses of revenue from unaccounted for water are a problem for most systems. It is difficult to define what is an acceptable level for unaccounted for water. A figure of 25% may be appropriate as a first target for an agency working at unaccounted for water levels of 50%, but significantly lower levels can and should be achieved. What is an acceptable level of unaccounted for water has to be determined on the basis of local conditions, but true wastage should not be significantly above 10% once illegal connections, free supplies, and leakage are reduced to acceptable levels and adequate metering, billing and collections procedures are maintained. High rates of unaccounted for water, whether they are caused by illegal connections, leakage, free water supply, or the result of inadequate commercial operations, result in significant financial losses and consequent poor service performance of the agency.

3.3 Management of Water Supply Systems

The operation and maintenance of water supply facilities throughout the world is undertaken by a wide range of differently structured agencies. These range from community owned and operated water supply systems at one extreme to government owned and operated utility companies at the other. Some agencies are very small and may only be responsible for the supply to a small rural village using a low cost technology while other agencies may be controlling a utility employing thousands of staff and operating a high technology system.

However, no matter what the scale of the facility, the system will perform poorly if it is not managed efficiently and well.

Typical management-problems include:

- inefficient organizational structures;
- absence of career structures for staff;
- low salaries; and
- poor relationships between the users and management.

The inefficient organization of many water supply agencies is a serious deficiency. If the organizational structure does not promote and allow efficient operation then the overall management will function poorly.

Personel problems are another reason for poor management performance. Low salaries, absence of career structures, lack of trained personel and the low profile of operation and maintenance as compared to new construction are all constraints. Some of these can be traced to a lack of sufficient funds in the agency but often they are the result of inadequate management.

The absence of transparent management and accountability to the users is another major issue. Often the customers are not involved in the water supply agency and there is no feedback from the consumers to the management of the utility. This is particularly acute in government owned and operated agencies which tend to be bureaucratic. This non involvement of the users in the management of the agency results in stress and in some cases the development of a confrontational relationship between the agency and the consumers. Studies of well run water supply agencies have shown that good customer relations and a sense of management responsiblity to the users are common denominations in these organizations; contributing to their overall success.

One of the lessons of the International Drinking Water Supply and Sanitation Decade has been the recognition that the user needs to play an important role in the development, implementation and operation of the facilities if the intended service is to be sustainable over the long term. This role varies according to local conditions. In rural and periurban projects, the user is likely to be intimately involved in the

process and may assume planning, construction and, at a minimum, operating functions. In urban systems, his role may be that of an informed customer with opportunities to participate limited principally to commenting on agency proposals, because the technical complexity of sophisticated urban systems are not suitable for "hands-on" participation.

User participation must begin with the design stage, e.g. the intended user must determine what he is willing and able to pay for. Subsequently, management and operation of the agency must convince the user that he receives full value for the payment he makes. The means of doing so, other than providing good service, vary again with the local conditions and range from direct participation in the management by the user through boards or committees in rural and periurban organizations to public meetings, consultations and other participatory activities in the case of organizations serving urban areas."

3.4 Inappropriate System Design

No matter how good the management of a water supply facility is, if it is not well designed technically, it will operate inefficiently. Many water supply facilities have been badly designed, poorly constructed and use technologies which are inappropriate. When a facility is improperly designed and constructed even with the best will in the world it cannot perform satisfactorily.

There are many reasons for poor systems design. In some instances consultants are chosen by ESA's who are not familiar with suitable technologies for use in the developing world and specify equipment and/or designs which are inappropriate. In other cases, there may be political interference to promote one particular technology or equipment supplier and they may not represent the optimum choice for that particular situation.

A lack of communication between the system designer and the operators of the system is a further drawback. This applies equally to a rural village receiving a handpump well to an urban centre with complex facilities. The operators of the system need to be familiar with, approve of and be comfortable

with the technology. In addition there needs to be a continuous feedback of information from the operators to the designers to pinpoint problems with the design and suggest remedial measures.

3.5 Low Profile of Operation and Maintenance

Operation and maintenance in water supply agencies has a low, and usually an inferior profile as compared to new construction and system extension. Thus for career minded engineers the route to top management positions is recognized to be through new construction and not operation and maintenance.

The emphasis on and recognition given to new construction is partly due to its political visibility. The provision of a water supply to many developing world communities is a vote winning exercise while good operation and maintenance receives few political accolades.

Within the water sector there is an insufficient appreciation of the magnitude of operation and maintenance problems, importance and the skills required to properly operate and maintain the facilities. In part this is due to a lack of financial data. Accurate costs are not available which will demonstrate to decision makers the financial benefits of good operations and maintenance and conversely the losses to the national economy from poor operations and maintenance. An urgent priority in operations and maintenance is to collect precise figures which clearly show the financial benefits of operations and maintenance to decision makers in ESA's and national governments.

This low priority assigned to operation and maintenance by decision makers is a severe constraint. In order to improve operations and maintenance performance it must be accorded a high priority and importance by national governments in their programmes.

3.6 Inadequate Policies, Legal Frameworks and Overlapping Responsibilities

There is a need for clear sector policies, compatible legal frameworks and a clear division of responsibilities and mandates within the water and sanitation subsector. Due in part to the low priority assigned to operation and maintenance, no clearly defined policies have been enunciated which adequately address this issue. Commonly the lines of responsibility between the various organizations involved are

often blurred. This is particularly true of the relations between water supply and sanitation where the maintenance agencies usually have no or limited contact.

The policies of ESA's with reference to operation and maintenance are frequently different and may be at variance with the approaches of national governments. National governments and ESA's should collaborate and coordinate their approaches in order to achieve higher levels of performance for O and M.

3.7 Political Interference

Political interference has been identified as a serious contributing reason for poor operations and maintenance. This is most noticeable in countries where the government is directly involved in owning, operating and maintaining the water supply facilities. Political interference manifests itself in several ways. In some countries for political reasons water is free. This decision not to charge for water makes it difficult to run a self financing viable system, even if government provides funding. When governments are short of cash, often it is the water supply facilities which are soft targets and experience the greatest budget cuts.

Political interference is often evident in the choice of technologies. Government officials may for one reason or another support the purchase of a particular technology or system which may not be the best or most appropriate selection. Equipment suppliers and ESA's frequently hinder the wise choice of a technology by lobbying politicians or through restrictive policies of tied aid.

The contracts awarded for building even small rural water supply facilities are significant and there is considerable competition between contractors to be selected. In some cases the job may be awarded for political reasons rather than on the basis of performance with the result that the completed facilities may be shoddily constructed.

The working group concluded that a precondition for the better management of water supply facilities was to devolve the responsiblity of managing systems from government to autonomous agencies which will manage the facilities under technical, financial and administrative guidelines from the government.

This would greatly limit the extent of political interference by governments and allow the facilities to be managed according to efficient business practices.

4.0 PRINCIPLES AND ACTIVITIES

The overall goal of the Geneva meeting was to develop a realizable number of concrete proposals for activities which could be undertaken and would lead to an improvement in the operations and maintenance of water supply facilities.

The participants focussed on identifying the key issues which constrain operations and maintenance performance and developed a priority set of specific activities to address these.

The activities proposed are designed primarily to be implemented by ESA's and national governments. The importance of involving the community was recognized but it was felt that the role of the ESA's and national governments should be accorded greater importance in this initial phase of a programme. Greater attention can be directed to the role and involvement of the users and user communities in subsequent stages.

The working group also established a number of overriding principles which should be incorporated into this new philosophy on operation and maintenance.

4.1 Principles.

Four overriding principles for operation and maintenance were adopted:

1. The group recognizes that the provision of water is a service which requires a service orientated attitude by the agencies involved. To ensure long term sustainability water should be managed as a commodity in exactly the same way as any other resource. Its use and exploitation should be on a financially sound and cost effective basis subject to the same legal and regulatory controls as other resources to ensure its conservation, protection and wise utilization.
2. The supply of water to consumers should normally be based on the principle of effective demand which can be defined as the standard of service that the users are willing to maintain, operate and finance to ensure adequate public health standards. The effective demand has to satisfy the priorities of the community at large.

3. Water systems should be managed and operated following the principles of good business practices. The form of management will vary depending on the local situation; ie. rural, urban, semi-urban, location, demographic structures etc. The responsible agency will be autonomous from government but manage the system under technical, financial and administrative guidelines set by national governments. The agency will be transparent and full accountable to its consumers.
4. Sanitation is recognized as an undervalued item in the sector and emphasis is required for sanitation development and for forging closer links between water supply and environmental sanitation (solid and liquid waste management) in the planning of new programmes.

The group, however also recognizes the legitimate concerns of government to satisfy the basic needs of the disadvantaged segments of the population. Governments may require agencies to provide service at lifeline tariffs for such groups or institute temporary subsidies to promote public health and economic development.

4.2 Activities.

The working group proposes that the following activities be implemented at global and national levels to improve operation and maintenance performance.

The activities are grouped under four main headings reflecting the priority issues identified:

Enhance Profile of Operation and Maintenance at Global and National Levels

Management Improvement

Data Collection and Operation and Maintenance Monitoring

Policy Formulation; Collaboration and Coordination

4.2.1 Enhance Profile of Operation and Maintenance

1. Preparation of a global position paper on Operation and Maintenance directed at decision makers in national governments and ESA's to promote giving the highest priority in the sector to operation and maintenance at both international and national levels.

2. Promotion of an awareness raising campaign on Operation and Maintenance at national levels through workshops, seminars and conferences.
3. Hosting of workshops at a national level to promote the maximum exchange of information on specific aspects of operation and maintenance and to develop strategies to improve operation and maintenance performance.
4. Promotion of a higher profile for operation and maintenance to professional associations, training establishments and other organizations through guidelines, workshops, seminars and conferences.
5. Preparation of guidelines for issue by ESA's to engineers preparing systems to encourage the inclusion of operation and maintenance concerns in systems designs.

4.2.2 Management Improvement

1. At the global level to promote viable autonomous agencies which range at one extreme from a community based rural organization through to urban utilities to manage water and sanitation systems on a fully self financing basis for operation and maintenance.
2. To encourage ESA's and national governments to support the strengthening of agencies to enhance their ability to sustain adequate operation and maintenance activities.

4.2.3 Data Collection and Monitoring

1. Develop and implement monitoring systems for operation and maintenance costs and performance at the national level.
2. Implement programmes at the global and national government levels to systematically collect financial and performance data on operation and maintenance based on standard guidelines.
3. International methodologies for the establishment of performance indicators should be developed and existing WHO guidelines on evaluation should be reviewed to determine if they properly reflect requirements for adequate operations and maintenance.

4. To institute at the global level a programme to accurately determine the costs of adequately operating and maintaining various types of water and sanitation systems.
5. Studies should be initiated to determine the extent of cost saving and/or improvements to efficiency that will result from improved operations and maintenance and the use of locally or regionally manufactured spare parts. These studies could be funded possibly by ESA's and may necessitate the rehabilitation of facilities before improved operations and maintenance methods can be applied.

The working group suggests that ESA's should assist with these data collection and monitoring programmes and facilitate the exchange of cost and performance data, especially technology performance between countries. ESA's should also play a major role in ensuring feedback of information from the monitoring and evaluation of technologies to the system designers.

4.2.4 Policy Formulation, Collaboration and Coordination

1. A review of ESA sector policy documents should be undertaken and a set of policy guidelines established that adequately address the operation and maintenance issue.
2. A review of national government sector policies and practices on operation and maintenance should be carried out and national government policies and legal frameworks established. These should ensure that operation and maintenance concerns are included in the project design right from the projects' initiation.
3. Legislation should be enacted to restrict the discharge of pollutants and to restrict the use of materials that would cause operation and maintenance problems.
4. A forum should be established to encourage the collaboration and coordination of ESA's and national governments at the country level in order to achieve common policies, unified approaches, compatible technologies and standardized equipment within the framework of national policies.

5.0 Recommendations

The present working group on operations and maintenance operates on an ad hoc basis and its lifetime is therefore limited. There was unanimous recognition by the meeting of the need for an international institution to act as a focal point and forum to promote, coordinate and strengthen operation and maintenance concerns.

The working group recommends that WHO with the support and collaboration of the other UN agencies, national governments and ESA's is the appropriate institution. It is further recommended that ESA's assist and support WHO through their participation in a professional advisory group to undertake these activities in the coming decade.

This advisory group should have a close link to the Collaborative Council of External Support Agencies.

APPENDIX 4

from IRC (1987)
Maintenance Systems for RWS

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Table 1: Summary of maintenance problems in existing rural water supply systems

Dug wells without hand pumps

- poor construction resulting in collapsing of well lining
- insufficient recharge due to clogging or insufficient depth
- formal responsibility for maintenance and repair not defined because it is often not envisaged

Drilled wells with hand pumps

- poor borehole construction resulting in sand intrusion in the well
- inadequate pump selection
- lack of preventive maintenance
- lack of repair capacities and spare parts particularly in the long run
- poor organizational structure
- no revenue collection

Piped gravity systems with public standposts

- insufficient spring protection
- poor quality control and adequate construction leading to leaking spring boxes, pipes and reservoirs
- insufficient monitoring and control
- maintenance organizations not legally established
- inadequate revenue collection systems

Pumped schemes with diesel or electric pumps

- unsecure fuel supply
- intermittent power supply
- variation in power output of electrical system
- inadequate institutional structures
- lack of preventive maintenance and monitoring
- lack of spare parts and repair capacity
- inadequate revenue collection systems

APPENDIX 5

TABLE A.8 - GLOBAL 1990
RANKING AND FREQUENCY OF CONSTRAINTS [a]

Constraints	No. of countries indicating constraint			Ranking index [b]
	Very severe	Severe	Moderate	
Funding limitations	33	32	13	176
Operation and maintenance	21	40	13	156
Inadequate cost-recovery framework	22	32	16	146
Insufficiency of trained personnel (professional)	19	27	23	134
Logistics	17	29	21	130
Insufficiency of trained personnel (sub-professional)	14	29	28	128
Intermittent water service	12	22	25	105
Inadequate or outmoded legal framework	6	23	35	99
Inappropriate institutional framework	8	19	36	98
Insufficient health education efforts	6	23	32	96
Inadequate water resources	10	11	40	92
Insufficient knowledge of water resources	4	16	43	87
Lack of definite government policy for sector	8	8	47	87
Non-involvement of communities	6	14	39	85
Lack of planning and design criteria	1	19	41	82
Inappropriate technology	3	15	40	79
Import restrictions	5	9	36	69

(a) Number of reporting countries = 95

(b) Ranking index = (No. very severe x 3) + (No. severe x 2) + (No. moderate x 1).

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Decade Review

TABLE 1.8 - AFRICAN REGION 1990
RANKING AND FREQUENCY OF CONSTRAINTS [a]

Constraints	No. of countries indicating constraint: Very severe	Severe	Ranking moderate	Index [b]
Funding limitations	11	7	5	52
Logistics	11	7	2	49
Inadequate cost-recovery framework	8	10	2	46
Operation and maintenance	6	12	4	46
Insufficiency of trained personnel (professional)	5	10	6	41
Insufficiency of trained personnel (sub-professional)	4	7	10	36
Insufficient health education efforts	2	10	8	34
Inadequate or outmoded legal framework	4	7	6	32
Intermittent water service	5	5	5	30
Non-involvement of communities	1	7	12	29
Inappropriate institutional framework	3	4	11	28
Insufficient knowledge of water resources	3	4	10	27
Lack of definite government policy for sector	4	-	14	26
Inappropriate technology	2	4	12	26
Lack of planning and design criteria	1	5	12	25
Import restrictions	2	2	11	21
Inadequate water resources	2	-	12	18
Insufficient quality control mechanisms. (Uganda)	1	-	-	3
Political/Military instability. (Angola)	1	-	-	3
Lack of inter-ministerial coordination. (Zaire)	-	1	-	2

[a] Number of reporting countries 26

[b] Ranking index = 3 x (No. very severe) + 2 x (No. severe) + (No. moderate)

APPENDIX 6

Results of O&M Working Group (June 1990)

Priority Issues (Results)	*Proposed Activities*
ENHANCE PROFILE O&M	Prepare position paper on O&M directed at decision makers to promote giving highest priority. Awareness raising through workshops, seminars and conferences To enhance information on specific aspects of O&M and to develop strategies to improve O&M performance. Prepare guidelines to engineers preparing systems to encourage the inclusion of O&M concerns in system designs.
MANAGEMENT IMPROVEMENT	Promote viable autonomous agencies ranging from community-based rural organizations to urban water supply and sewerage organizations, which would operate systems on a fully self-financing basis. Encourage ESA's and national governments to support the strengthening of agencies to enhance their ability to sustain adequate O&M activities
DATA COLLECTION AND MONITORING SYSTEM DEVELOPMENT	Monitoring O&M costs and O&M performance. Establish performance indicators Determine cost savings resulting from improved O&M.
POLICY FORMULATION, COLLABORATION AND COORDINATION	Review policies and evolve policy guidelines and legal frameworks to ensure that O&M concerns are included at initial stages. To establish forum to achieve collaboration and coordination.

APPENDIX 7

from WHO (1990) Proceedings of the meeting of O&M Working Group Vol 2

7

TOWARDS IMPROVED OPERATIONS AND MAINTENANCE PERFORMANCE

J. Kalbermatten
Washington, D.C.

Introduction

During the International Drinking Water Supply and Sanitation Decade, major efforts have been made in attempts to increase investments in Water Supply and Sanitation. Regrettably, investments in increasing operating and maintenance skills have not kept pace. As a consequence, many water systems are not providing the full services they were designed to deliver and the backlog of rehabilitation needs grows year by year.

Operation and maintenance (O & M) is the activity of a water supply and sanitation agency which has the most immediate impact on the user, the value of the service he receives, and his perception of it. Operation and Maintenance should therefore have the highest priority among an agency's activities. Unfortunately, Operation and Maintenance is rarely so regarded by organizations with a backlog of unmet demand (unserved areas). Both the institutions and the decisionmakers in External Support Agencies and governments are under considerable pressure to give priority to extensions and new construction. To make things worse, Operation and Maintenance is so intimately connected to sector and institutional issues that it would be difficult, at best to improve it without an understanding of those larger issues and at least their partial resolution. Moreover, the implementation of Operation and Maintenance programmes should be considered as a priority stage in the process of the institutional development of water agencies.

This paper reviews the broader sector and institutional issues to place Operation and Maintenance in proper perspective and suggests minimum actions and activities to improve Operation and Maintenance. The method of analysis followed is to identify and briefly review an issue, to indicate what action by sector and agency decisionmakers (or External Support Agencies) is required and to suggest activities to assist decisionmakers in the promotion and implementation of Operation and Maintenance

improvements. The information generated should convince decision makers of the priority Operation and Maintenance should have for the achievement of long-term sustainability and thus the economic viability of the sector.

Sector Performance

Inadequate maintenance is a symptom of faulty priorities and lack of understanding of the importance of good operating and maintenance practices by decisionmakers inside and outside the sector as much as it is a problem of inadequate funds or lack of skills. Decisionmakers must be convinced of the benefits of good maintenance before they authorize the allocation of funds and give higher priority to Operation and Maintenance.

To convince decision makers, the cost and benefits of adequate maintenance as well as the costs and disbenefits of inadequate maintenance must be clearly demonstrated. The situation is similar to the often referred to reluctance of economic decisionmakers to accept health improvement claims of water supply projects without a quantification of benefits. Decision-makers must be given quantitative evidence in order to provide financial support, for Operation and Maintenance just as for health improvements. One topic which can be used to demonstrate the costs, benefits and disbenefits of different levels of Operation and Maintenance activities is unaccounted for water. Reduction in unaccounted for water through better Operation and Maintenance increases revenues, reduces rehabilitation costs and postpones future investments, issues decisionmakers in both External Support Agencies and governments appreciate.

Fortunately, it should be easier to produce the evidence in the case of Operation and Maintenance, although with some difficulties caused by the dispersed character of the sector. Unlike electric energy, which can be transported over great distances and thus is usually supplied by enterprises serving large geographic areas, water supply agencies are relatively small in comparison or consist of a large number of individual units. Exchange of experience and information is consequently more difficult and often neglected, leaving individual units unaware of progress made elsewhere. Training, management,

provision of supplies, applied research and development suffer similarly from this dispersion of the sector, particularly in rural areas. Obtaining information on Operation and Maintenance performance, costs and benefits will therefore be an arduous task.

In order to address this situation, government and sector decisionmakers should establish policies giving maintenance adequate priority at all levels of project development, implementation and operation. Specific activities which might be undertaken include undertaking a study of pertinent literature and documentation and preparing a report directed at decisionmakers which:

- Defines adequate Operation and Maintenance performance and quantifies its costs and benefits (for different system components or technologies) on the basis of information available from well managed and maintained water supply systems.
- Quantifies disbenefits of inadequate Operation and Maintenance performance for similar systems, such as early replacement of assets inoperative due to lack of maintenance, on the basis of actual experience.
- Provides a cost-benefit analysis to justify increased support for Operation and Maintenance activities.
- Suggests policies establishing financial support and priority of Operation and Maintenance programmes.

Included in this analysis could be such topics as rehabilitation vs. new construction, maintenance vs. planned obsolescence and similar issues.

Funding of Operation and Maintenance

Inadequacy of maintenance funding is usually assumed to be the cause when systems fail because the operating entity was unable to buy materials or engage a sufficient number of adequately trained staff. Unfortunately, that only answers the question of what is inadequate but leaves unanswered

what amount of funds would be required for adequate maintenance. To budget adequate financial resources, that question must be answered.

With financial requirements known, policy decisions on how to generate necessary funds can be established. To be sustainable over the long term, the user should be able to pay for maintenance or be capable of undertaking the maintenance tasks himself. This is so because governments and External Support Agencies have no direct interest or responsibility in Operation and Maintenance (in contrast to the user), have changing priorities, and thus should not be depended upon as sources for Operation and Maintenance funds except during a short term period of transition.

To optimize investment and resource recovery potential for Operation and Maintenance, projects should be designed for "effective demand", i.e. the user's choice of system or technology based on his own judgement of acceptability, willingness and ability to pay (in case or in kind). Design for effective demand requires the project developer to work with the user community. This often results in an iterative process to find the solutions which are acceptable and affordable. The intensity of community participation varies greatly, reflecting the likely technical option. For complex urban systems, users may be asked to approve the broad concept only, while in small communities, periurban and rural areas the user may participate in decisions about layout, technology choice and financing.

Government and sector decisionmakers, including those of External Support Agencies, should include in their cost recovery policies the requirement that long-term sustainability of investments must be achieved and that in an effort to do so, projects should be designed on the basis of effective demand, should specifically assess Operation and Maintenance requirements, and provide for agency, community or user capacity to undertake or finance Operation and Maintenance.

To help provide decisionmakers with the information necessary to determine the financial requirements of the proposed cost recovery policy, a study should be initiated which analysis the financial requirements for Operation and Maintenance or develops a methodology or a model on how to determine

financial requirements for Operation and Maintenance for individual projects. The research should also compile a matrix relating investment and Operation and Maintenance costs for different systems or technologies and describe maintenance needs of technologies listed in the matrix.

ESA Support

External Support Agency (ESA) support has to be based on the recognition that governments are responsible for determining sector policies and priorities and that, ultimately, users must sustain the services they choose to receive. External Support Agencies, in assisting governments and users, can make significant contributions in accelerating progress of the sector, not only by making funds available but by providing advice and information on policy issues, assistance in policy and guideline formulation and support through adopting appropriate policies themselves.

For example, External Support Agencies should give preference to financing projects designed on the basis of effective demand and encourage cost recovery policies which require the user to be ultimately responsible for Operation and Maintenance (in kind or cash), even if this requires a relaxation of procurement rules (tied aid), if their application would result in the use of "inappropriate" technology or equipment.

This imposes on External Support Agencies the responsibility to ensure its staff evaluates projects in accordance with these principles and that the consultants they fund for project preparation are skilled in designing projects for effective demand.

External Support Agencies should also encourage their clients to make better use of management information systems designed (among other things) to provide the data necessary to determine the cost of Operation and Maintenance and its impact in order to be better able to judge the adequacy of Operation and Maintenance. The system should include appropriate indicators for the monitoring and evaluation of Operation and Maintenance and arrangements for feedback to system designers so lessons learned will be incorporated in future designs. External Support Agencies should review their policies to

ascertain that they are compatible with the objectives of effective demand design and long-term sustainability through the users own efforts. If necessary, existing guidelines should be adapted. Subsequently, their consistent application should be ensured on projects financed with ESA financial support. There are several specific activities which ESAs could undertake. These include the preparation, for their own use and that of developing country agencies they support of:

- Guidelines and training materials on how to develop and implement projects designed on the basis of effective demand. These guidelines would be for ESA and sector agency staff and their consultants and could be adapted by individual External Support Agencies to meet specific demands.
- Guidelines and indicators for the monitoring and evaluation of Operation and Maintenance performance.

Individual External Support Agencies should define how they will provide feedback to designers about the performance of their designs to ensure that necessary improvements will be made in future designs. The "lessons learned" feedback process should be automatic.

The preparation of the guidelines should be followed by appropriate training of ESA and sector staff and their consultants.

Appropriate Use of Technology

To be appropriate, technology must be least cost, financially affordable and socioculturally acceptable to the user. Where there is any doubt that this definition refers to both investment and operation, additional phrasing such as "and maintainable by the user either through his own labor or by payment to a public or private operating enterprise" may be added. Projects designed in accordance with the principles of effective demand meet these conditions.

This approach not only allows the user to decide what he is able and willing to pay, but it requires the designer to base his designs on cost and/or ease of maintenance of the technology selected. Experience shows that it cannot be simply assumed that needed operators will eventually be trained. It

also means that the operators (users or operating agency employees) need to be consulted in the design process.

Sufficient information is available about appropriate technologies for this process of consultation except on the topic of maintenance, particularly its cost. External Support Agencies and developing countries should agree that the appropriate use of technology as described above is a fundamental requirement in the development of joint projects. To ensure implementation, projects are to be designed on the basis of effective demand, i.e. giving the user a voice in defining what is acceptable and affordable to him. Project design is to explicitly consider the ability of the user to maintain the constructed facilities or pay for their Operation and Maintenance. If necessary, policies and guidelines should be amended to reflect this requirement.

To avoid problems of past project development when initial costs only were considered and insufficient attention was paid to the complexity or cost of Operation and Maintenance (particularly when hardware was made available at concessionary terms), the guidelines developed by External Support Agencies for staff and consultants should include specific instructions on the evaluation of Operation and Maintenance appropriateness. These should be made available to implementing agencies.

System Performance

Even a system using appropriate technology may perform poorly if design was inadequate, construction shoddy or using faulty construction techniques, materials were of inadequate quality or inappropriate to local conditions. Participation in the construction supervision by those who will operate the system helps overcome the problem.

The use of materials not locally or in country available, such as treatment chemicals, can result in performance defects even with the best Operation and Maintenance staff and procedures if foreign currency is not available to the operating agency. The same is true for spare parts not locally available. Design can minimize this problem, of course.

Poor system performance can also be caused by events not under the control of the operating agency. For example, upstream water pollution may exceed treatment capacity, diversion of scarce water resources (illegal or legal) for other purposes may cause severe supply deficiencies, regardless of operating skills.

In periurban and rural areas, operational responsibilities are at times ill defined and can also result in neglect of Operation and Maintenance activities. Coordination arrangements with other institutions, especially where community participation is an important factor and hygiene education a need, is a must if long-term sustainability is to be achieved.

Implementation of quality control monitoring for manufactured goods and construction, followed by corrective action, is important. The promotion of local production of necessary equipment and material and the use of adequate chemicals or disinfectants locally produced should be encouraged. However, where these locally produced materials, including chemicals, are not suitable their substitution for improved materials should be encouraged (development of better products or purchasing of imported materials).

Strengthening collaboration with other agencies in an effort to overcome water pollution and scarcity problems should be an integral part of water supply management in an effort to overcome related Operation and Maintenance problems. National governments should also issue appropriate guidelines and directives to implement quality control, promote local manufacturing and ensure adequate interagency cooperation.

A review should be undertaken in selected countries to determine the adverse impact on projects dependence of materials not locally available and the effect the lack of adequate spare parts distribution has on system performance. This should lead to conclusions as to what substitutions would be possible, and what design changes in future projects may make such substitution easier to implement. Appropriate

design guidelines could then be developed to encourage the engineer to investigate materials availability prior to design and to select process modifications to reduce Operation and Maintenance problems.

Based on the results of the review, a study should be conducted in appropriate countries to determine the feasibility of establishing local manufacturing of equipment, spare parts, materials and chemicals (or substitutes). Subsequent establishment of manufacturing capacity could be part of a water supply investment or a separate project.

Also guidelines on how to determine the feasibility of and promote local manufacturing of spare parts and materials should be developed from these studies in an effort to solve related Operation and Maintenance problems for the long term in other countries.

Institutional Performance

A properly designed and implemented water supply system provided with adequate financial resources depends for its long-term sustainability on the institution in charge of its management. Indeed, inadequate Operation and Maintenance is tied to many institutional problems, most of which are not amenable to corrections without major institutional changes. Clearly, those exceed the capacity of Operation and Maintenance units to modify. The following recommendations address those issues which can be at least partially improved by the operating institution for the benefit of Operation and Maintenance.

Systems will invariably fail as long as the institutional environment concentrates on expansion and neglects Operation and Maintenance. Governments and institutions should recognize that the fundamental purpose of an operating organization is to operate, not to build. That is obvious to a "mature" organization, where capital expansion is a relatively small part of activities. Until developing countries' organizations behave as operators rather than builders, they will forever be building because their neglect of maintenance will require them to rebuild deteriorated assets. Funding allocation between

new construction and rehabilitation and maintenance therefore needs to be reconsidered, and organizational arrangements changed to reflect higher priority for Operation and Maintenance.

The traditional public utility arrangement frequently is not effective for periurban and rural areas where community participation is an essential ingredient of successful project development and Operation and Maintenance. The institution must become multidisciplinary, employ behavioral scientists and public health specialists to work with the users, and establish, as part of its own organization or separately, support structures to help the community with tasks of a technical nature it cannot accomplish by itself alone. A multidisciplinary team will also be in a better position to work with other institutions to arrange for corollary activities, for example the hygiene education of the users by the ministry of health.

The participation of the user in the design and implementation process, and his responsibility for Operation and Maintenance, requires the operating agency to pay much closer attention to monitoring and evaluating the performance and impact of the project so lessons learned can be incorporated into future designs. The planning process is no longer one of developing a masterplan with a first stage project for those who can afford a given service standard (technology), but one of preparing a dynamic plan responsive to user preference, i.e. various standards depending on affordability and willingness to pay. Because they change over time, monitoring will indicate needed changes and provide lessons for future project design.

The role of the private sector in the provision of support services to the community, particularly in Operation and Maintenance, should be considered. Private entrepreneurs are often the supplier of last resort when water is not communally available, usually at high marginal costs. However, entrepreneurs may be able to provide repair and maintenance service more quickly and at lower cost than a centralized institution, especially in periurban and rural areas. Specific tasks, such as computerized billing, leak detection, treatment plant operation, etc. may also be candidates for contracting to the private sector in

an effort to make the service more efficient and less expensive in urban areas. The engagement of the private sector in Operation and Maintenance should be carefully considered in the context of an institutional development process, without losing the perspective of the need to ensure the sustainability of this process.

In most developing country institutions, the way to a successful career is through design and construction activities, not by being an excellent Operation and Maintenance manager. Not only do Operation and Maintenance activities suffer from this, but future projects do not reflect operating experience. To change this, institutions should establish career-paths for operating personnel which are as attractive as those of design and construction staff to encourage talented young staff to consider operations as an option. The chief of operations position should be on a level equal to that of the capital works or chief engineer, with veto power over new project designs. No senior staff appointments should be made of candidates who do not have experience in both operations and design/construction. Training activities should reflect this approach.

The organizational structure of the traditional centralized institution has to be modified to make it more responsive to the needs of the periurban and rural population. Whether this adjustment will be essentially a reorganization of an existing institution or the creation of new agencies will depend on local conditions and government policies for the sector. In either case, an institutional structure has to be implemented which is designed to support local communities and users in their own efforts to develop, implement, operate and maintain systems in periurban and rural areas where the traditional centralized operations have been largely unsuccessful.

Privatizing can be interpreted to imply anything from contracting for minor services to complete private control of the provision of water supply services. In this context it means contracting for specific services, complete privatizing being beyond Operation and Maintenance purview. Appropriate policies

should be enacted to give an agency the opportunity to contract for specific services if they prove to be efficient.

Suggested activities which could be undertaken by ESA's and or national governments to improve institutional performance are:

- To study organizational structure and personnel policies of the Operation and Maintenance complex (and its status within the organization) of successful developing and developed country operating organizations and develop models for implementation by other organizations. Included in the analysis and the model should be an assessment of the cost of modifying the organizational structure.

- To investigate alternative arrangements of organizing water and sanitation support structures, capable of working with the community and the user in Operation and Maintenance, suitable for periurban and rural areas and recommend, if deemed necessary, testing and demonstrating appropriate models. Particular emphasis should be paid to the needed relationship between centralized urban utilities and local community organizations serving periurban neighborhoods. In the rural areas, attention needs to be paid to spare parts distribution. Because Operation and Maintenance cannot be entirely separated from other institutional considerations, this study should include overall institutional aspects. It should therefore preferably be based on or included in institutional improvement projects.

- To determine the cost of specific unidentifiable tasks, such as meter reading and billing, maintenance of treatment plants or isolated rural facilities, network of spare parts provision, technical assistance to community organizations, and evaluate whether services of private entrepreneurs or nongovernment volunteer organizations would be less expensive, more responsive or more efficient. If private provision of such services is found to be more effective, appropriate policies and contracting procedures should be developed to encouraged privatizing of these services.

User Participation

The traditional engineering approach is to identify a problem, design a solution, construct the resultant project, and leave Operation and Maintenance considerations to local authorities. With the effective demand based design method, this is no longer adequate, except in the case of complex urban projects. Now the user, individually and as part of a community, participates in the decisionmaking process, beginning with project identification through all the intermediary steps ending with the decision as to how the system is to be operated and by whom. As a consequence, the responsible institution must equip itself to work with the community, both by adapting its structure and by engaging appropriately qualified staff.

In the rural and periurban area, community participation will probably be intense as a general rule. In central urban areas, community participation will probably involve traditional public utility marketing practices, supplemented by more intense efforts at convincing consumers to conserve water through modifying personal habits and the use of water saving appliances. This is because the standard of service in densely populated areas is not amenable to individual choice (economies of scale determine technology to be used) and other decisions, method of water treatment for example, require expertise users ordinarily do not possess.

User participation in project design is important not only because it allows a determination of willingness to pay, but it permits the user to determine his involvement in Operation and Maintenance activities. Without it, there is no reason to expect user involvement in Operation and Maintenance. User participation also has to include an appropriate degree of hygiene education to be successful: the user must understand the health aspects of safe water, technology selection and personal hygiene behavior. For example, the user needs to understand and practice the protection of water quality within the household (and while carrying water to it) to benefit from improved water quality and to maintain the facility which provides it.

Community participation is recognized to be the key to long-term sustainability of water supply and sanitation facilities in periurban and rural areas. How to organize and maintain user interest, and how to help user in their tasks of operating and maintaining systems is well known among behavioral scientist field staff and community workers. The problem is that traditional public utility staff, in keeping with institutional priorities, have little interest or incentive to promote community participation. Overcoming this problem requires an intensive effort of education, preferably in parallel with such institutional changes as are necessary. Documentation for such an educational effort should be assembled and prepared to suit the needs of the audience. This should not lead to a belief that education alone will be sufficient. Institutional attitude and organizational modifications are necessary, and staff qualified in community participation and user education have to be engaged to complement institutional technical staff who, however willing, will not acquire overnight the necessary skills to implement projects based on community participation.

Institutions have to organize staff units capable of working with the community in improving Operation and Maintenance. The training of present staff is essential and it may be necessary to engage additional staff (community workers).

In order to improve the participation of the consumers in operation and maintenance national governments and project staff should review available user and community training materials, identify gaps and prepare missing documentation. Gaps are likely to be found mostly in the documentation for training/sensitizing of institution staff. Institutions should also be prepared to assist in the preparation and implementation of the necessary training activities. Again, the greater need is probably in the training of institution staff because in the past community work has been primarily undertaken by volunteer organizations.

Summary and Conclusion

There is an urgent need to promote adequate Operation and Maintenance of water supply systems so more people can be served on a sustained basis. It is in the interest of operating agencies to properly maintain their systems so they can successfully provide the services expected and attract additional funds for system expansion. It is of equal interest to External Support Agencies and Governments to ensure that the systems they have helped finance are properly maintained: a) to protect their investment, because without it does not make sense to continue investing in the sector and: b) a malfunctioning system does not contribute to economic development.

A cooperative effort between national governments and External Support Agencies is required as there is a need to agree on the importance and the methods of improving Operation and Maintenance performance. Actions can be implemented individually, but a general agreement on how to proceed is necessary to make efforts more effective.

Finally, exchange of information on cost, methods and benefits of proper Operation and Maintenance can help each individual government and ESA to improve the effectiveness of its own programmes, and networking on specific activities can increase the impact of individual efforts.

A strategy to reach the objective of improved Operation and Maintenance should include:

- Defining the activities needed to generate the information necessary for developing policies and programmes.
- Consulting with other programmes engaged in the procurement of information on similar topics to expand the database.
- Promoting and supporting the elaboration of policies and programmes and propose their implementation to decisionmakers in countries and External Support Agencies.
- Assisting in the implementation of policies and programmes.
- Monitoring the implementation and evaluate the results.

and - Suggesting and supporting the reformulation of policies and programmes, as indicated from monitoring, to obtain expected benefits.

APPENDIX 8

New Delhi Statement (1990)

8

A Statement

Towards a New Philosophy on Operations and Maintenance

The operations and maintenance of water supplies and sanitation in developing countries is badly neglected, so much so that many schemes have fallen into disrepair and no longer provide the services for which they were constructed. Because of this the actual coverage levels of adequate water and sanitation in developing countries is even lower than statistics would suggest. Furthermore, this low level of service has become accepted as the norm in many places. The deterioration of these valuable physical assets is a major loss to national economies which should be avoided and although most external support agencies do not fund operations and maintenance, rehabilitation projects have become an increasing part of many country support programs. Rehabilitation is the extreme form of operations and maintenance which would not have been required, or would have been postponed if regular maintenance had taken place.

This situation has come about for a number of reasons. Mainly, the emphasis by developing country governments and external support agencies on trying to make up the large sector deficit by providing services to those without adequate facilities, and hence the emphasis on capital construction and expansion particularly of water services. Also, because of the previous long standing tradition of some governments and external support agencies perceiving of water and sanitation as being a free social service for all, the costs of which are not borne by the user.

In order to rectify this situation and improve operations and maintenance a number of fundamental changes must take place in the agencies
(1) responsible for providing these services. First, the agencies should change their orientation and begin to perceive of their primary role as the provider of a service to people and not the constructor of physical
(2) works. Second, the agencies themselves, which could range from a public utility to a community group, should become autonomous in efficient and transparent management and financing of the services. Third, these
(3) agencies should provide integrated water and sanitation services only in response to the effective demand of the consumer. That is, the level of services for which the consumer is willing to pay for in order to ensure good public health and environmental standards for the community.

In order to ensure the long term sustainability of water and sanitation services an awareness should be created which recognizes that maintenance is an essential component of successful development and resource utilization. Furthermore, the above principles should be embodied in the projects, policies and practices of the agencies responsible for providing water and sanitation, and the external support agencies who assist them.

This statement reflects the findings and deliberation of an operations and and maintenance working group meeting held in Geneva during June 1990.

APPENDIX 9

"SOME FOR ALL RATHER THAN MORE FOR SOME"

The New Delhi Statement

Safe water supplies and environmental sanitation are vital for protecting the environment, improving health, and alleviating poverty. Disease, drudgery and millions of deaths every year are directly attributable to lack of these essential services. The poor, especially women and children, are the main victims.

Concerted efforts during the 1980s brought water and sanitation services to hundreds of millions of the world's poorest people. But even this unprecedented progress was not enough. One in three people in the developing world still lack these two most basic requirements for health and dignity.

Every developing country learned its own lessons during the International Drinking Water Supply and Sanitation Decade (1981-1990). The global community must now more effectively combine these experiences with a renewed commitment to sustainable water and sanitation systems for all. Access to water and sanitation is not simply a technical issue; it is a crucial component of social and economic development. Sustainable and socially acceptable services can be extended by using appropriate technologies, adopting community management and enhancing human resources.

Political commitment is essential and must be accompanied by intensive efforts to raise awareness through communication and mobilization of all sections of society.

Challenge

Entering the 1990s, governments face formidable challenges. Population growth continues apace. Infrastructure in many cities is stretched to breaking point. Uncontrolled pollution is putting greater stress on the living environment. Depletion and degradation of water resources are causing the costs of new water supplies to escalate. Without fundamentally new approaches, the broadscale deprivation will turn into an unmanageable crisis.

Creating the right conditions for accelerated progress will often involve profound institutional, economic and social changes, as well as reallocation of resources and responsibilities at all levels.

To achieve full coverage by the year 2000 using conventional technologies and approaches would require five times the current level of investment. However, there is a realistic two-pronged alternative:

(1) Substantial reduction in costs of services, through increased efficiency and use of low-cost appropriate technologies.

(2) Mobilization of additional funds from existing and new sources, including governments, donors and consumers.

If costs were halved and financial resources at least doubled, universal coverage could be within range by the end of the century.

Guiding Principles

For countries taking up this challenge -- "Some for all, rather than more for some", the New Delhi Global Consultation recommends four Guiding Principles:

1. Protection of the environment and safeguarding of health through the integrated management of water resources and liquid and solid wastes.

2. Institutional reforms promoting an integrated approach and including changes in procedures, attitudes and behaviour, and the full participation of women at all levels in sector institutions.

3. Community management of services, backed by measures to strengthen local institutions in implementing and sustaining water and sanitation programmes.

4. Sound financial practices, achieved through better management of existing assets, and widespread use of appropriate technologies.

Principle No. 1: The Environment and Health

Safe water and proper means of waste disposal are essential for environmental sustainability and better human health, and must be at the center of integrated water resources management.

Rapid population growth and accelerating urbanization, threaten health and the environment, presenting governments with daunting challenges in the 1990s. The poor, especially women and children, will continue to be the hardest hit.

Every day, water related diseases cause the deaths of thousands of children, and untold suffering and loss of working time for millions. Safe water combined with improved hygiene and better nutrition can reduce, and sometimes even eliminate these diseases.

The dramatic reduction of dracunculiasis (Guinea worm disease) has resulted from the provision of improved water supplies and hygiene education in endemic areas. The target of total eradication by 1995 should be fully supported. Affected countries should accord it high priority in investment programmes.

Toxic and industrial wastes pose increasing dangers to the environment in developing countries. They represent a significant threat to human health through direct contact and the pollution of water and soil. Governments and responsible agencies must take steps to control these health hazards.

Improvements to the household environment can be best achieved through the community's involvement as an equal partner with government and sector agencies. This means building on indigenous knowledge, so that policies and programmes are credible and relevant to the beneficiaries. Emphasis must be placed on education, social mobilization and community participation.

Proper drainage and disposal of solid wastes have a major impact on the neighbourhood environment. New solutions are needed which are environmentally appropriate and affordable to the communities they serve and which also conserve water resources and minimize pollution.

Integrated water resources management is necessary to combat increasing water scarcity and pollution. This includes water conservation and reuse, water harvesting, and waste management. An appropriate mix of legislation, pricing policies and enforcement measures are essential to optimise water conservation and protection.

Principle No.2: People and Institutions

Strong institutions are essential for sustainable development.

They require sound management, motivated people and an enabling environment of appropriate policies, legislation and incentives. Institutional development takes time. The short term achievement of production targets should not take precedence over the need for capacity building. The overall objective is achieving sustainable facilities which are used effectively by the beneficiaries.

A changing role of government is envisaged, from that of provider to that of promoter and facilitator. This will enable local public, private and community institutions to deliver better services. Decentralization demands a strong policy and support role from central governments, while local private enterprise can assist in improving the efficiency and expansion of service delivery.

The special role in development of non-governmental organizations (NGOs) and of volunteers must be acknowledged and strengthened. NGOs are flexible, credible, ready and able to experiment with innovative approaches. Governments should support the NGOs in replicating these approaches, and include NGOs, wherever appropriate, as partners in projects.

Human resources development (HRD) at all levels, from community members to politicians, is essential to institutional development. Training of professionals, managers, technicians and extension workers builds competence and confidence. Information, education and communication strategies must be integrated within HRD policies. Women must be trained and guaranteed equal employment opportunities at all levels of staff and management. National professional associations can play an important role in better HRD.

Education is a key part of the new approach. Schools offer a vast, most receptive audience for hygiene education. Polytechnics and universities already include water and sanitation related subjects in their curricula, but must be encouraged to respond to this sector's needs for multidisciplinary skills. Sanitary and environmental engineering curricula should incorporate substantial elements of community development, communications, appropriate technology, and project management.

Principle No. 3: Community Management

Community management goes beyond simple participation. It aims to empower and equip communities to own and control their own systems.

Community management is a key to sustaining services for the rural poor and is a viable option for poor urban settlements. Governments should support community management, through legislation and extension, and give it priority in national sector strategies for the 1990s.

Communities should have prominent roles in planning, resource mobilization, and all subsequent aspects of development. Within these strategies, gender issues will be all important. Women should be encouraged to play influential roles in both water management and hygiene education. Capacity building is necessary to make community management effective and enable women to play leading roles.

Linkages must be established to ensure that national plans and programmes are responsive to community needs and desires. Methods for evaluating community management have been developed for rural areas. They should now be adopted at the national level and implemented through participatory monitoring and evaluation techniques.

Principle No. 4: Finance and Technology

Given the number of people unserved and the growing demand, more effective financial strategies must be adopted in the 1990s for the long-term sustainability of the sector.

Current levels of investment in the sector are about US$ 10 billion per year.It is estimated that approximately US$ 50 billion a year would be needed to reach full coverage by the year 2000, using conventional approaches. Such a five-fold increase is not immediately feasible.

New strategies should aim towards two key objectives:

* Increased efficiency in the use of available funds

* Mobilization of additional funds from existing and new sources, including governments, donors and consumers.

Substantially increased effectiveness in the use of financial resources can yield major gains in sustained coverage. This will require changes in the way service agencies operate, to make them more cost-effective and responsive to consumer needs and demands. Involving consumers in choice of technology and service levels has proved to have a positive impact on cost recovery and sustainability.

A powerful case can be made for greater government and external support agency support. However, economic and social benefits need to be better quantified. Clear sector strategies and action plans increase the likelihood of water and sanitation programmes receiving higher priority in national planning processes. They may also make the sector more attractive for support from external support agencies (ESAs).

The high debt burden of many developing countries makes it particularly difficult for them to consider loans at market interest rates for all investments in this sector. With this in mind, lending agencies and donors are urged to look favourably on requests for grants or soft loans to support water and sanitation programmes. ESAs can also help by developing procedures or guidelines which will reduce project preparation and approval time. Support should also be given for the establishment of financial intermediaries to make credit more widely available.

Restructuring the utilization of funds for sector investments and setting of user charges are key issues in sector finance. Maximum benefits can be accrued by allocating a higher proportion of funds to affordable and appropriate projects in rural and low-income urban areas, where needs are greatest.

Rehabilitation of defective systems, reductions in wastage and unaccounted for water, recycling and reuse of wastewater, and improved operation and maintenance can often be more effective than investment in new services. Choices of technology and levels of service are major factors in determining construction, operation and maintenance costs of new projects. Due attention must be given to operation and maintenance arrangements which will ensure sustainability before investments are made.

Higher budget allocations and recovery of recurrent costs of operation and maintenance to ensure system sustainability are primary goals to be achieved. Effective cost recovery requires that sector institutions be given autonomy and authority. Further, there must be widespread promotion of the fact that safe water is not a free good. Appropriate charging mechanisms must be adopted, which reflect local socio-cultural and economic conditions. Collection should be decentralized so that revenues are available for management and operation of services.

Public sector institutions frequently default on payments for water supply and waste disposal services. For reasons of financial viability and equity, this practice is unacceptable. Increasing collection efficiency must be part of better financial management.

Research and development in developing countries has resulted in widespread application of much improved handpump and on-site sanitation technologies. The momentum established during the 1980s must be maintained and increased in the next ten years. Among the priority needs for the 1990s are improved household technologies for protecting water quality from source to mouth and low-cost wastewater disposal systems for low-income urban areas. Exchanges of information and experience among developing countries (South-South cooperation) must be further developed.

Follow-up

Implementation of the approaches outlined in this Statement will need to be part of country specific strategies.

Countries and ESAs are urged to formulate and implement action plans for water and sanitation incorporating the Guiding Principles of the New Delhi Statement. UNDP is invited to take a leading role in this process, in collaboration with other UN-system agencies.

The Water and Sanitation Collaborative Council, created immediately prior to the New Delhi Global Consultation, offers a new global forum for the exchange of information and promotion of the sector.

This New Delhi Statement will be reflected in a document to be presented to the World Summit for Children in late September 1990, along with a UNICEF-initiated statement on behalf of children, which was adopted at the Global Consultation.

The New Delhi Statement will be presented by the Government of India to the 45th session of the United Nations General Assembly in October 1990.

In addition, it is recommended that this Statement be brought to the attention of the organizers of the 1992 United Nations Conference on Environment and Development in Brazil, with a request that it be tabled to emphasize the special importance of water and sanitation in environmental management.

APPENDIX 10

CHOOSING A COMMUNITY WATER SUPPLY SYSTEM

from IRC, 1992 Pochaus for Progress - TP 28

Table 1: Choosing an appropriate water supply system

QUESTIONS	CONSIDERATIONS
1. *INITIAL SERVICE LEVEL ASSUMPTION* What service level is reasonably expected?	- improved traditional source - handpumps - public standposts - neighbourhood taps - yard taps - house connections
2. *WATER SOURCES* Which reliable water source is available? Can this provide the required amount of water?	- springs - groundwater - rainwater - surface water - streams - lakes, ponds
3. *ENERGY SOURCES* What reliable energy source is available?	- gravity flow - electricity - diesel supply - wind - solar energy - biomass - human power
4. *WASTEWATER DRAINAGE* In which way can the wastewater be disposed hygienically?	- soakaway - gardens - sewers - drains
5. *TECHNICAL RESOURCES* What skills and materials can be made available to sustain the desired service level?	- skills/technical advice: diesel/electro mechanics, pump mechanics, plumbers, carpenters, masons, caretakers - materials: pipes, pumps, taps, valves, fuel stores, chemicals, spare parts
6. *ORGANIZATION* What is the most appropriate organizational structure to sustain the desired service level?	- village organization - water committee - water supply agency - extension service - power utility - training opportunities
7. *CAPITAL RESOURCES* What are the financial resources available for the desired level of service?	- users' funds - government subsidies - ESA support
8. *RECURRENT RESOURCES* What kind of payment system is most appropriate for the users' ability to pay?	- fund raising - communal income - regular contributions - water vending - contribution in kind
9. *APPROPRIATE LEVEL OF SERVICE* Is/Are the levels(s) of service chosen appropriate for all segments of the community?	- acceptability of different levels of service - social justice - rates tailored to users' ability and willingness to pay
10. *SELECTION OF APPROPRIATE SERVICE LEVEL(S)*	

APPENDIX 11

COURSE: September 1993 Handpumped Water Supply (Borehole) - exercise A

IDENTIFICATION OF O&M TASKS AND RELEVANCE FOR SUSTAINABILITY
Gravity-fed piped water system supplying to several villages

Relevance for sustainability:
** essential for sustainability
* preferable for sustainability
-- not relevant

Cost indication per task of component:
$$$ high costs
$$ reasonable costs
$ low costs
0 no costs

O&M tasks Components of systems	Operation	Preventive Maintenance	Minor Repairs	Major Repairs	Monitoring
Borehole with casing					
Screen					
Pump cylinder					
Pump rod					
Raising main					
Pumphead					
Pumphandle					
Pumpmonitoring					
Platform					
Drainage/soakaway					

IDENTIFICATION OF RESPONSIBLE ACTORS FOR O&M TASKS
Gravity-fed piped water system supplying to several villages

Possible actors:

1. user
2. user group/caretaker
3. village committee/government
4. area mechanic (government)
5. district departments
6. regional departments
7. private mechanic
8. spares retail-shop
9. private contractors

O&M tasks / Components of systems	Operation	Preventive Maintenance	Minor Repairs	Major Repairs	Monitoring
Borehole with casing					
Screen					
Pump cylinder					
Pump rod					
Raising main					
Pumphead					
Pumphandle					
Pumpmonitoring					
Platform					
Drainage/soakaway					

APPENDIX 12

A list of activities related to O&M of a gravity-fed piped water supply may include:

Operation of intake
operation of mains, branch and service lines
operation of valves and taps

maintenance of intake
maintenance of mains, branch and service lines
maintenance of meters and valves
maintenance of standpost, taps, drainage system
maintenance of handpump

reading of meters: consumed water
charging for consumed water by agency
charging for services by village management unit
bookkeeping

spare part production
spare part distribution
spare part sale

village management unit
caretakers
mechanics
agency support

training of village management unit, caretakers
training of mechanics
training of agency support staff

monitoring for village management
monitoring for water agency management

Other issues are:

major repairs
major overhaul (of mechanical parts or borehole/well)
major replacements
extension of system: new taps or pumps (wider area or more connection/pumps per area unit)

IDENTIFICATION OF O&M TASKS AND RELEVANCE FOR SUSTAINABILITY
Gravity-fed piped water system supplying to several villages

Relevance for sustainability:
** essential for sustainability
* preferable for sustainability
-- not relevant

Cost indication per task of component:
$$$ high costs
$$ reasonable costs
$ low costs
0 no costs

O&M tasks / Components of systems	Operation	Preventive Maintenance	Minor Repairs	Major Repairs	Monitoring
Catchment					
Intake					
Break pressure tank					
Trunk line					
Branch box					
Branch line					
Storage tank					
Service line					
Stop valve					
Valve, meter and box					
House connection					
Soakaway					

IDENTIFICATION OF RESPONSIBLE ACTORS FOR O&M TASKS
Gravity-fed piped water system supplying to several villages

Possible actors:

1. user
2. user group/caretaker
3. village committee/government
4. area mechanic (government)
5. district departments
6. regional departments
7. private mechanic
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9. private contractors

O&M tasks Components of systems	Operation	Preventive Maintenance	Minor Repairs	Major Repairs	Monitoring
Catchment					
Intake					
Break pressure tank					
Trunk line					
Branch box					
Branch line					
Storage tank					
Service line					
Stop valve					
Valve, meter and box					
House connection					
Soakaway					

APPENDIX 13

from WHO (1990) Handbook of Financial Principles and Methods. 13

PART I
PRINCIPLES

INTRODUCTION

Institutional and Financial Issues in WSS

Following several consultations on institutional development in WSS, the WHO Working Group on Cost Recovery formulated action lines to address those institutional and financial issues which are most commonly encountered in WSS.

WATER SUPPLY AND SANITATION
INSTITUTIONAL AND FINANCIAL ISSUES*

Sector Management Issues
Inter-ministerial coordination in planning
Institutional and human resources development
Agencies' autonomy (including over tariffs)
Agencies' regulations and monitoring
Activities that can be privatized
Activities that can be devolved on to communities
Funding for operation and expansion

Agency Management Issues
Financial planning and management information
Project preparation and appraisal
- .reduction of non-revenue water
- .efficient use of resources
- .preventive maintenance

Billing and collection
Other revenue sources
Consumers' willingness to pay (surveys)
Women's involvement in projects
Effective and efficient ways to serve the poor

Tariff Issues
Balance feasibility, efficiency, equity and expansion objectives against free services
Cover operating costs, and generally investment costs (charges to reflect value to the economy)
For the poor, willingness to pay may be high because the alternatives are unattractive
Stepped and differentiated tariffs
Metering
Cross-subsidization

* S. Ettinger and H. Garn
Senior Economists, World Bank.

These action lines are contained in the Report of the Fourth Consultation on Institutional Development (Geneva, 21-25 November 1988), in two volumes:

- Vol.I: "Managerial and Financial Principles for Water Supply and Sanitation Agencies" (WHO/CWS/89.5);
- Vol.II: "Principles and Models to Achieve Sustainable Community Water Supply and to Extend Household Sanitation" (WHO/CWS/89.6).

This handbook does not cover the whole range of issues identified by the Fourth Consultation but rather concentrates on financial management. The purpose of Part I is to explain the principles of sound financial management for sustainability, and to show the resources mobilization process which leads to the achievement of a number of objectives (desirable states) required to ensure the sustainability of WSS operation. This process is illustrated graphically on the facing page.

Kinds of Resources and Costs

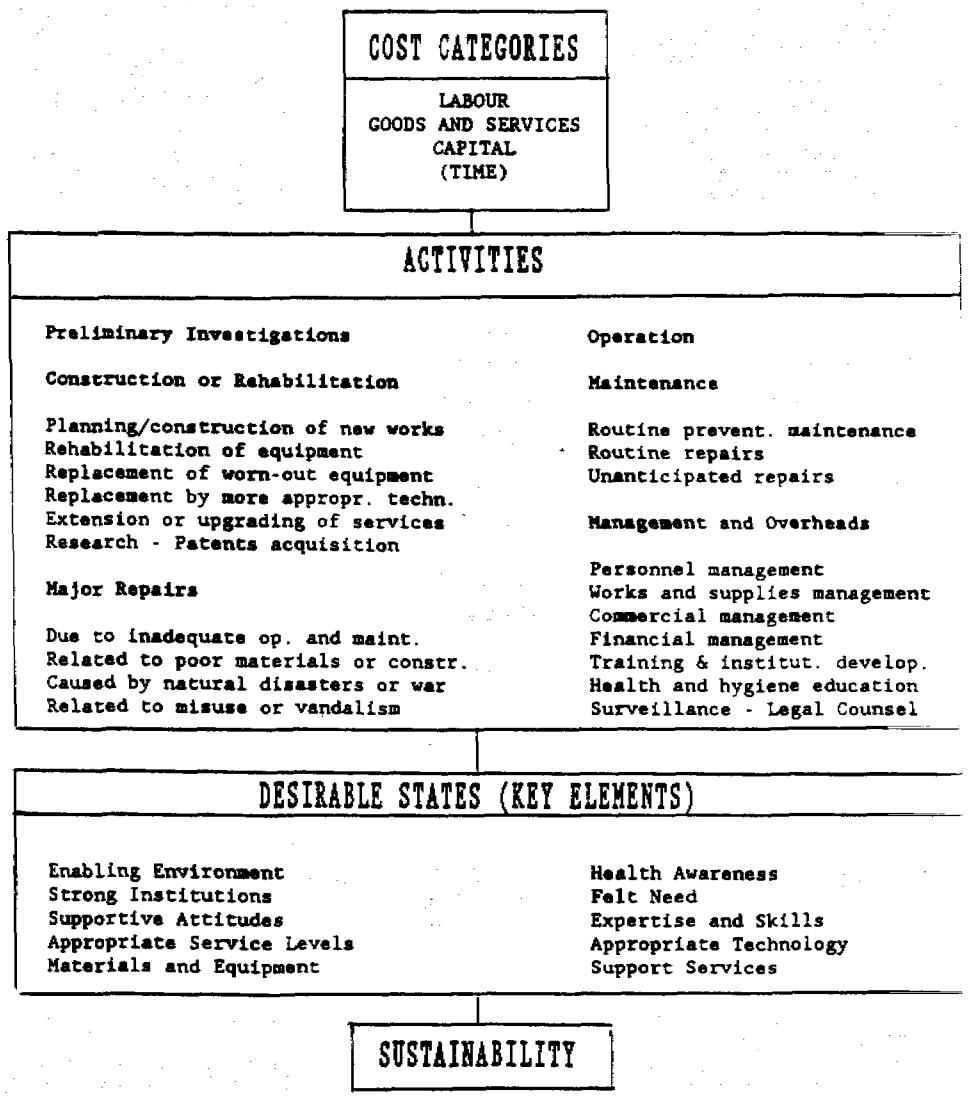
As in all fields, a set of terms - or jargon - has emerged. "Cost recovery", "cost containment" and "liquidity maintenance" are terms currently used by economists and financial analysts to describe what a public utility should practice if "viability" of its water supply or sanitation system is to be ensured. Other people involved in development work stress "appropriate technology", "community participation", "in kind contribution", "partnership", when talking of achieving "sustainable" community-based water supply and sanitation schemes.

The two groups look at and stress different things, which often leads to lively debate, but both have a common goal - a system that functions well, is utilized to the full with continuing health and socio-economic benefits, and operates efficiently on at least a break even, if not a surplus basis - in short, a sustainable system. What is required is that all costs and responsibilities associated with the system's planning and construction, operation and maintenance (O&M), and eventual replacement, having been clearly identified and allocated, should be adequately met.

The resources mobilization process on the facing page shows a breakdown of costs according to their nature: labour, goods and services , or capital. The time element is also to be considered.

The table also shows a breakdown of cost into activities, such as construction, maintenance, or rehabilitation.

RESOURCES MOBILIZATION FOR SUSTAINABILITY



The total cost of a WSS operation should always be calculated as:

- either the sum of labour, goods and services and capital resources mobilised as inputs to the WSS system,
- or the sum of costs of activities undertaken to plan, design, construct, operate, maintain and eventually extend and renew this system. The latter calculation requires rather sophisticated forms of cost accounting, which necessitate the breakdown of labour, goods and services and capital costs into various activities. It is generally not practiced in medium size or small WSS agencies.

There exist other categorizations and distinctions, like of fixed versus variable, or direct versus indirect costs. The purpose of enumerating these distinctions and the key elements of sustainability, is to make the handbook self-contained, thereby saving readers the trouble of seeking complementary knowledge in the literature.

The Nature of the Problem

The difficulty to recover cost is a major constraint to sound WSS financial management. The fulfilment of at least minimum WSS needs is an essential step towards the health improvement objectives of most governments, yet half the population of the developing world is still deprived of adequate services. Ensuring that all costs are covered through user charges alone is sometimes difficult, especially in urban poor and rural areas where cash is a minor aspect of the economy and is in short supply, while social and political considerations complicate the competition for and allocation of scarce development resources and operational subsidies.

There is a critical need for managerial and financial improvements to meet budgetary constraints and optimise water utilisation. It is necessary to improve the allocation, size and timing of application of investment funds, to contain all costs, and to diversify and increase the sources of recurrent income. Particularly in developing countries and especially in rural areas, there is an increasing need for communities to organize themselves to construct, operate and maintain WSS facilities, and to derive the maximum benefit from these facilities while ensuring that all costs are met.

A widespread idea is that water is free. However, payment of its cost is always required. Although sound tariff structures are beginning to be widely used, WSS services in many countries are provided at prices unrelated to either financial or economic costs. Besides, large consumers (including governments) sometimes do not pay their water bills; industries often enjoy the benefits of private supplies and discharge untreated effluents free of charge or penalty. At the same time, charges for those who do pay are high.

It is not uncommon that utilities have irregular incomes and trouble meeting fixed obligations such as debt-service and payrolls. Inadequate setting of charges is one reason for this state of affairs. But a number of "larger environment" problems, such as unwillingness to pay, perceptions that rates are too high in relation to quality of service, lack of qualified staff and lack of political will also influence the commitment to contain and recover costs.

Another constraint to efficient resources mobilization is that this is too often restricted to the WSS sector alone. The linkage with other sectors, especially public health, should be emphasized. The role of the health sector should be considered, as a resources provider for health education and WSS surveillance, in addition to promotion and organization of community involvement. In many countries, health agencies can also assist in planning, construction, operation, maintenance and repair of simple systems. In some instances, industry and rural development also have a role to play in helping the agencies of the WSS sector, and possibly subsidizing other consumer groups.

One last constraint to efficient financial management is the high cost of providing WSS services to very small communities in remote areas or areas where provision of safe water is difficult. In some countries, these communities represent more than half of the total population. Rigid policies setting fixed proportions of total cost to be met by the community can be unfair or unrealistic, and therefore no universal rule applies. Studies are required on a case by case basis, stressing appropriate technology, community participation, intersectoral action and cross-subsidization, bearing in mind, however, that in the end all sector costs must be covered.

Perception of the Problem

Engineers, financial analysts and economists have different perceptions of the problem, and the objectives which they pursue, as well as the languages which they use, differ widely, while corresponding to the same overall concept of sustainability. As Parts I and II of this handbook contain frequent indications on how objectives should be set and costs and benefits calculated, it is important to define precisely the perceptions which professionals of various disciplines have of their respective objectives with respect to cost recovery.

In a restrictive sense, the engineer is concerned with a project: WSS services cost tons of material, hours of labour, and capital resources such as pipes, reservoirs or pumps. The engineer's objective is that the project should represent the least cost solution to meet the demand (or to achieve any other type of benefit).

The financial analyst is concerned with an agency with one or several projects: WSS services cost money, corresponding to the market prices of material, labour and capital. The objective here is to ensure liquidity maintenance, as the agency must at all time have all the funds it needs to cover its costs.

The economist is concerned with a country with several agencies: WSS services cost the money and time which are spent on them while they could be employed in other sectors. The objective is to ensure that the return on these resources is at least that which could be attained on average in other sectors where they could be rationally employed. Health and environmental benefits are included in the objective to the extent that they can be appraised.

One of the aims of the handbook is to broaden these individual concerns.

THE COST SHARING APPROACH

The Partnership Model

The provision and continuing operation of any WSS facility involves costs and responsibilities, which are usually shared between the Agency and the Community (or the User).

"Agency" is defined as the implementing or initiating authority, and "Community/User" is defined broadly as the end user (either an individual or a collective group of any size, but whose members have common water supply or sanitation service interests).

At the community end of a community/user-agency scale of responsibilities are the examples of:

Case A-1: Farmer Smith buys a handpump, pays a contractor to dig a well and install the pump, then maintains the pump himself (this assumes that free abstraction of water is allowed).

Case A-2: Farmer Smith constructs a ventilated pit latrine for family use, paying for all materials and providing the labour himself.

At the agency end of the scale, the community/user has little responsibility and costs; for example:

Case B-1: During the project's development phase, the Grand City Water Corporation (GCWC) plans, designs and supervises construction of a new piped water system. Construction is carried out both by direct labour and by contract. Capital investment is 40 percent financed by an international low-interest loan and 30 percent grant-funded by a bilateral donor; the balance of funds is provided from national sources within the infrastructure development budget.

These are the extreme cases; the following are typical situations of cost and responsibility sharing:

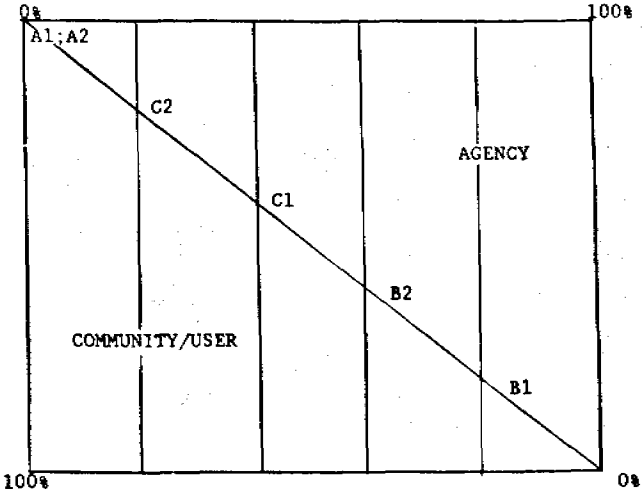
Case B-2: After having commissioned the facilities, GCWC operates and maintains them with its own staff. GCWC's recurrent budget (including debt service) has as its only source of funds user charges based on metered consumption.

Case C-1: For the construction of a piped water supply scheme in the rura village of Small (population 3000), the community is organized t dig trenches and lay pipelines as its in-kind contribution to hel offset initial costs. Materials, transport and supervision ar provided by the Ministry of Water. When completed, the system i "handed-over" to the community.

Case C-2: During the operation, the community is responsible for dail operation and routine maintenance of facilities. A local mechani has been trained as a pump mechanic. Villagers contribute func at the end of each harvesting season. A two-tier maintenanc system has been developed, which means that Small's Water ar Health Committee can call in a mobile regional maintenance unit t perform major repairs at an agreed-upon rate which is partl subsidized from general agency funds.

On this sliding scale, it is possible to represent the "partnership" (agency-community/user responsibility sharing by a point on the diagonal line.

The case examples given above are plotted here, with distances above a below the diagonal line reflecting the relative responsibilities to be assum by each party.



The relationship is rarely static, so over the life of the project the poi of placement on the diagonal line may be different, depending on h responsibilities are divided at that particular time. The gradual takeover operation and maintenance responsibilities by a community will thus illustrated by an upward move from right to left on the diagonal line.

Gaps and Overlaps in Responsibility Sharing

Except in the case of an individual doing everything on his own, the provision and operation of WSS facilities imply a two-way partnership between project executors and project beneficiaries. However, the intended partnership and division of responsibilities are not always achieved.

In such situations:

- where it is found that neither party wants, or is able to fulfil its commitment, actions should be taken to ensure each partner's ability to meet its obligations, and/or a different level of technology should be chosen so that the gap can be eliminated;
- where one party is doing more than it should while the other is doing less, action should be taken to ensure that both partners understand, accept and execute their responsibilities. The corrective actions identified in the previous situation may also apply;
- where both partners are doing more than they should and there is overlap and confusion, action should be taken to clarify the respective responsibilities.

What is important is that the right balance of responsibility sharing should be struck.

THE SUSTAINABILITY OBJECTIVE

Key Elements

* Enabling Environment
* Health Awareness
* Strong Institutions
  - . Community
  - . Agency
  - . Special interest groups
* Felt Need
* Supportive Attitudes
* Expertise and Skills
* Appropriate Service Level
* Appropriate Technology
* Materials and Equipment
* Support Services
  - . Customer relations
  - . Community support
  - . O&M support

These elements relate to the creation and maintenance of conditions that ensure technical, social and financial project success, subject to availability of resources and adequate sharing of responsibilities between the community and the agency.

Enabling Environment

This element is largely a responsibility of Government. It consists of legal provisions, informal regulations, education, information and other incentives which influence the behaviour of both the community/user and the agency. Developing country politicians and policy-makers should provide an Enabling Environment which involves:

* the promotion and commitment to the provision of WSS services for improvement in health and quality of life of the whole population.
* political will for a genuine commitment to sustainability, which includes the existence of a clear and consistent policy and legal framework, as examplified by the creation of autonomous organizations clearly committed and allowed to improve organizational efficiency, financial viability, reliability of services, and to provide services tailored to the consumers' needs and willingness to pay.
* clearly formulated objectives and standards for construction, operation and use of facilities.
* creation and maintenance of a positive and supportive environment to ensure that new or old WSS facilities continue to function well, giving maximum benefit to the users.
* monitoring and regulation of WSS agencies to ensure that they provide an appropriate service to the public.

An Enabling Environment is not consistent with a "Free Water" policy, for it emphatically requires a commitment to a partnership approach (agency vis a vis the community/user) in the provision and meeting of costs of water and sanitation services.

Health Awareness

For the community /user, Health Awareness implies awareness of:

* the health benefit of improved water and sanitation services, to the extent that the user refuses to use alternative facilities of easier access or lower cost.
* the seriousness of diseases due to lack of adequate water and sanitation, and the affect on personal health of unhygienic practices; this knowledge is particularly important among women, since they have a major influence on the health of children; it should be based on local concepts of water use, hygiene and disease, and the understanding of how specific local conditions and practices can affect health.

For the agency, Health Awareness implies:

* a working knowledge and acceptance of the complementarity of water, sanitation and health;
* a commitment to bring about improvements in health through health education and other promotional activities;
* a continuous cooperation with agencies of the health sector, with mutual transfers of resources.

In addition, on the part of the community/household or user, it means an acceptance of personal responsibility, and willingness to pay or contribute otherwise towards efforts and activities to improve personal and community health.

Strong Institutions

This element covers agency and community-based institutions for the management of water and sanitation services.

For the agency, Strong Institutions mean:

* organizations with clearly defined responsibilities, a sound legal basis, and autonomous control of finances and human resources;
* institutions with adequate financial resources to carry out their mandated responsibilities during the development and the operational phases of any project.

For the community, Strong Institutions mean:

* they have a formal, legitimate and permanent status;
* they are characterised by strong leadership and solid backing by the constituency (especially women);
* they represent all user groups, including women and poor households;
* they have an ability to organize and carry out a planned and agreed programme of activities.

Felt Need

This element is characterised by the existence of a genuine individual/household or community need for improved WSS services, and means:

* an awareness and expressed need of the health, economic and social advantages of improved WSS services;
* a desire to have WSS services that are convenient and time-saving, which also implies the existence of productive pursuits for the time saved.

Felt Need also implies a willingness to contribute to the development, operation and maintenance of WSS facilities.

On the part of the agency it means:

* a willingness and capacity to consult men and women of various socio-economic and cultural sections of the community on their felt needs and priorities;
* a willingness to encourage communities to make improvements in WSS facilities for health, economic and socio-cultural reasons.

While a general Felt Need may be (or is often thought to be) self-evident, needs for a particular level of service may have to be nurtured through health promotion, literacy programmes and general economic activities.

Supportive Attitudes

For the agency, Supportive Attitudes mean commitment to:

* a partnership process for implementation of WSS facilities;
* a genuine desire to work with communities to assist them in finding solutions to their WSS problems;
* policies and institutions which motivate agency staff.

For the community it means:

* the acceptance of responsibilities and a willingness to assume ownership, pay for services and contribute towards the provision of WSS.

These supportive attitudes should be created and maintained among the formal and informal leaders of the community, and the agency. Such attitudes are reinforced by examples of successful WSS projects or of projects observed in other areas. Therefore, the resources mobilisation plan for monitoring performance and progress and allowing timely corrective action should also provide for continuous exchange of experiences.

Expertise and Skills

This element is characterised by the existence of levels of skills required for the development, construction, operation and management of WSS facilities.

At the community level it means:

* technical skills for carrying out minor repairs and routine maintenance;
* skills for organizing cash-raising and managing financial resources;
* organizational skills for mobilising community inputs, identifying community preferences and consulting with agency staff.

The agency should possess not only the necessary technical, administrative and management skills, but also have (or be able to draw upon) resources persons with appropriate skills in social organization, extension work, communications, training, monitoring, follow-up, and review/evaluation. The agency should also have skills to effectively involve women in these activities.

Expertise and Skills also require the existence of training programmes and activities targeted at agency staff and at the community.

Appropriate Service Levels

Appropriate Service Levels should be jointly agreed between the users or beneficiaries and the implementing agency, and reflect appropriateness in the socio-economic and technical context of the project. The concept therefore applies to small communities, but is also useful for larger systems. This element is characterised by the acceptance of responsibilities for development and operational phases inputs. The Appropriate Service Level for a particular situation ideally allows the community to upgrade later to a higher service level, thus encouraging maintenance of the facility until it can be improved.

In reaching appropriate service levels resources are required for:

* comprehensive analysis of alternative service levels;
* consumer surveys;
* communications with communities/users to explain the implications of each alternative;
* paying the extra cost of service levels appropriate to specific situations, which require more than the type of WSS adopted in national policies and plans.

Appropriate Technology

The chosen service level should reflect technology that is practical, economically viable, satisfies the needs of the users and is socially acceptable.

Thus the Appropriate Technology element for WSS is characterised by:

* socio-cultural appropriateness;
* affordability;
* ease of maintenance with the skills available in the agency or community;
* maximum use of locally available materials or spare parts;
* easily understood attributes;
* technical efficiency.

Choice of appropriate technology is thus determined by an array of technical and non-technical factors which should be analyzed, discussed and finally agreed upon by the agency and the community/user.

Materials and Equipment

For the agreed service level and technology choice, there should be adequate resources, jointly provided by the agency and the community, to cover all the required development and operational phase inputs.

The key characteristic of the Materials & Equipment element is the timely availability of necessary inputs.

It implies:

* availability of materials and equipment for new schemes, for rehabilitation and for operation and maintenance;
* close coordination with communities/users so as to guarantee the availability of their in kind contributions.

Support Services

This element covers O&M support systems, extension services and customer relations. Although this element is primarily provided by the agency during the development phase, some inputs should be identified and jointly agreed to come from the community and should increasingly shift towards the community/user at the operational phase.

The O&M support system is characterised by the regular availability of funds, equipment, spare parts and staff to carry out operations of the system.

At the agency level it requires:

* establishment of maintenance teams, leak-detection teams, and technical teams to provide back-up support for community-based water/health committees;
* the existence of monitoring systems and a preventive maintenance programme;
* an O&M training programme for agency staff as well as for community-based operators.

At the community level O&M support requires:

* supervision and payment of local O&M tasks;
* assigned responsibilities for community-based operators;
* monitoring, and reporting on resource coverage.

Community extension services should also be readily available and properly equipped and trained to provide for technical support, training and supervision, as well as promotional work in hygiene and health education.

Extension services would also require:

* multi-disciplinary teams with social, as well as organizational and technical skills;
* a customer-relations service, especially in largely agency-managed systems. This service should provide for fault-reporting, public relations and user education (health, water conservation, security, etc.).

The Resources Coverage Process

Each element of sustainability has responsibilities and costs attached to it. In order to ensure that the elements are in place certain resources have to be provided by one of the main parties in the WSS development process - the development authorities (agencies) or the beneficiaries (community and/or users). A broad range of resources is necessary and they include cash; equipment, materials and supplies; expertise and skills; and time and labour.

The level of resources required and the corresponding responsibilities will vary from one project to another and be determined by the situation anticipated at each phase of the project cycle.

It may be found that the elements of sustainability are not available to some degree. In such cases, resources may be needed to strengthen national institutional capacities in order to develop the elements, for example:

- to establish community institutions for maintaining a rural water supply facility;
- to provide for training in the required skills for operating the facility.

With respect to agency-managed systems, resources may be needed:

- to establish more efficient organizational structures;
- to carry out a comprehensive institutional reorganization of the sector;
- to strengthen or enhance existing systems for delivery of the required elements of sustainability.

Sometimes it will only be necessary to provide resources to maintain the delivery systems for anyone of the elements.

It is important, however, that all necessary responsibilities and resources should be identified, quantified, allocated, shared and agreed by all parties.

This process, called "Resources Coverage" can only be carried out effectively in an atmosphere of confidence and trust between the development authorities and the beneficiaries. It requires a partnership approach.

The Partnership Process

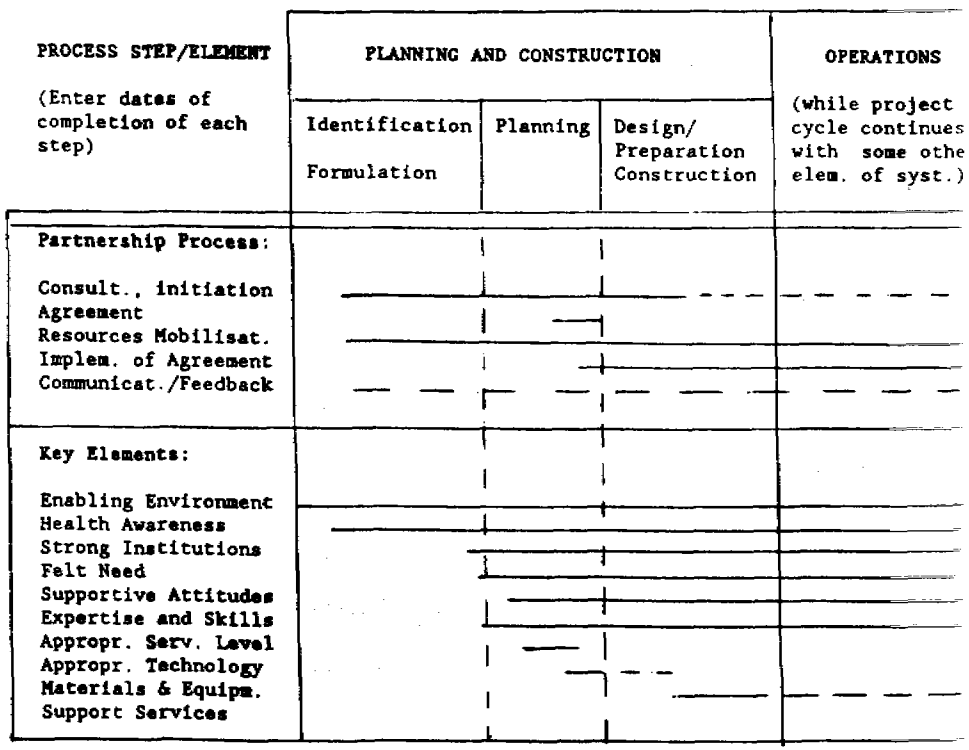
Basically, the partnership process is a two-way communication and joint decision-making process comprising consultation, reaching of agreement, mobilisation of resources, implementation of points agreed upon and feedback between the agency and the community/user. The step by step approach is discussed in detail later.

The partnership process requires adequate resources (too often neglecte in terms of time and skills for communication and gradual patient exchan between the partners in the development of water supply and sanitation.

A very important point is that the key elements, as well as the partnersh process itself, affect time, money, materials and skills requirements.

Timing

The relative timing of all inputs to the development process is importar to the success of any WSS project. The timing of the process and the input o the resources (key elements) extend over the duration of the project. Th implications are that there are certain critical periods when the elements o sustainability must be in place (the desired state must have been reached) Before these critical periods are reached, resources will be needed to build u the elements to an appropriate level.



Assessment of Elements of Sustainability

It is important to make a complete assessment of the elements to ensure sustainability. For each element the key questions will include:

- is the element in place?
- what resources are needed?
- are the responsibilities for resources provision properly allocated?

It has been emphasised throughout that a systematic process of identification, quantification, provision and timing of inputs and responsibilities is crucial to ensure sustainable WSS development. The following are examples of worksheets to help obtain the overviews, assessments and establishment of responsibilities for the required inputs.

Resources Coverage Worksheets

PLANNING/CONSTRUCTION PHASE INPUTS			OPERATIONAL PHASE INPUTS	
Agency's Allocation	Community's Allocation	KEY ELEMENT	Agency's Allocation	Community's Allocation

Assessment of Inputs Required at Development or Operational Phase

RESOURCES REQUIRED FROM THE AGENCY					RESOURCES REQUIRED FROM THE COMMUNITY			
Cash	Time	Labour	Matls.	KEY ELEMENT	Cash	Time	Labour	Matls.

NOTES

1. "Time" means all time not otherwise included under "labour" -- time for communications, organization, planning, implementation, supervision, education, follow-up, accounts management, reporting, etc.
   Together, "Time" + "Labour" = 100% of all time required.
2. "Matls" means supplies, equipment, materials, parts, transport, fuel, etc.
3. "Cash" should be broken down into local and foreign currency components as appropriate.
4. On the Agency side, there are cost and budgetary implications associated with "Time", "Labour" and "Matls" inputs, as well as "Cash". The Agency's budgetary requirements can be determined by translating inputs into cost.

Examples of Completed Worksheets

Overview of Inputs Required for Community Water Supply Project

PLANNING/CONSTRUCT. PHASE INPUTS		KEY ELEMENT	OPERATIONAL PHASE INPUTS	
Agency	Community		Agency	Community
* * *	*	Enabling Environment	* *	* *
* *	*	Health Awareness	*	*
* * *	* *	Strong Institution	*	* *
* *	*	Felt Need	-	*
* * *	* *	Supportive Attitudes	-	*
* * *	*	Expertise and Skills	*	* *
* *	* *	Appro. Service Level	-	-
* *	* *	Appropriate Technology	-	-
* * *	*	Materials & Equipment	*	* * *
* *	-	Support Services	*	* *

Overview of Inputs Required for Peri-urban Sanitation Project

PLANNING/CONSTRUCT. PHASE INPUTS		KEY ELEMENT	OPERATIONAL PHASE INPUTS	
Agency	Community		Agency	Community
* * *	*	Enabling Environment	* *	* *
* *	*	Health Awareness	*	* *
* * *	* *	Strong Institution	*	* *
* *	* *	Felt Need	*	* *
* *	*	Supportive Attitudes	-	*
* *	* *	Expertise and Skills	-	*
*	* *	Appro. Service Level	-	-
* * *	*	Appropriate Technology	*	*
* *	* * *	Materials & Equipment	*	* *
* *		Support Services	*	*

Rating Scale Used

*** = Upper end of scale -- relatively important input required
** = Value toward upper end of scale
* = Value toward lower end of scale
\- = Lower end of scale -- relatively little/no input required

(for illustrative purposes only)

THE GENERAL MODEL

For a WSS project to be sustainable, good financial and institutional management and effective use of the available cash resources are required. Besides resources coverage, two basic operating principles are:

** **Cost Containment**: Every effort should be made to reduce wastage, cut costs and improve cost-effectiveness. For a typical piped water system, for example, such measures as minimizing non-revenue water (which includes unaccounted for water and all other water which is not paid for) and maximizing efficiency of billing and collection can often significantly reduce cost or produce gains in revenue.

** **Liquidity Maintenance**: At any given time, all cash needs should be covered. For a public utility this means having always enough cash on hand to meet expenses for construction, debt service and O&M.

The model on the facing page is applicable generally, although, in some cases some boxes may not be relevant and emphasis on specific key elements can vary. Following the lines of cash flow, it can be seen that:

* All agency inputs (expertise, manpower, materials, equipment, transport, etc.) are budgeted for.

* There are four sources of funds for the agency:

  (1) user charges or water or sanitation taxes;

  (2) grants from external and local funding institutions;

  (3) loans;

  (4) funds made available by the Government from taxation.

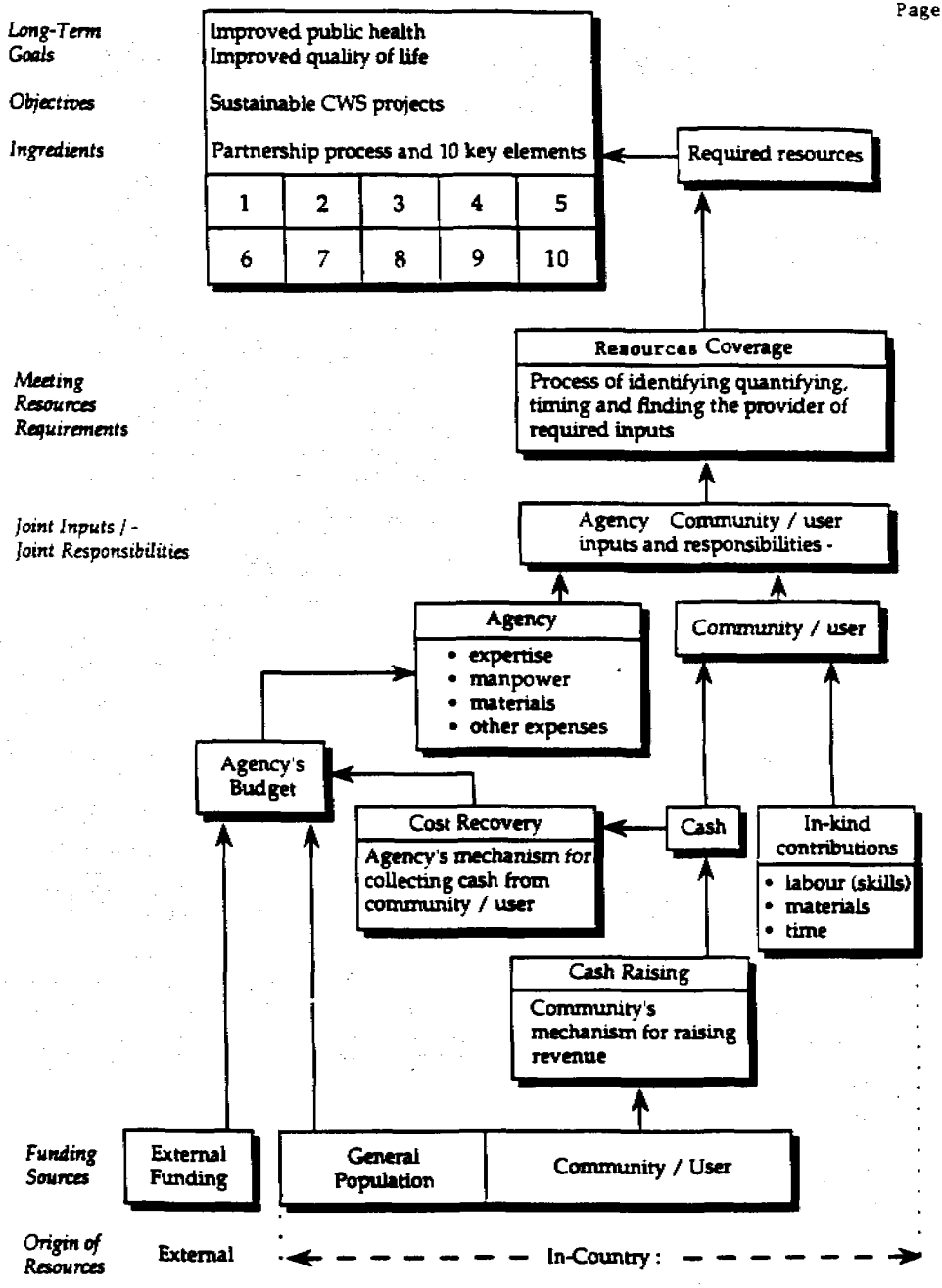
* Except for direct grants from external agencies, all investment and operational costs are met from in-country resources. In one form or another, the citizens bear the substantial part of, if not all, incurred costs.

* Cost recovery mechanisms are means used by the agency to collect funds from the service population (in the form of charges, fees or taxes).

* Cash-raising is what the community/user *does* as a collective/ individual activity to raise necessary funds to meet cash needs.

  (Various financing options available to the community are discussed later.)

* The community/user's cash contributions can be in the form of fees paid to the agency or of direct inputs to the project.



GENERAL MODEL FOR ACHIEVING AND FINANCING SUSTAINABLE WSS

APPENDIX 14

Summary of Principal Findings

In November, 1992, an international workshop was held at The Hague, The Netherlands, with the theme "The Role of Communities in the Management of Improved Water Supply Systems". Held at the IRC International Water and Sanitation Centre, the workshop received financial and other support from the United Nations Children's Fund (UNICEF)*, the United Nations Development Programme (UNDP)/World Bank Water and Sanitation Program, the World Health Organization (WHO), and the Directorate-General for International Cooperation (DGIS) of The Netherlands.

The aim was to consolidate experiences of community management approaches in different parts of the world, and provide guidance for agencies and governments considering its application in their own water supply programmes. The workshop brought together up-to-date experience of community management from seven developing countries: Cameroon, Guatemala, Honduras, Indonesia, Pakistan, Uganda and Yemen. Participants from these countries presented case studies of their own experience, and these were set alongside a broad background paper prepared by IRC and a review of experience from 122 completed water supply projects prepared by the UNDP/World Bank Water and Sanitation Program.

The workshop took place over a seven day period, from 4 to 10 November. The 17 participants are listed in Annex 2. This report presents a synthesis of the workshop findings based on the workshop documents, working group findings, and plenary discussions. The workshop proved to be a rewarding experience and created much optimism among participants for the prospects of community management as a major approach to sustainable water supply development in the years to come. While recognizing that much still remains to be done in understanding more about the prospects and limitations of management by communities of improved water supply systems, the workshop identified a number of important lessons which can be learned from current experience.

Principal Findings

1. Community Management goes beyond community participation, and equips communities to take charge of their own water supply improvements.

Some critical features distinguish community management from community participation and are at the heart of successful community managed water systems:

- The community has legitimate authority and effective control over management of the water supply system and over the use of the water.
- The community commits people and raises money towards the construction and upkeep of the water system. The link between the scale of community contribution and the resulting sense of ownership is not yet well understood, but the need for a significant contribution is well established.
- Supporting agencies provide advice and technical support, but all key decisions are taken with the community. This means that real choices must be offered, backed by a full appraisal of all the resources needed for each.
- Development of people is a parallel goal with development of water. Community management is 'people-centred'. Its success depends on the user community and support agency staff acquiring new skills and confidence in applying them. Special capacity-building techniques are required.
- Local organizations for water management are in tune with existing community decision making structures and ensure that the views of all sections of the community are reflected in management decisions. Strong community leadership, or the continuous involvement of a charismatic individual, has been shown to be a major factor in the success of many community-managed water supplies. Women are known to be highly influential in community-managed water supplies, though the influence is not always apparent in organizational structures.

2. Community Management involves a long-term and changing partnership between communities and supporting agencies. It strengthens the capacity of each partner and enables their combined resources to be used more effectively.

A community's partners in the management of its water supply system may include government agencies, NGOs, the private sector, and, crucially, other communities. Relationships change as the community develops greater capacity to manage its own affairs, and to choose for itself where to acquire the support services it needs to keep its water system functioning reliably. Inter-community collaboration can add a new dimension, in terms of both resource sharing and replicability.

The case studies include a wide variety of community management applications, matched to particular cultural and socio-economic settings. In Guatemala, Pakistan and Indonesia, support from national and international NGOs enables communities to implement and sustain cost-effective water projects, and in some cases to replicate those projects through evolving community networks. In Yemen, Honduras, Uganda and Cameroon, government agencies successfully transfer control of water projects to communities, while enhancing their own performance and status.

3. Community management can mean more widespread implementation of sustainable water supply systems.

In the past, community management has often been seen as an approach which requires repeated time-consuming activities in one community at a time. The case studies provide important new evidence that successful community management encourages communities to help one another and in that way to achieve more rapid replication. Experiences in Guatemala, Indonesia and Pakistan illustrate the scope for community-led replication of successful approaches, with pooled resources providing dependable technical support. Community organizations can combine to form associations to share knowledge and experience, and build local capacities to manage.

4. Community management means a new role for support agencies as facilitators rather than providers, demanding new skills and offering greater opportunities.

There is a powerful logic to community management of water supplies. The resource is local, its use is local and its effects are local. Nevertheless, it has to be recognized that there are genuine fears among agency staff (and at higher levels of government) that empowerment of communities to manage their own systems may diminish the role of and respect for water agency staff, or conflict with national government priorities. In Cameroon, Yemen, Uganda and Honduras, such fears have proved unjustified. Support for community managed water supplies has brought more effectiveness and greater job satisfaction in the implementing agencies, while the community water management organizations have remained non-political.

Community management does not mean less work for agencies. It means a greater emphasis on the development of supporting and enabling skills and less on routine management and maintenance. This frees institutional, human and financial resources, to enable agencies to reach more communities. Government has a vital continuing role in establishing the policy and legislative framework to enable community management to work. It also retains the duty to protect water resources and the environment, and to maintain public health standards.

** A list of acronyms and abbreviations is included as Annex 1*

5. Benefits of community management can extend beyond water into other development activities.

The skills and knowledge acquired in building a community's capacity to manage its water system can become a stimulus for further community-led development. In Indonesia and Honduras, access to a convenient water supply plus awareness gained in project self-surveys led to the self-help construction of sanitary latrines and changes in hygiene behaviour. In Guatemala, successful water development was followed by income generation from coffee production which provided further support for the upkeep and extension of the water system. In Pakistan, there are examples of water development following from other community activities based on income generation, when the village organizing committee acquired the skills and the resources to implement programmes based on its own priorities.

6. The scope for community management extends beyond rural water supplies

Most current models for community management are based on rural experience. However, successful community management is also being achieved in peri-urban areas, with Honduras being a good example. Further study is needed to establish the criteria which make community management effective in peri-urban situations.

7. Conventional progress indicators need to be adjusted to monitor and evaluate community management

Mobilizing and equipping communities for water system management takes time. Indications are that this initial investment is paid back in greater cost effectiveness. Further work is needed to provide conclusive demonstration of the economic benefits in the long term. Conventional indicators are not an appropriate way to monitor progress in community management, in which capacity building is a major component. Alternative progress indicators are being developed and need to be tested, along with innovative participatory evaluation techniques.

APPENDIX 15

Partners in Community Management

Community management puts water users in charge of their own water system. It does not mean that the users do everything themselves. The most effective community management is an evolving partnership, in which a community-centred organization – typically a water committee – draws on resources from within the community, from other communities, and from a variety of other outside agencies. Potential partners include:

The Community

The most important partner is the community itself. Defined as the group of people using the same water supply system, the community invariably consists of many different parts. Divisions may be ethnic, socio-economic, religious, or gender-based. Communities at different stages of development differ significantly in their desire and capacity to manage improved water supplies. The case studies confirm, however, that if the need is great enough even the poorest communities are willing and able to contribute substantial resources towards the provision and upkeep of water supply improvements.

Other Communities

A new and exciting aspect emerging from the workshop case studies is the evidence of community-driven replication and sharing of successful community management approaches. Not only can success in one community stimulate neighbouring communities to follow suit, but the sharing of knowledge and pooling of resources can bring faster and more cost-effective implementation and play a vital role in long-term sustainability. The potential for inter-community networking is seen as a powerful advantage of community management over centrally managed water programmes. Further work is needed to assess the best ways of promoting and facilitating inter-community partnerships.

The Water Agency

The most common partner for the community will be the government water agency. Accustomed to a patron/client relationship, and staffed accordingly, the water agency has to undergo significant attitudinal and organizational changes to make community management work. The changes affect all aspects from staffing and training to planning, implementation and financing. These should be taken as an opportunity for achieving greater success and a higher respect from both communities and government, rather than, as is sometimes the case, being regarded as a threat to job security and a diminution of power. Agencies need a balance of technical staff and experienced community workers, and must see their role as raising community awareness, providing backstopping support, and responding to community needs.

NGOs

Non-governmental organizations (NGOs) often have a strong capacity for facilitating community-centred development, and make natural partners in community management activities. As long as conflicting interests do not create an adversarial relationship, they can help to increase the outreach capacity of governments and donors.

In the majority of the workshop case studies (Guatemala, Indonesia, Pakistan, Cameroon), an NGO is the principal partner of the community (in Cameroon alongside the Government's Community Development Department). In both Guatemala (Agua del Pueblo) and Pakistan (Aga Khan Rural Support Programme), the NGO operates in direct partnership with communities, without a water agency partner. The Agua del Pueblo case is special, in that AdP has itself become the umbrella agency providing backup support and resource management for the network of regional community water associations. In Indonesia, CARE works with the government in each stage of its project dialogue with communities, but provides the initial technical support from its own resources.

Whatever the partnership arrangement may be, partner NGOs need official government backing for their activities.

The Private Sector

Local management of water systems can be a powerful stimulus for private enterprise. Communities may hire contractors to help construct the water system; hiring local mechanics can be a cost-effective way of ensuring timely maintenance, particularly where their services are shared among several communities; materials suppliers can sometimes be a useful source of credit for community water supply improvements; and there are examples of commercial establishments and the mass media raising funds for community-based water and sanitation initiatives.

The Government

Though its role is less direct than that of the water agency, government has a vital part to play in the promotion and implementation of community management, through its control over policy and national resources. Agenda 21 is a global commitment which depends on the support of individual governments, including official support for community management. Its promise of more effective use of resources and enhanced sustainability and replicability is attractive both for internal strategic planning and for potential donor support, and in many cases may make it the only viable alternative.

The important role for governments is a facilitating one. In creating an "enabling environment" of supporting policies and legislation, government must retain the vital role of protecting public health and ensuring compliance with national norms and standards. At the same time, national training courses and education curricula may need to be modified, and new courses developed, to provide the right skills base to support community management. Governments will also need to integrate community management of rural and peri-urban water supplies into overall water resources management strategies. Most important of all, communities must be given the legitimate authority and encouragement to take care of their own water systems.

The right to manage

When it began the UNICEF supported Tegucigalpa project in the urban fringe of the capital of Honduras was operating in a very grey area of the national law and early risks were taken in seeing how far community ownership and management rights could be pushed. In time, clearer legal agreements have evolved between the national water authority (SANAA) and its agency for marginal urban areas (UEBM), UNICEF, and the communities themselves, and a sound legal framework for community management has gradually been developed. This has considerably strengthened confidence, within both UEBM and the communities. The only major constraint remaining is that UEBM can only serve communities with legal titles to land, and thus is as yet unable to offer a service to squatter settlements until their legal position is formalized.

Donor Agencies

Community management is an attractive proposition for donor support. Specifically aimed at providing sustainable services in a sector where sustainability has proved difficult to achieve in the past, it has the additional appeal of promoting community self reliance and the potential for the achievement of broader development goals.

Community management programmes often depend on external support for capital investment elements, and for early capacity building. For external support to be effective, it is important that donors recognize the changes required just as much as the other partners. Demands for rapid, demonstrable effects, may create obstacles to success. Donors must be prepared to accept longer time frames in putting community management approaches into place, and broaden progress indicators to account for "process" factors such as capacity building in measuring the return on their investment and assessing needs for further support.

APPENDIX 16

16

Background Information

1. Identification of constraints

Examples of typical barriers:

* culture/religion
* attitudes (of male leaders, husbands, women themselves)
* access to information (on the project, project meetings, community tasks)
* participation in meetings (time, location, seating, etc.)
* training
* job execution and remuneration

Cards can be combined under each constraint.

2. Potential involvement of women

(From Training material on Women, Water supply and Sanitation, ILO, UN INSTRAW, UN DTCD)

In view of their most direct interest in improved water supply and sanitation, women often play a large role in innovative approaches to management of water and waste, especially at community or neighborhood levels.

Low - income urban areas

In low-income urban areas, women have been reported to take part in water supply and sanitation management:

a) as members of local committees that manage taps or sanitation facilities.
b) as organizers and managers of water vending ('kiosk system'). United by their need for reliable and affordable water, and their dislike of high water prices from private vendors and licence holders, women of low-income urban neighborhoods in Honduras, Burkina Faso and Kenya have taken on managed their own licensed water vending points.
c) as organizers and managers of neighborhood water supplies and sanitation systems. Water is used for beer brewing, teashops and launderette.

Management in rural areas

When women are involved in management in rural areas, it is mostly in management of water use and hygiene at water points and as members of local management organizations.

Site management

As managers of communal water points, women are concerned with drainage and hygiene, proper use of taps and pumps, prevention of damage by children and livestock, and they increasingly execute preventive maintenance and simple repairs.
In some cases, traditional norms and social control on the use of communal sources and the sense of communal ownership of new facilities are strong enough to guarantee that the individual users take care of the proper use and management of the site.
In other cases, satisfactory site management has been achieved through the organization of women users. Well committees have been formed to supervise use of protected wells. Women have also been encouraged to use the pipeline routes as paths and to report leakages to the village caretakers.

Caretaking
Where women have been involved in maintenance, their role has been closely related to their traditional management tasks. They have been particularly involved in preventive maintenance and the preservation of site hygiene and the control of use at the source. In some cases, arrangements have been made spontaneously, thus preserving their original tasks as users and informal managers. In other cases, special tasks have been formulated in consultation with the agency. These have varied from appointment to a nearby women to look after the water point, to a site committee, user roster, or a team of a male and a female caretaker, with the woman responsible for hygiene and the man for technical matters.

System management
As members of mixed water management organizations comprising both men and women, women are involved especially in financing aspects, e.g. as treasurers and rate collectors.

Much of the work involved in maintenance, in particular the more regular preventive work is particularly suited for women. Reasons given in project reports include:

* the direct concern and personal interest of women in their water supply
* their regular visits to distribution points
* the compatibility tasks of women
* easier communication between women caretakers and women users
* their greater sensitivity to social pressure from other women to do a good job
* the importance of health aspects
* the lower career orientation and labour mobility of women
* the recognition that training in modern technology will contribute to household's water supply and sanitation

(see also overhead sheet 1)

3. Practical ways to women's involvement

* Get consent & support from local leaders to bring in women
* Use local organizations (church, women's groups) to inform women and get them together
* Use several channels to reach women with info on project & meetings
* Organize village meeting with men & women with help of local leaders
* Organize women's meeting with help of leaders
* Facilitate women to reach:
  . by involving female workers to help them speak out
  . by stimulating internal correction
  . by planning meeting proper time & seating
* Assist in choosing female Committee members:
  . get men & women to agree on presence and number of women on Committee
  . women choose Committee members on time, trust and social capability
* Develop local training adapted to male and female Committee members
* Unite women on common interest and help women Committee members act as women's representative
* Involve women in local decisions on:
  . caretakers
  . financial system.

The facilitator might want to use brief examples of case studies regarding involvement of women in water and sanitation programmes.
Some examples are proposed in the supporting material taken from the Annual Abstract Journal no. 1 of May 1991: "Woman, Water, Sanitation" published yearly by IRC, with support from PROWWESS/UNDP and NORAD.

APPENDIX 17

from IRC et al. (1993) Community management Today

17

Women earn the right to be heard

Women in Indonesia have proved to be skilled fund raisers and committed supporters of water and sanitation improvements, building on their traditional responsibility for managing household finances. In the village of Wonoanti, women established a number of fund-raising groups and made cash contributions each time the groups met. Once enough money had been raised a lottery was held and the winning group was given the money to build water-seal latrines. This system was continued until all groups were able to benefit. In the village of Kedompol, CARE assisted the community to build 60 rainwater catchment tanks, serving 190 households. The local women were sufficiently impressed to organize fund-raising meetings and succeeded in raising enough money to serve a further 250 households, entirely by their own efforts. Women's success in fund-raising has increased their influence over decision-making. More and more women are now occupying key positions on water and sanitation committees and are being consulted on important community decisions.

involvement is not overt or apparent in organizational structures, women often play a highly influential and beneficial role in the community management of water supplies. Women in Indonesia have proved to be particularly resourceful in raising funds for water and sanitation improvements, and have strengthened their position as decision-makers as a result.

The adequate representation of women in community managed water programmes can not be taken for granted, and the advancement of women remains a development goal. The growing numbers of women-headed households in developing countries give added urgency to this issue.

Inhibiting factors are still proving hard to overcome, but innovative ideas are being developed for encouraging enhanced involvement of women in water programmes. The panel below lists ten steps which can be taken by water and sanitation agencies to ensure that women play as full a part as possible in their programmes.

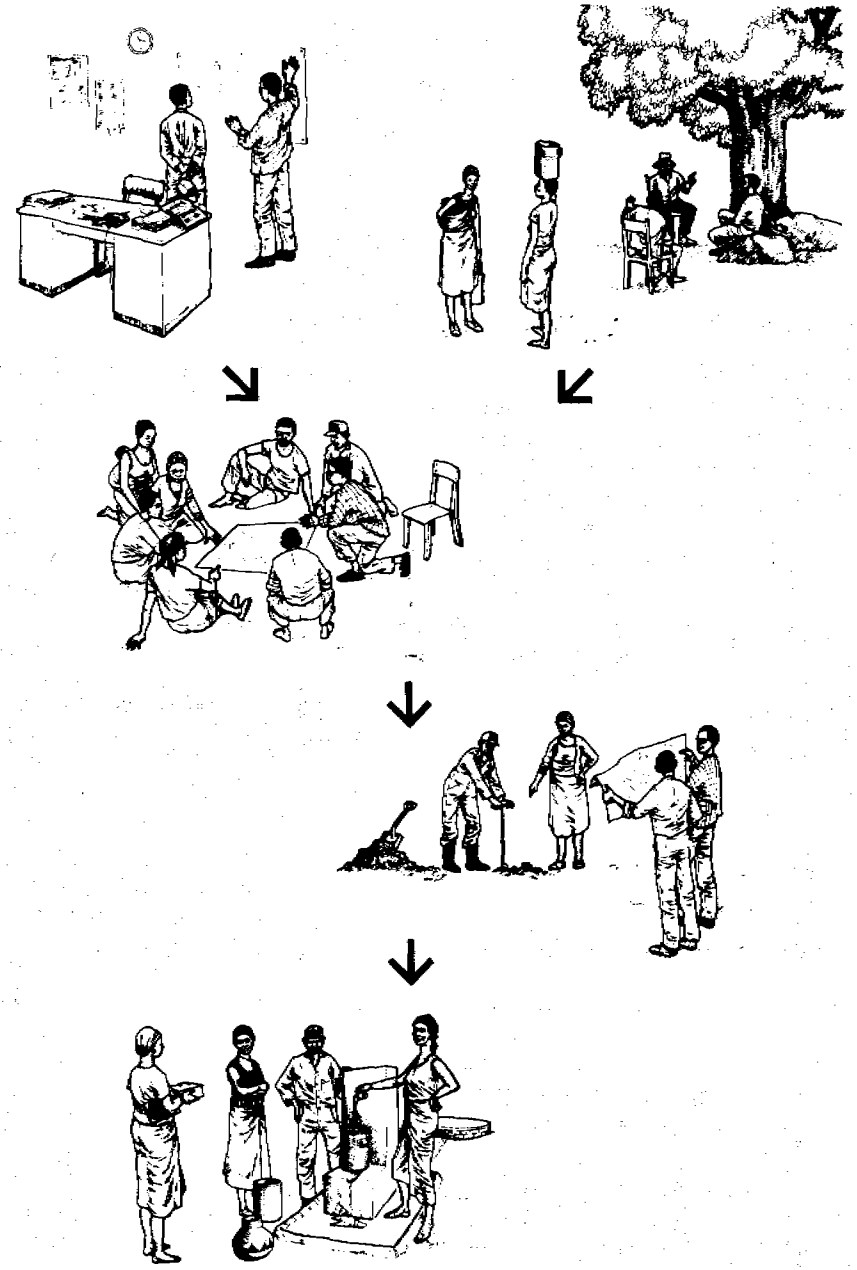
Ten key steps to enhance the involvement of women in water supply and sanitation programmes

The following steps can be taken by water agencies as a means of advancing women's involvement:

- Orient male management and staff in how women's involvement helps to realize project objectives;
- Work with women field workers, both from the agency itself and from other services, and/or with local intermediaries;
- Discuss with local leaders and authorities why women should be involved in the planning and management of water services, and how this can best be achieved;
- Inform women about project and programme meetings, using a variety of different channels, and encourage their participation;
- Organize meetings at times and places suitable for women to attend;
- Make it easy for women to hear and to be heard at meetings, by sitting them together in the main gathering, not at the back, and by conducting meetings in the vernacular or arranging translation;
- Stimulate dialogue by presentation techniques, inviting comments/questions/criticism, inserting discussion breaks, and involving respected and representative spokeswomen;
- If the participation of women in general, or poor women in particular, is difficult, organize separate meetings at more convenient times and places;
- Explain the tasks and the authority involved in system maintenance, management, hygiene education, and system finance before choosing local candidates; discuss which roles are best performed by women and who are the most suitable candidates;
- Give training adapted to women's conditions and roles, and include follow-up visits for monitoring and support.

Source: C van Wijk, 1989. Community management and sustainable water supply in developing countries. Mimeo, IRC, The Hague.

APPENDIX 18



The Partnership Approach.

1. *Towards Sustainable and Effective Services*

Considerable improvements for many millions of people have been brought about by the International Drinking Water Supply and Sanitation Decade (IDWSSD). Nevertheless, by the end of 1990, when the IDWSSD came to an end, at least 800 million people in the rural and urban fringe areas of developing countries were still without a safe supply of drinking water (WHO, 1988). With the developing world population rising at a rate of 160,000 people per day, the challenge of providing basic services for all people by the end of the century is formidable.

But providing new or improved water supplies is only part of the challenge. Experience during the IDWSSD has shown only too clearly that operation and maintenance of water supply systems once they have been installed poses severe difficulties for many water agencies. Examples of recently implemented water projects which have fallen into disuse and disrepair are all too common. They represent a waste of money and effort, and have a strong demotivating effect on the communities concerned when further initiatives are suggested.

1.1 Objectives of improved community water supplies

The IDWSSD has helped donors, recipient governments and sector agencies to learn some important lessons about the approaches to community water supply improvements in developing countries. The most critical of these lessons involves the relationship between the water agency and the benefiting community at all stages of project planning, implementation, operation and maintenance.

Failures of all types of water projects can frequently be traced to the fact that either the community or the water agency has been unable to meet the commitments necessary to keep the installed facilities functioning. Because so many water systems have fallen into disrepair, the key concept for water projects today is to ensure **SUSTAINABILITY**, that is, to *design, build and manage improved water services in such a way that they continue to function reliably and well, and the funds for keeping them functioning continue to be available.*

"Functioning reliably" in this context means that the systems function throughout the year with convenient operating times and only infrequent breakdowns, which are quickly repaired.

"Functioning well" implies that the systems supply enough water to meet at least the basic needs of all households in the defined project areas, and that this

water is of a consistently acceptable quality. It also means that the systems are expanded in time to cope with population growth and increased water use, and that enough funds continue to be available to maintain the agreed standards of operation.

The cases where water agencies can do this job alone are not frequent. Most agencies deal with large and rapidly growing numbers of small and scattered water systems in large areas, often with difficult access. The same agencies usually have a shortage of trained manpower, lack of reliable transport and insufficient funds to meet the service requirements of the system. One way out is to lower agency costs (for example by decentralization) and seek more financial contributions from the government and/or the users. Another, and increasingly popular approach is to reduce direct maintenance costs and improve results by sharing maintenance and repair tasks, including management and financing, with the user community itself.

However, sustainability is not the only goal for a successful water supply project. Sustainable services which a part of the population in the project communities does not actually use, or uses ineffectively, fail to realize their potential health and socio-economic benefits. The sustainability concept is therefore complemented by the concept of **EFFECTIVENESS**: *all families in the project communities actually use the improved water service in an optimal way.*

"**Optimal way**" in this case can have several meanings: general and exclusive use, hygienic use and developmental use.

"**General and exclusive use**" occurs when all households in the project communities use only the improved water system, at least for drinking. This will only happen when the improved water system is competitive with the formerly used water sources, the service is reliable and affordable and the water quality (taste, colour) acceptable. In some cases, unimproved water sources will still be used by some or all households, e.g. in case of competitive traditional sources, or prolonged breakdown of the improved system. This need be no problem when drinking water is consistently boiled, or when traditional sources are adequately protected and hygienically used (see figure). However, this is seldom the case without special project inputs.

"**Hygienic use**" means that drinking water from the improved water system is collected, stored and drawn in a safe manner, without risk of contamination. Also intake areas and water points are kept clean and free from polluting activities and conditions. Further, the volume of water used from the improved system should increase in comparison with that from traditional water sources, indicating improved personal and domestic hygiene.

"**Developmental use**" occurs when women and children benefit from shorter distances, lower efforts and/or greater safety in water collection; women and children have as a result more time and energy to spend on domestic or economic work, education and community development. More surplus water becomes available near to the home for vegetable gardening, animal husbandry and small-scale industries like brick and tile making. While such benefits are feasible, they usually only occur with the right preconditions and inputs.

Hygienic use of water includes improved personal hygiene, and brings greater health benefits. Photo: PROWWESS.

The concepts of sustainability and effectiveness are related: when systems do not function reliably and well it will not be possible to establish good use. On the other hand communities have to be convinced of health and other benefits of safe and sufficient water to be motivated to take up a large share of maintenance and management responsibilities and tasks for long-term sustainability.

To promote sustainability and effectiveness as they are outlined here, agencies have to adopt a new approach and acquire new skills, different from those which have been usual up to now. Instead of emphasizing technical knowledge and inputs only, they will need to focus more on ways of sharing knowledge, decision making and tasks with communities.

1.2 Piped systems and the need for partnership

Piped water systems offer excellent opportunities for the sustainable implementation and effective use of improved water supply. The term "piped supplies" covers a range of water supply systems with different degrees of sophistication and complexity. Piped supplies differ from "point source" systems (handpumps and dug wells) in that the water is conveyed by pipes some distance from the source to a number of distribution points. The power needed to achieve this water transmission will ideally be natural (gravity flow from upland streams or springs) or, more commonly, where gravity flow is not possible, be provided by motorized pumping (electric, diesel, solar, wind) from boreholes or river intakes to elevated storage tanks. At the consumer end of the system, distribution of the water may be through public standposts, neighbourhood taps, yard taps, or individual house connections.

When they function reliably, piped supplies offer a higher level of service than point source systems. Taps can be more conveniently located than the boreholes or dug wells from which consumers must lift or pump their own water; and the quantity of water available from a reliable piped supply system is generally greater than from a dug well or handpump. As a result, general and exclusive water use and improved hygiene are more easily obtained, especially in the case of group, yard or house connections. Average water use for communal taps within 250 metres for example, ranges from 20 to 50 litres per person per day (l/p/d). For single private taps this range is 30 to 60 l/p/d, while use from communal traditional sources may be as little as one litre, but is usually around 4 to 12 l/p/d.

The pre-condition "when they function reliably" is important. The price of the increased convenience of piped supplies is added complexity and extra cost. Piped supplies keep functioning only when pumps, pipes, valves and taps are regularly maintained, leaks are promptly repaired, fuel supplies are continuous, and spare parts are on hand when needed. They depend too on water resources being sufficient to cope with growing demand, and on suitable drainage facilities being provided and maintained, to dispose of extra wastewater. There is no shortage of examples of systems where these basic requirements have not been met. Long queues of water containers waiting for the next "on" period of an intermittent supply are a common sight in developing countries.

Often the problem can be traced back to poor planning. Attractions of piped supplies compared with, for example, handpumps encourage their adoption for communities where upkeep of the technology cannot in reality be afforded or managed. The result is a badly functioning scheme and "beneficiaries" worse off than they would have been with a less superficially convenient but more reliable system based on handpumps. Where communities do have the resources and the willingness to look after a piped water supply system, careful planning and design are essential ingredients of long term success. In most cases, the agency

will need to prepare local people for such tasks as lubricating pumps, checking and repairing taps, tracing and repairing leaking pipes. Guidance will also be needed on appropriate management and financial systems to ensure that fuel, spare parts and major repairs are available and can be paid for when needed. If surface water is used and there is a need for treatment, additional training of operators will be necessary, along with the organization of supplies of any chemicals needed.

As well as equipping the users to meet their maintenance commitments, the water agency must accept commitments of its own. Any initial training will need to be followed up with refresher courses and regular monitoring and advice for local caretakers/mechanics and management organizations. Supplies of fuel and spare parts will have to be organized, as well as agency assistance for the more major repairs. The agency will also need to offer continuing hygiene education, advisory and problem solving services. Cost recovery mechanisms will be needed to ensure that the agencys own inputs are sustainable.

Regular training is needed for local mechanics, as well as for agency staff. Photo: WHO/WPRO.

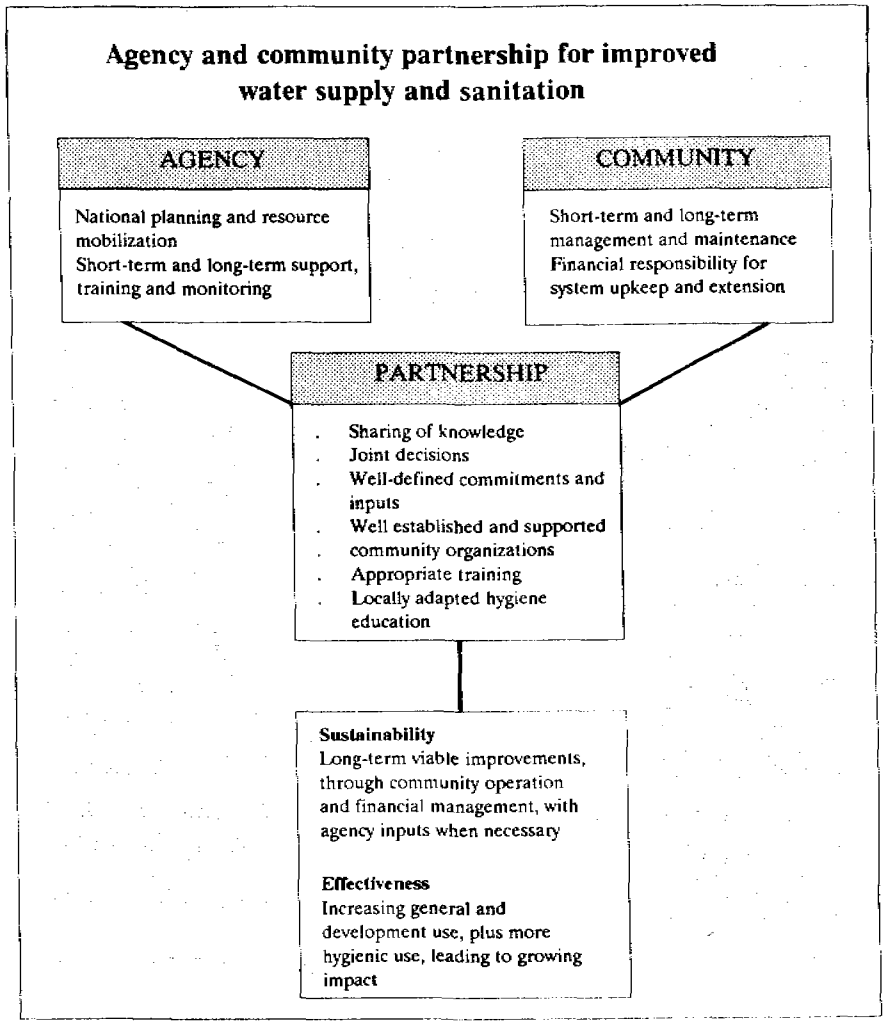
Recognition of these, and many other needs of a successful piped water supply system, has led to the concept of a "**PARTNERSHIP APPROACH**". Right from the start, it is argued, decisions about types of technology, levels of service, positioning and frequency of neighbourhood taps, organization of water committees, provision of local labour for construction, selection and training of community members for maintenance duties, and so on, need to be reached jointly through continuous dialogue between the prospective users of the new system and the implementing agency. This partnership not only has to continue throughout the project cycle, including the monitoring and evaluation of all phases, but also after the project, when community and agency co-operate in maintenance of the system.

Community participation is not a new concept, but its application in the planning and implementation and maintenance of water supply systems is only recently being attempted in such a comprehensive way as called for by the partnership approach. However, experience shows that it is only when the community is in this way involved in all parts of the project cycle, and plays a real part in decision-making, that new systems will be accepted and successfully maintained.

Adoption of the partnership approach requires considerable skill on the part of the implementing agency. Technological knowledge must not be used to override the desire of a community for particular levels of service, but must be shared in such a way that the choice emerges through the community's own decision-making processes. Ways of involving different sections of the community in water supply planning, implementation and operation are discussed throughout this book.

1.3 Some key aspects of the partnership approach

Why is this partnership so important for sustainability and effective services? Experience over the last ten or more years shows that communities will only maintain and pay for water supplies which they feel are an improvement over their traditional systems and consider are worth spending their limited resources on. The best guarantee to obtain accepted and sustained water systems is to involve users early on in decisions on what they can get, what the technical, cost and health consequences of each option are, and how they could organize such improvements. The following are some key aspects of the partnership approach, drawn from the lessons learnt from world-wide experience so far.



Choosing technologies that are acceptable and sustainable

One useful general principle applying to technology choice in community water supplies evolved during consideration of the preconditions for success on handpump projects. It is that "the technology chosen should give the community the highest service level that it is willing to pay for, will benefit from, and has the institutional capacity to sustain" (Okun and Ernst, 1987).

There is sometimes a tendency for water agencies, perhaps under pressure from donors, to steer communities towards choosing lower cost technologies, on the basis that available funds can then be spread further. While it is a mistake for a community to aim for a level of service too high for it to afford or sustain, those users who do have the resources to sustain yard taps or house connections should be encouraged to do so. Seemingly "cheaper" options will often fail because they do not meet the people's aspirations and will not be accepted. It is however important that consumers receiving higher levels of service should pay the full costs of providing such services, if others are not to be penalized.

An example is the standpost programme supported by USAID in Thailand in the 1960s (Dworkin et al, 1980). The installed pumps were not maintained and used only to a limited extent because the service was not considered better in terms of convenience, privacy, water quantity and quality. Subsequent rainwater collection tanks and piped systems with yard connections became very popular, especially when appropriate financing systems to sustain them were set up.

On the other hand it is wrong to presume that yard-tap supplies automatically provide a higher level of service than, for example, handpumps. If the supply to the yard taps is only available for a few hours a day because of water or fuel shortage, or if pump breakdowns mean that no water can be supplied for several weeks until the mechanic arrives, most communities when asked to make a conscious choice, would sacrifice the "convenience" of yard taps and settle for a walk to a neighbourhood handpump supplying continuous water and repaired by the village caretaker as soon as it breaks down. The key point is that, whatever technology is chosen, it must be sustainable with the resources available to the community.

Accepting varying needs and capacities as a starting point

Taking sustainability as a guiding principle means recognizing two additional points:

(a) different communities are not necessarily uniform in their needs and capabilities and
(b) within the communities themselves, user needs and readiness to contribute also varies.

As a result, a mixture of technologies and service levels may often be the right answer.

At present, often only single technologies and service levels are introduced, regardless of the characteristics of the communities concerned. At one end of the range of conditions, communities may be poor isolated villages with subsistence agriculture and limited technical and administrative experience, yet a great sense of unity and self-help tradition. At the other end are large, well-to-do settlements situated along main roads or railways, with growing businesses, a cash economy, modern administration and a desire for efficient

private services without community demands on self-help and voluntary administration. Yet both types of community often get the same technology and service levels, because of national standards or donor decisions, even though individual consumers may be willing to meet all extra costs for an above-standard service.

Within communities, needs and potentials also differ. In the Thai case for example, even when yard-tap piped supplies were offered, some poor families were not ready to pay the relatively high water rates and did not connect to the service. This hampered the public health and social benefits of the system, and 60% of the systems provided water for less than the whole community. A greater mix of service levels, eg. group connections next to private taps or spreading payment of connection costs, may increase the accessibility of lower income households to a sustainable basic service.

Planning for community involvement

For the partnership approach to be fully effective, the agency has to plan carefully for the involvement of communities in all project planning and decision making. The communities not only have to be informed on the project but the agency must in the first place work with them to identify their needs and capacities. To give both the agency and the communities a good overview of conditions and issues that have to be taken into account, it may be necessary to gather some baseline data on water use and needs, socio-economic status and health and hygiene conditions, of the communities concerned.

Another important aspect of planning for community involvement is the identification or establishment of strong community organizations which will be able to take on the management of the improved water system.

Informed decision-making during local planning

If the communities are to take on all or part of the maintenance, management and financing tasks after the installation of the water supply, it is only logical that they should get an informed choice on what they are going to maintain, administer and finance. Each technology type and service level has its own consequences for community inputs during construction; cost and complexity of maintenance and administration; likelihood of reliable service; quantity and quality of the water supplied; potential benefits for community and family health; costs and productive use of water; time gains. It is only when the full consequences of each option are considered that the users can make a wise choice, and the basis is laid for future community contributions.

Choosing appropriate maintenance, management and financing systems

Just as the appropriateness of the technology choice and service levels have to be considered on their longer-term consequences, so have the appropriateness of different maintenance, management and financing options. Management of the water system by an existing village organization may for example be possible when this organization is efficient, can handle different tasks at the same time and represents the interests and has the support of the whole community and not just of a specific section. In other cases, some other form of local management will have to be looked for. The same goes for local maintenance and financing, say in choosing between repairs by village-selected, trained and employed staff, or instead relying on private enterprise in the area, or in choosing between monthly collection of water rates or organizing different types of public fund raising.

Continuing local planning after the design phase

During local design and planning the basis is laid for future maintenance, management and financing, for example by choosing suitable village water organizations, suitable candidates for maintenance training, and agreeing on the principles and approximate costs of local maintenance and management tasks. More detailed planning of the active work will come during the later stages of the project, when the physical work has started, and again when it is nearing completion. Thus, there is a progressive refinement and practical character to local planning, supplemented by specific training for agreed tasks.

Formal division of responsibilities and rights

Another fundamental aspect of the partnership approach is that the sustainability of any water system depends on the right division of responsibilities between the beneficiaries and the water agency concerned, in both implementation and operational phases.

Duties and rights of each party in planning, construction and maintenance need to be clearly defined, and mechanisms for making sure they are kept agreed upon. This makes clear where each party stands and increases opportunities for corrective action, for communities as well as agencies. Agencies may for example have the duty to ensure that all construction material is in place before self-help in trench-digging is started, to avoid trenches that have caved in by the time the pipes arrive. Communities may have the duty to keep maintenance records so that the agency can assess the cost-effectiveness of its participatory programme in the longer run, and at the same time have the right to receive the training, record books and supervision needed to do a good job.

Training and support on technical and managerial aspects

The capacity of a community to manage the maintenance of a particular technology can be developed only if project planners include some essential provisions in the overall programme. Unless tools, lubricants and regularly-needed spare parts are easily accessible locally, the community will have to depend on agency mechanics, even for routine maintenance. Evaluation and possible strengthening of manufacturing, distribution and sales outlets for essential materials and components must be part of the project planning.

Similarly, planned training programmes for caretakers and mechanics, and practical training in simple budgeting, financing and financial management for village water organizations are vital to the ultimate success of the community water project.

Training for these tasks will often involve strengthening the capabilities of local or district offices of the agency itself to support community activities or to establish collaborative programmes with other agencies or institutions capable of training and supporting community organizations. Thus, the PSWS water supply project in Malawi (Kwaule, 1988) had first to develop a more practical bookkeeping system and train programme staff in monetary skills before it could train rural committees for better financing and financial management.

Complementary improvements in sanitation and hygiene education

Apart from sustainable and reliable water systems, there is another essential component if maximum health benefits are to accrue: provision of new water supplies has to be accompanied by complementary improvements in sanitation and in hygiene education. This need for integration means that water supply programmes must have an interdisciplinary approach, combining technical aspects of health, water supply and sanitation with socio-economic and cultural issues influencing the upkeep and use of new facilities. Merely adding general health programmes to water supply projects has proved not to work (Burgers et al, 1988). Usually successful water supply projects demand a specific hygiene education strategy as well as close collaboration among ministries and agencies at all levels, to work towards the common goals.

Planning for extension and upgrading

Agencies also need to encourage communities to see the development of water supply systems as a step-by-step process. As benefits accrue and operational experience is gained on the first level, so the demand for improvements and the capacity to sustain them grows, until the community is ready to take further steps. Thus progressive upgrading of initial lower technology solutions - such as public standposts to neighbourhood and yard taps - and expansion of service to new settlements areas, can be achieved as the community develops.

Monitoring, evaluation and sharing of information

To be able to improve on project actions and procedures and to learn from experiences, regular monitoring and evaluation of projects are necessary. With the partnership approach both agency and communities will contribute to monitoring and evaluation and will benefit from the results.

Finally, it is important to recognize that the replicability of successful approaches depends on the sharing of information about both successes and failures. Timely and comprehensive recording of project results and evaluation of the approaches and technologies used, provides valuable data for future planning and implementation. For example the results of the PSWS demonstration project have been laid down in a series of country-level reports, including a comparative overview of the different approaches developed in the four participating countries.

from: Estimating O&M costs for WS in DCs
by Jordan & Wyatt (1989) WASH report 48

1.4.2 Other Uses of the Workbook

The workbook can also serve as a useful guide for proposed and existing water supply systems in other areas, such as:

1. Preparing the O&M Budget. The guide will help O&M managers to determine line-item costs that should be included in the annual budgets for operations and maintenance.

2. Analyzing Existing Water Supply Systems. The guide will help to identify high cost areas and enable managers to assess more easily the impact of changes in system operation. It will help to pinpoint areas where savings may be realized through system modifications. For example, being aware of the method used by the electric utility to calculate power charges may suggest alternate schedules for operating water pumps.

3. Analyzing Design Alternatives. O&M cost estimates can be prepared for different engineering design alternatives or levels of service and their cost implications can be examined. That is, the O&M cost for providing water to a community in different ways can be estimated and evaluated. For example, the decision of whether to provide standposts or yard taps can be based not only on initial investment costs but also on the recurrent costs of operations and maintenance. The affordability and consumers' willingness to pay can then be compared to a realistic estimate of recurrent costs.

4. Project Redesign. The inability of the water board or local communities to fund O&M costs for a new water project has, on occasion, forced the reconsideration of the design of the project. Unfortunately, the conclusion that the project should be modified because of lack of funds for O&M often is not reached until major capital investments have already been made. Clearly, an early estimation of O&M costs, as well as an assessment of the ability of the government and consumers to fund recurrent costs, will assist project planners in designing a sustainable project, avoiding the costly situation where a water supply project needs to be modified in midstream.

5. Tariff Design. The first step in tariff design will be an estimation of O&M costs. This information, along with willingness-to-pay data, water demand data, and other inputs, can lead to an appropriate tariff.

APPENDIX 19

from Rosen et al. (1993) Models for Management of O&M of RWSS facilities 19

Table 1

Tunisia Rural Water Supply Maintenance System

Sectoral Level	Organization	Primary Role or Activity (Currently or in near future)	Degree of Organization's Involvement		
			Past	Present	Future
Central	■ International Bilateral Donor Agencies	■ Provide funding for technical assistance & training.	Medium	Medium	Med/Low?
	■ Ministry of Agriculture	■ Establish O&M policies and procedures; provide technical assistance and training to regional MOA maintenance offices; assist in equipment procurement and efforts to standardize equipment.	Low	Medium	Low
	■ Ministry of Health	■ Establish and supervise programs at regional level for hygiene education, and water disinfection.	Low	Low	Low
	■ Ministry of Finance	■ Establish and supervise procedures for oversight of community financial management.	Low	Medium	Low
	■ Engineering Firms & Consultants	■ Conduct studies and provide technical assistance under contract.	Low	Low	Medium
	■ Equipment & Material Manufacturers, Importers & Suppliers	■ Provide equipment and parts	Medium	Medium	Medium
Regional	■ Regional Water Resource Committee	■ Oversee community water user association legalization process and annual budgeting.	None	Low	Low
	■ Governor and Governorate Council	■ Provide funds to assist communities with O&M expenses, as needed, through budget negotiation.	High	Medium	Low ?
	■ Ministry of Agriculture	■ Assist in the establishment and monitoring of community user associations, negotiate O&M budgets and responsibilities with communities, train and assist communities to conduct O&M, conduct major repairs and rehabilitation work, develop and execute preventive maintenance programs with communities and private sector crews.	High	Medium	Med/Low ?
	■ Ministry of Health	■ Conduct hygiene education and disinfection programs in communities in cooperation with MOA.	Low	Low	Med/Low ?
	■ Ministry of Finance	■ Exercise financial control of expenses and revenue.	None	Low	Medium
	■ Engineering Firms and Consultants	■ Conduct studies and provide tech. assistance.	Low	Low	Medium
	■ Equipment and Material Suppliers	■ Provide equipment and parts.	Medium	Medium	Medium
	■ Contractors, Mechanics, & other Repair Personnel	■ Conduct repairs and other maintenance under contract to MOA or to communities.	Low	Low	Medium
	■ Regional Training Centers	■ Conduct training for communities (planned).	None	None	Medium?

Sectoral Level	Organization	Primary Role or Activity (Currently or in near future)	Degree of Organization's Involvement		
			Past	Present	Future
Delegation (District Level)	■ Ministry of Agriculture (only some regions)	■ Assist regional crews and communities w/ communication and logistics on maintenance.	Low	Medium	Medium
	■ Ministry of Finance	■ Exercise financial control of expenses and revenue.	None	Low	Medium
	■ Mechanics and other Repair personnel	■ Conduct repairs or other maintenance on demand or contract from communities.	Low	Low	Medium
Community	■ Board of the Community Water User Association	■ Oversee all O&M activities, oversee fee collection; hire and supervise operator; contract with repair people; negotiate responsibilities & establish budgets w/CRDA; attend and plan training; manage funds.	None Low	Medium Medium	High High
	■ Pump Operator / Caretaker	■ Operate system; conduct preventive maintenance and small repairs; stock parts and supplies.	Low	Medium	High
	■ Water Users	■ Use water and equipment carefully.			

APPENDIX 20

20

Background Information

1. Who is involved in O&M ?

A great number of actors are involved in various tasks and roles, each with its own potential and limits.
Four entities can be described though as having a determinant action and influence on O&M activities of rural water supply and sanitation schemes. A fifth one, external support, is implied with supporting activities at all level.

Four types of actors directly involved:
- the community
- the public authority
- the water agency
- the private sector

One type of actor involved in supporting activities:
- external assistance

COMMUNITY

PUBLIC AUTHORITY

WATER AGENCY

PRIVATE SECTOR

EXTERNAL ASSISTANCE

A. THE COMMUNITY

THE USERS:

<u>WHO?</u>
Users are collecting water for their household needs, for public use (schools, dispensaries) or for productive use (agriculture, gardening or livestock).
They can be independent individuals or informal groups of neighbours or women. Women often carry the task of collecting water and are therefore often present on water sites.

<u>ROLE?</u>
They can carry out routine maintenance tasks in order to keep water points clean and tidy without any financial charge but their participation will depend on their commitment.
They are an important financial source in the community - based O&M management systems, and their contribution will depend on their affordability and willingness to pay.

CARETAKERS:

WHO?
A caretaker can be appointed by the community, or individuals, women in many cases, can have the task of a caretaker.

ROLE?
A clear job description must be done concerning the daily and weekly routine and preventive maintenance, small operating procedures and minor repairs and /or replacement of parts. With a proper former training and a good keeping of records, the caretaker's task will be optimum.

LOCAL HUMAN RESOURCES:

WHO?
Local mechanics, other craftsmen, shop owners, cooperatives can be also active in O&M activities.

ROLE?
Mechanics and craftsmen can provide their skill for minor repairs and in some cases major repairs and replacement of parts. They should be acquainted though with the technology involved in the water supply scheme.
Shop owners can insure the provision and distribution of parts, but this will greatly depend on the regional and national availability of parts.

TRADITIONAL LEADERSHIP:

WHO?
In many rural areas of developing countries, traditional leaders (chiefs and councils of elders) still have a considerable authority in the community they live in.

ROLE?
They cooperate in the initial decision - making process, but they do not always represent the community as a whole.

TAP COMMITTEES:

WHO?
Formal gatherings of individuals, often women, living in the same neighbourhood, in close relationship with all the other users.

ROLE?
They look for hygiene around the taps as well monitor basic maintenance and repairs. Their advice and cooperation should be included in the higher level decision-making bodies.

WATER COMMITTEES:

WHO?
Formal association representing all the different members of the community (men, women, old, young, teachers, plumbers, mechanics, etc..).
They can be directly elected by the community members or formed by the water agency or the local council, and should represent all shades of local opinion.
The committee is composed of : a chairperson, a secretary, a treasurer, of several other advisory members and in most cases the caretaker.

ROLE?
They represent the community in contacts with the agency.
They organize collection and management of contributions.
They organize and supervise O&M activities and procedures.
They inform the community on activities and expenditures.

DEVELOPMENT COMMITTEES:

WHO?
Formal association englobing a whole range of development projects locally, where the cover area should coincide with the water supply boundaries, the water project being considered as a sub-committee.

ROLE?
Global coordination of activities and expenditures on a local level but these committees may not represent necessarily the view of the community.

LOCAL AUTHORITIES:

WHO?
Local authority boundary can coincide with the project area.

ROLE?
Providing a legal and institutional framework representing sometimes more the interests of the government rather than the interests of the community concerned.

B. THE PUBLIC AUTHORITY:

WHO?
The administrative body is represented at the local, district, regional and national level. They can represent the interests of the Ministry of Health and the Ministry of Water and Natural Resources. A National Development Bank or Development Fund can be present in the sector.

ROLE?
Mainly to provide a legal and institutional framework for the water sector in general and O&M in particular, through a water policy , subsidies, taxing system, control of water quality standards, training of local personnel, promotional activities on health behaviour and ensuring a proper manufacture and distribution network of spare parts throughout the country. The National Bank can allow an access to foreign currency if needed. The National or Regional Development Fund gives an access to loans for development the sector.

C. THE WATER AGENCY

WHO?
In many developing and developed countries, one or several water agencies are operating on a local, regional or national level. They can be public or private. They operate through a network of mobile teams and are organized as large firms.

ROLE?
Mainly to ensure a reliable and sustainable water supply throughout the country or the region, through periodic control and emergency interventions or major repairs and replacements. They have the disadvantages of a centralized system, with a limiting role and responsibility for the community implied. National budget expenditures cuts might affect particularly the O&M sector, being an "unproductive" sector. The present trend is to seek a partnership approach between the water agency and the community, the agency playing a supporting role and ensuring that supplies and back-up services are available when needed.

D. THE PRIVATE SECTOR

WHO?
The private sector's presence in O&M activities of rural water supply schemes lies in the manufacturing and the distribution of parts as well in the commercial banking system.

ROLE?
Spare parts for pumps, engines, filters, piped distribution systems can be manufactured by private firms, which can give indications and technical advices regarding a proper use and maintenance of equipment. In some cases, manufacturers can provide directly for maintenance being a part of the contract negotiated during the purchase of the equipment. Traders and shops can insure a proper distribution and an "always" available provision of parts. Commercial banks can assist important communities in obtaining loans.

E. EXTERNAL ASSISTANCE

WHO?
Multilateral and bilateral cooperation agreements and aid agencies, support agencies, NGOs and Development Banks.

ROLE?
After the completion of the planning and constructing phase, the general policy of external supporting agencies (ESAs) has been to hand over the projects to the government responsibility. Its main field of activity though continues to be in advising, monitoring and evaluation activities, training activities and foreign currency availability.

APPENDIX 21

from WHO (1984) Preventive Maintenance of Rural w.s.

Annex 4

PREVENTIVE MAINTENANCE CHECK LIST FOR A SHALLOW WELL/HANDPUMP INSTALLATION

Maintenance Period	Task to be performed	Materials Required	Allocation of Responsibility
Daily	(i) Check operation of the pump	-	On-site caretaker
	(ii) Check all nuts and bolts and tighten as necessary	-	
	(iii) Clean the concrete slab	-	
	(iv) Clean the wastewater drain and check that water is not leaking back into the well	-	
	(v) Inspect and repair protective fence	-	
	(vi) Control use of area as playground/work area	-	
Monthly	(i) Check for damage, rotting of wooden handle (if fitted), etc.	-	On-site caretaker
	(ii) Grease and oil all pivot points, oil wooden handle (if fitted)	Lubricating Oil	
	(iii) Check concrete slab for cracks and make temporary repairs as necessary	-	
6 months	(i) Remove and disassemble pump unit, rising main, cylinder, etc.. Inspect and repair as necessary	Spare parts as required	On-site caretaker plus maintenance team
	(ii) Pump out well, remove all debris and disinfect with bleaching powder	Bleaching Powder Plastic Buckets	
	(iii) Repair all cracks in well slab, base and wastewater drain	Cement	

APPENDIX 22

from WHO/IRC
Training Manual

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Working sheet for all type of scheme

1. DESCRIPTION OF THE SCHEME

Type of scheme:

The description can simply be in the form of a list of key elements grouped under the main components making up the scheme.

Description given in handed-out explanation of the exercise.

2. DESCRIPTION OF O&M ACTIVITIES

Type of scheme:

Daily

Weekly

Monthly

Annual

Irregular

Working sheet for all type of scheme

3. DESCRIPTION OF O&M REQUIREMENTS

Type of scheme:

Labour
unskilled

semi-skilled

skilled

Materials & equipment

available within the community

available within the country

only available outside the country

Finance

community funds

government funds

Working sheet for all type of scheme

4. IDENTIFICATION OF TASKS

Type of scheme:

O & M TASKS:	Supervision & Monitoring	Operation	Preventive maintenance	Minor repairs	Major repairs
COMPONENTS					

** essential for sustainability
* preferable for sustainability
-- not relevant

Supporting material

2. DESCRIPTION OF O & M ACTIVITIES

Type of water supply: Borehole with handpump

Daily	Check pump operation: early morning foot valve test; normal or low delivery. Check handpump: firmly fixed in place; check for loose nuts and bolts. Check pump surround: clean the platform and drain; check the fence and if gate will close.
Weekly	Carry out daily checks and in addition: tighten all above-ground nuts and bolts with a spanner; clean moving parts and only grease parts which require greasing.
Monthly	Same as weekly checks. Collect and record contributions to the water committee.
Yearly	Dismantle pump head parts; Remove connecting rods, piston assembly and foot valve; Inspect all parts; Replace worn or defective parts; Replace piston seals; Straighten bent connecting rods, or replace; Replace rods with badly corroded threads; Replace corroded or missing connecting rod lock nuts. If connecting rods show bad corrosion, remove rising main; Check rising main and replace pipes with badly corroded threads; Clean pipe threads and install rising main. Re-assemble and replace below-ground parts; Assemble pump head and grease where necessary. Check pump operation and pump until the water delivered is clean. Record all significant actions.
Irregular	If cracks appear in the pump platform or drain, repair with cement mortar. If pump mounting bolts become loose in the concrete platform, remove pump, breakout old bolts, and remount in fresh concrete. If pump delivers cloudy water with silt - clean borehole.

Supporting material

3. DESCRIPTION OF O & M REQUIREMENTS

Type of water supply: Borehole with handpump

Labour	
unskilled	Users can carry out the daily activities. Water committee to organise maintenance and collect, record and dispense funds for spares and repairs.
semi-skilled	Caretaker can carry out the weekly checks
skilled	Water agency maintenance team to carry out annual preventive maintenance. Private or water agency mason for concrete work.
Materials & Equipment	
available within the community	sand for mixing cement mortar fencing materials brush for cleaning platform and drain record book and pen
available within the country	cement for platform repairs spare parts for pump repairs tools for preventive maintenance and repairs pipes for the rising main
only available from outside the country	vehicle and fuel for maintenance team
Finance	
community funds	labour and materials for platform repair purchase of handpump spare parts
government funds	maintenance team

Supporting material

2. DESCRIPTION OF O & M ACTIVITIES

Type of scheme: gravity piped distribution to standposts

Daily

At each standpost: if use of standpost is controlled by a lockable tap or isolation valve - unlock tap or open valve.
check the tap operates correctly;
check the flow of water is normal.
Attend to any dripping tap.
Attend to any leaking valve.
Clean the standpost platform, drain and surroundings.
Inspect standpost structure, platform and drain - repair any cracks in the plaster with cement mortar.

Weekly

Reservoir: Check -
there are no leaks;
the overflow is in good order;
valves are in the correct position;
water is flowing into the reservoir at the required rate.

Walk the distribution pipeline:check for pipeline leaks;
look for any disturbed sections of pipe e.g. erosion around gulley crossings;
check valves are correctly set.

Monthly Collection of water committee contributions

Yearly

Drain reservoir, clean and inspect.
Repair any damage to the reservoir tank.
Plaster and make good any cracks in the walls and floor of the reservoir.
Check the operation of valves and inspect internal parts if a valve is stiff to operate - repair or replace parts as necessary.
Check air release valves.
Open 'wash-outs' to flush pipeline.
In the dry season, remove soakaway stones - clean soakaway pit and stones before replacing.

Irregular

Repair pipeline leaks;
Control erosion around pipes.

Supporting material

3. DESCRIPTION OF O & M REQUIREMENTS

Type of scheme: gravity piped distribution to standposts

Labour	
unskilled	Users carry out daily checks at the standposts Users assist in annual activities Users assist in the repair of pipeline leaks and erosion control Water (tap) committee collects, records and dispenses funds for tap and valve spares, etc. or replacement Water committee officials keep records of leaks and repairs
semi-skilled	Caretaker carries out daily and weekly activities on the distribution system
skilled	Water agency pipefitters to assist in major pipeline leaks Water agency or private mason to repair reservoir Private mason to repair standpost structures
Materials & Equipment	
available within the community	sand for cement mortar; brush for cleaning platform and drain; stone for erosion control; tools for digging up broken pipe
available within the country	cement for reservoir and standpost repairs; PVC and steel pipe for major pipeline repairs; spares for taps and valves; tools for maintenance and repair
only available from outside the country	-
Finance	
community funds	all labour and material costs of tap, valve and minor reservoir and pipeline repairs.
government funds	cost of the pipefitters and materials for major pipeline repairs.

APPENDIX 23

2. *Why Should Users Pay for Water and Sanitation Services?*

The issue of community financing of water and sanitation services is complex and controversial. The most basic question to ask is why an increased share of responsibility should be taken by communities in paying for services. A variety of points of view are to be found in the literature, with some seeing no realistic alternative to user payment and others presenting a more cautious view. A number of the major arguments are presented in the following pages. Some of the most forceful arguments for maximum cost recovery from users are outlined first. These are then put alongside some of the constraints and dilemmas which have led others to adopt a softer line. In the process, it should become clear that user payment is an issue with many facets and very broad implications.

The evidence in the literature suggests that although the case for user payment is strong, adopting community financing as a universal policy may prove to be extremely difficult. At the same time, there is clearly scope to widen the net and mobilize a broader range of resources (including those within communities) than are being used at present. Viewing the issue of cost recovery within a broader "resources coverage" perspective may help to support this process, as a review of the findings of an international working group on cost recovery indicates. The findings of this group are outlined towards the end of this chapter.

The case for user payment

The principal arguments put forward to justify greater user payment are summarized in Box 2. These range from very practical justifications, pointing to basic problems of resource availability, to more complex developmental arguments which see a broad range of advantages, beyond cost recovery alone, for adopting user payment.

Box 2

WHY USERS SHOULD PAY FOR WATER AND SANITATION SERVICES

* Available capital funds are inadequate to achieve full coverage
* Available public funds are inadequate to meet recurrent costs
* State intervention and control has proven to be inefficient and ineffective
* Social and economic benefits of improved water and sanitation are too indirect to justify free services
* Subsidies disempower users by denying them choice
* Subsidies discourage cost-effectiveness and the development of low-cost solutions
* Evidence of demand and willingness to pay is strong with many poor people already paying high rates for services
* Properly regulated user charges would mean the poor would pay less and get better service
* Payments increase sense of value and commitment among users
* User payments maximize the use of available resources
* User payments improve quality and standards of service

(Adapted from Briscoe and de Ferranti, 1988; Katko, 1990).

An analysis of the achievements of the International Drinking Water Supply and Sanitation Decade (1981-1990) suggests that, with current approaches, continued heavy reliance on donor and government funding to sustain improved services means that the goal of safe water and improved sanitation for all may never be achieved. Official United Nations figures (see Table 1) show that net increases in service coverage have been modest. Although global coverage in rural water supply slightly more than doubled during the Decade, other increases in most cases resulted in a less than 10% net improvement, even after intensive efforts over a 10-year period. At current rates of implementation, population growth alone will absorb a large proportion of further progress. According to UN projections, net gains in percentage coverage by the year 2000 are likely to be negligible, in spite of substantial gains in the actual numbers of people served.

Not only have investment levels been too low, but meeting recurrent costs for operation and maintenance has also proven to be a major problem. An unacceptably high level of investment continues to be wasted as many systems fall into disrepair almost as quickly as they are built. Estimates suggest that 30-40% of water systems in developing countries may be broken down at any one time. For individual countries and systems percentages as high as 60-70% have been reported (WHO, 1990a). Inadequate levels of funding have often been seen as a root cause.

The UN Secretary General's end-of-Decade report to the General Assembly stated:

> *"Since financial resources for the sector are extremely limited in most countries, and because radical shifts in sector allocations are unlikely in the foreseeable future, the conclusion is increasingly being reached that project beneficiaries should participate in cost recovery if service coverage in developing countries is to be extended" (UN General Assembly, 1990).*

Not only are allocations to the sector unlikely to increase, but the impact of structural adjustment programmes in a number of the world's poorest countries will actually mean a decline in available public resources, limiting even further their capacity to maintain basic services. Since resources in developing countries are by definition scarce, it has been argued that use of all available resources must be maximized, including those at the disposal of users themselves. Five years before the water decade began, an influential study argued that high levels of subsidy could not be justified if optimum use is not being made of what is already available. To ensure this, first priority in service provision should be given to those who are prepared to pay (Saunders and Warford, 1976).

Evidence from case studies published just before the start of the Decade, and a review published soon after, have been used to support the view that user payment leads to more efficiency and greater sustainability. Studies in Tanzania, Thailand, and elsewhere, suggested that the water supply systems which provided the most reliable service were those where communities not only contributed to operation and maintenance costs, but met them in full (Dworkin, 1980a, 1980b, and 1982). User payment is seen by advocates as a means of protecting systems from the uncertainties of government financing and making sustainability more likely. It may also increase the commitment of users to the sound management and use of systems. Although water is acknowledged to be a basic need, "..the fact that a service is vital is not sufficient grounds for that service to be free" (Okun, 1982).

Providing free or heavily subsidized services may limit the number of improved systems which can be built, with the effect that those who are most in need may be the very ones who miss out. Furthermore, assuming that poor people have no resources is, according to one study, "the worst possible approach" and:

Table 1: Water Supply and Sanitation Coverage by Region, 1980-1990, and Coverage for 2000 at Current Rates of Progress (Population in Millions)

	1980				*1990*				*2000*			
Region/sector	*Population*	*% coverage*	*No. served*	*No. unserved*	*Population*	*% coverage*	*No. served*	*No. unserved*	*Population*	*% coverage*	*No. served*	*No. unserved*
Africa												
Urban water	119.77	83	99.41	20.36	202.54	87	176.21	26.33	332.49	76	253.01	79.48
Rural water	332.83	33	109.83	223.00	409.64	42	172.05	237.59	496.59	47	234.27	262.32
Urban sanitation	119.77	65	77.85	41.92	202.54	79	160.01	42.53	332.49	73	242.17	90.32
Rural sanitation	332.83	18	59.91	272.92	409.64	26	106.51	303.13	496.59	31	153.11	343.48
Latin America and the Caribbean												
Urban water	236.72	82	194.11	42.61	324.08	87	281.95	42.13	416.79	89	369.79	47.00
Rural water	124.91	47	58.71	66.20	123.87	62	76.80	47.07	122.84	77	94.89	27.95
Urban sanitation	236.72	78	184.64	52.08	324.08	79	256.02	68.06	416.79	79	327.40	89.39
Rural sanitation	124.91	22	27.48	97.43	123.87	37	45.83	78.04	122.84	52	64.18	58.66
Asia and the Pacific												
Urban water	549.44	73	401.09	148.35	761.18	77	586.11	175.07	1 085.56	71	771.71	314.43
Rural water	1 823.30	28	510.52	1 312.78	2 099.40	67	1 406.60	692.80	2 320.79	99	2 302.68	10.11
Urban sanitation	549.44	65	357.14	192.30	761.18	65	494.77	266.41	1 085.56	58	632.40	453.16
Rural sanitation	1 823.30	42	765.79	1 057.51	2 099.40	54	1 133.68	965.72	2 320.79	65	1 501.57	819.22
Western Asia												
Urban water	27.54	95	26.16	1.38	44.42	100	44.25	0.17	67.26	100	67.26	0.00
Rural water	21.95	51	11.19	10.76	25.60	56	14.34	11.26	30.66	57	17.48	13.18
Urban sanitation	27.54	79	21.76	5.78	44.42	100	44.42	0.00	67.26	100	67.26	0.00
Rural sanitation	21.95	34	7.46	14.49	25.60	34	8.70	16.90	30.66	32	9.94	20.72
Global totals												
Urban water	933.47	77	720.77	212.70	1 332.22	82	1 088.52	243.70	1 902.10	77	1 456.27	445.83
Rural water	2 302.99	30	690.25	1 612.74	2 658.51	63	1 669.79	988.72	2 970.88	89	2 649.33	321.55
Urban sanitation	933.47	69	641.39	292.08	1 332.22	72	955.22	377.00	1 902.10	67	1 269.05	633.05
Rural sanitation	2 302.99	37	860.64	1 442.35	2 658.51	49	1 294.72	1 363.79	2 970.88	58	1 728.80	1 242.8

(Source: UN General Assembly (1990). Achievements of the International Drinking Water Supply and Sanitation Decade 1981-1990. Report of the Secretary-General).

"..inevitably leads to unsustainable subsidies, which reach primarily those of greater influence and least need, and to malfunctioning and restricted services which leave the lot of the poor unchanged. Promises of free service for all too often result, in practice, in some service for a few and little or none for most" (Briscoe and de Ferranti, 1988).

The argument that subsidies and free services are justified by the health and other benefits produced has been questioned on the grounds that the supposed benefits have not been proven clearly enough to justify public investment on the scale required. Apart from being both inefficient and ineffective, subsidies also discourage the development of more efficient and lower cost options for service delivery, and deny the opportunity to users to exercise their power as consumers to demand a better service (Churchill, 1987).

Worries that people simply cannot afford to pay have been countered by arguments that in spite of disturbing recent statistics on global poverty (World Bank, 1990; UNDP, 1991), millions of people in developing countries are already paying a high price for often sub-standard water and sanitation services. Improved services would mean that in many cases people would pay less than they are now, and receive a more effective service (Okun, 1982; Churchill, 1987; Kalbermatten and McGarry, 1987; Okun, 1988; Briscoe and de Ferranti, 1988; Whittington et al, 1988; Whittington et al, 1989; UNDP/World Bank, 1990; Briscoe et al, 1990; UNICEF, 1991a).

Prospects and dilemmas

Despite these arguments, "..low levels of cost-recovery .. remain the rule" in the water and sanitation sector, and financial self-sufficiency remains a "distant goal" (Baum and Tolbert, 1985). In 1987 a global consultation on progress during the Decade concluded that cost recovery in the sector "is generally ineffective" (WHO, 1987a). A year later, UNICEF reported that an average of 30% of its assistance to water and sanitation programmes was devoted to recurrent costs, and would probably continue to be so "well into the future in many countries" (UNICEF, 1988). Rural areas are particularly problematic, due to "..low incomes, the absence of industrial and commercial users, and the attachment of villagers to their traditional, free sources of supply.." (Baum and Tolbert, 1985).

Prospects for cost recovery are thought to be particularly difficult in rural sub-Saharan Africa, where poverty is most acute. Participants at the 1987 Interlaken consultation on progress in the Decade supported the view that full cost recovery should be the long-term goal, but recognized limitations in the immediate term which may make a transition period necessary (WHO, 1987a). Some contribution from users is seen as necessary, however. The reality of free social services in Africa "..is that it means inadequate provision or no provision at all to many people and particularly the poorest and most vulnerable" and, on the more positive side, that it is a means of "..empowering the beneficiaries to demand improved services and of fostering a sense of individual and community responsibility for their delivery" (World Bank, 1989).

If cost recovery is to be based on ability to pay, it has been argued that greater equity can be achieved by asking the better off to pay more, effectively providing a subsidy to poorer consumers. As Laugeri has suggested: "Everyone should contribute to the cost, but not necessarily in the same proportion, in the same way or at the same time." (Laugeri, 1987). Where mixed service levels can be provided, for example through a combination of house connections and public standposts drawing from the same piped system, cross-subsidies can be introduced by varying the rates charged to consumers in relation to the level of service they enjoy. This idea has been supported by White (1981), and methods for implementation described by van Wijk-Sijbesma (1989). In Malawi, and other places, this method is used with success (IRC, 1991).

Subsidies can also be provided by linking payment to the economic benefits obtained from improved services, with those who gain more being asked to pay a proportionately higher charge. This approach recognizes that needs and demand will often vary within a community itself, and that some users will consume more water and obtain greater benefits than others. This point is discussed further in a later chapter in a review of options for community financing systems and the management of cost recovery.

Though people may appreciate the benefits of subsidized services, there may be a hidden cost to enjoying them. If paying for supplies gives users more power, those who are not paying full costs are likely to have less influence than those who do. Having advocated cross-subsidies to support public standpost supplies for the poor, White acknowledged in a later publication that subsidies can serve to disempower communities by limiting, or denying them, choices. If users are not meeting the full cost, they have less power in demanding the level and quality of service which meets their own felt needs (White, 1983).

Theory and practice

The issue of cost recovery produces many dilemmas and is one of a "new generation of challenges" confronting the sector (Black, 1990). Although the arguments for higher levels of contribution from users are strong, applying this principle in practice is far from easy. The supposed benefits of user contributions are not easily achieved, as a case study from Lesotho has shown (see Box 3). This experience suggests that the assumptions that community payment will provide evidence of demand, reduce costs to government and support agencies, improve commitment from users, and generally encourage further development activities, may not always be valid.

Many of the problems noted in the Lesotho study can be attributed to shortcomings in general strategy and approach, and certainly do not provide conclusive evidence in themselves that the supposed advantages of user charges cannot be obtained. They do, however, provide a note of caution and a useful reminder that introducing user charges is by no means a simple and straightforward task, and has costs of its own.

Cost recovery or resources coverage?

Many more factors than financing alone come into play in achieving the long-term sustainability of improved services. In many cases, failure to appreciate this basic point lies at the root of many failed attempts to introduce user payment for services. This broader perspective has been interestingly developed by the WHO Working Group on Cost Recovery, and through a series of informal consultations on institutional development hosted by the same agency. The work of these groups, composed of representatives from both donor agencies and developing countries, has led to the development of the "resources coverage" approach to sustainability.

According to this perspective, recovery of costs does not always have to be in the form of cash (WHO, 1987b). A very large number of water supply and sanitation projects recover at least part of their costs through user contributions of labour and local materials, a feature frequently found in programmes based on community participation. Such contributions may account for as much as 20-30% of capital costs, and an equally significant proportion of the costs of operation and maintenance.

Box 3

COST RECOVERY: PRACTICAL PROBLEMS IN LESOTHO

An influential study in the 1970s, based on an in-depth evaluation of rural water supply systems in Lesotho, questioned four basic assumptions about the merits of user contributions and self-help approaches, all of which are still currently advanced in support of user payments. These were stated as follows:

"(1) The villagers' contribution will reflect a desire for the project in question so that aid will be given in response to a genuinely felt need.
(2) A cash and labour contribution from the villagers should reduce the cost to Government and donors of installing the supplies.
(3) The fact that they have contributed should encourage villagers to accept the project as theirs to look after and maintain.
(4) Their successful experience with water supplies will lead villagers on to undertaking other development tasks."

The evidence from Lesotho casts doubt on all of these assumptions. The level of cash contribution collected from villages was so modest that it effectively invalidated the first two assumed advantages. On average, village cash contributions only amounted to 7% of the total materials costs. First, villagers really had no idea of the true cost of their water supplies and their contributions were often nominal. Second, the amounts collected were often so small, and the administrative costs so high, that there were no net cost savings to government.
Rather than instilling in villagers a sense of ownership and responsibility, the raising of cash contributions, and provision of labour and local materials for the construction of the schemes, convinced them that they had already paid a fair share of the cost. The government should therefore be willing to take on the longer term responsibilities for operation and maintenance. This same point of view was found among villagers in Zimbabwe, in a study conducted more than a decade later (Cleaver, 1991).

Finally, the incentive that the experience of undertaking a self-help approach to water supply improvement should provide in encouraging villagers to undertake other development tasks was undermined in many cases by the factionalism and hostility which attempts to manage community contributions gave rise to. The Lesotho study demonstrated very clearly the error of assuming that rural communities can generally be expected to be homogeneous and highly cohesive. More often than not, the opposite is the case.

In view of these findings, the authors of the Lesotho study concluded that "..In the long-term, voluntary contributions for the upkeep of a public service do not work."

(Source: Feachem et al, 1978).

The working group noted that water should not be free to users. Costs should be met within a framework of partnership between user communities and support agencies, with the crucial principle being that all costs must be met from in-country resources. This approach provides an interesting departure from most other discussions of cost recovery, which tend to put governments and ESAs together as providers of services and communities as receivers, with the problem seen as one of shifting responsibility from one to the other. The WHO working group frames the problem as one of shifting the balance from external to in-country funding. The balance of contributions between the agency and community is not necessarily fixed, but can change with time, with communities progressively taking an increasing share of the burden.

Identifying the problem as that of covering resources rather than just recovering costs has many merits. As well as noting that costs need not always be covered through financial contributions, the approach also recognizes that resource requirements go way beyond financing alone and include wider human and institutional factors. The group identified ten key elements, all of which must be adequately covered if sustainability is to be achieved (see Box 4).

Box 4

THE TEN KEY ELEMENTS OF SUSTAINABILITY

- **Enabling environment**
- **Health awareness**
- **Strong institutions**
  - Community
  - Agency
  - Interest groups
- **Felt need**
- **Supportive attitudes**
- **Expertise and skills**
- **Appropriate service level**
- **Appropriate technology**
- **Materials and equipment**
- **Support services**
  - Customer relations
  - Community support
  - O&M support

(Source: WHO, 1990b).

The ten key elements of sustainability are broadly based, covering technical, non-technical, quantitative and qualitative, factors. All but the first element, which is seen as almost entirely a responsibility of government, need to be resourced by both agencies and communities.

Cost recovery is not explicitly referred to in the WHO document as a key element of sustainability. At the same time, the need for user contributions is frequently referred to. The model developed by the working group reflects the dilemmas which the debate over cost recovery has underlined, and the tension between the need to provide everyone with clean water and adequate sanitation and the need to do this in a sustainable way. A brief description of each of the elements is given below (all quotes from WHO, 1990b).

Enabling environment: An enabling environment is created by establishing a legal and policy framework which explicitly supports the development of sustainable water supply and sanitation services. The creation and development of this environment is largely the responsibility of government. An appropriate enabling environment "..is not consistent with a 'Free Water' policy, for it emphatically requires a commitment to a partnership approach...in the provision and meeting of costs of water and sanitation services."

Health awareness: This is required in both the agency and the community. Both should recognize the importance for health of water supply and sanitation improvements, and the benefits which can be obtained from supporting and sustaining these. Health awareness implies on the part of the community/user "..an acceptance of personal responsibility, and willingness to pay or contribute otherwise towards efforts and activities to improve personal and community health."

Strong institutions: At the agency level, institutions are required with: clearly defined responsibilities; a sound legal basis; and autonomous control of finances and human resources. In the community, with: formal, legitimate and permanent status; strong leadership and solid backing, especially from women; capacity to represent all groups, including women and poor households; and ability to organize and carry out planned and agreed programmes of activities.

Felt need: Water and sanitation improvements must be perceived by communities as a high priority, manifested as an awareness and expressed need for the health, economic, and social advantages of improved services. "Felt need also implies a willingness to contribute to the development, operation and maintenance of water supply and sanitation facilities". Agencies must be conscious of the felt needs of users and be willing to take account of them and, where necessary, stimulate them through "..health promotion, literacy programmes and general economic activities."

Supportive attitudes: The agency must be fully committed to the partnership process, have a genuine desire to work with communities, and work within a policy and institutional framework which motivates staff. At the same time, the community must accept its responsibilities and be willing to assume ownership of water supply and sanitation systems, pay for services, and otherwise contribute towards water supply and sanitation provision.

Expertise and skills: All necessary skills are required at both agency and community level, with training inputs being provided as required. The community should have or develop: technical skills for minor repairs and routine maintenance; skills for organizing cash-raising and managing financial resources; organizational skills for mobilizing community inputs and preferences, and consulting with agency staff. The agency requires not only the necessary technical, administrative, and managerial skills, but should also have access to resource persons with appropriate skills in: social organization, extension work, communications, training, monitoring, follow-up, review and evaluation, and involving women.

Appropriate service levels: The level of service should be jointly agreed between the agency and users, and should be appropriate in both technical and socio-economic terms. The appropriate service level for a particular situation "..ideally allows the community to upgrade later to a higher service level, thus encouraging maintenance of the facility until it can be improved." Identifying the appropriate service level for any particular situation implies making a comprehensive analysis of alternatives, consulting communities on their preferences and clearly communicating the implications of each alternative, and, for communities, "..paying the extra cost of service levels appropriate to specific situations which require more than the type of water supply system adopted in national policies and plans."

Appropriate technology: This element is closely linked to service level. Technology choice should be a joint responsibility of agency and community, and "..the chosen service level should reflect technology that is practical, economically viable, satisfies the needs of users and is socially acceptable." Affordability, ease of maintenance, technical efficiency, and availability of spares and materials are all important factors in technology selection.

Materials and equipment: All necessary inputs should be available in a timely manner. Materials and equipment, including in-kind contributions from users, should be available as required for scheme development, rehabilitation, and operation and maintenance.

Support services: This element relates to operation and maintenance, extension services, and customer relations. "Although this element is primarily provided by the agency during the development phase, some inputs should be identified and jointly agreed to come from the community and should increasingly shift towards the community/user at the operational phase." Operation and maintenance support requires the regular availability of funds, equipment, spares, and staff, with responsibilities clearly agreed between the agency and community. Back-up support through extension services and the maintenance of good lines of communication play important roles in ensuring that this element is adequately resourced.

The resources coverage approach is essentially a compromise, reflecting the broad range of views represented in the working group. Whatever its shortcomings, however, it serves to underline the vital point that cost recovery is only one part of a very broad process by which required resource needs for sustainable water and sanitation improvements are met. Not all resource needs can be met with cash payments, and not all costs have to be recovered in monetary form. Covering costs is in itself no guarantee that sustainability will be achieved, though it is clearly a necessary condition. Whatever financing option is chosen in a particular country or programme, the need to cover all required resources cannot be avoided. If the full range of resource needs is not met, improved services are unlikely to be attractive enough to persuade users to pay for them.

Partnership and resources coverage

The case for greater user payment is strong and it is clear that there is plenty of scope for improving efficiency in resources coverage, and increasing users' contributions as a means of achieving this. Although there are clear dangers in advocating user payment on a universal basis, particularly in view of the evidence from sub-Saharan Africa, much can be done to more effectively mobilize resources and make better use of those that are available. Only by making full resources coverage a major goal will the true extent of resource availability become apparent. At the same time, it should also be possible to identify more clearly which sections of the population really do need financial assistance to ensure that basic service needs are met, and that support is therefore directed to the people most in need. Doing this has important implications, and these must be recognized. The greater the contribution from users, the less they can be treated as beneficiaries and the more they must be seen as partners.

As partners, communities are entitled to ask a number of basic questions of agencies who are encouraging them to invest in improved water and sanitation services. Among these, the most obvious include: what benefits will be obtained and what costs are entailed in making improvements; to what extent improvements will meet their own felt needs; and how financing can best be organized and under whose control. These issues are reviewed in the chapters which follow.

APPENDIX 24

24

Background Information

1. Possible questions to be asked on local financing

The very first question to be asked is **Why should the users pay?**
Here is a set of possible answers (adapted from Briscoe and de Ferranti, 1988; Katko, 1990, by Evans, 1992):

* Available capital funds are inadequate to achieve full coverage
* Available public funds are inadequate to meet recurrent costs
* State intervention and control has proven to be inefficient and ineffective
* Social and economic benefits of improved water and sanitation are to indirect to justify free services
* Subsidies disempower users by denying them choice
* Subsidies discourage cost-effectiveness and the development of low-cost solutions
* Evidence of demand and willingness to pay is strong with many poor people already paying high rates for services
* Properly regulated user charges would mean the poor would pay less and get better service
* Payments increase sense of value and commitment among users
* User payments maximise the use of available resources
* User payments improve quality and standards of service

Another set of questions could be related to the implication and relevance of decentralizing financial management.
By its very nature water supply is a decentralized activity; in general, water is used near the place where it is produced. The same applies, mutatis mutandi, for sanitation.

- Which aspect of financial management can be decentralized to community level and which should remain under national / regional/district authorities? How can financial coordination be improved between the community and other authorities concerned ?

- How could it be promoted that village water committees accept responsibility for financial management of water supply and sanitation services at local level ? What support would this require in terms of information, education, training ?

- Should privatization be promoted ? What financial responsibilities could be delegated to private enterprises ?

- How could Governments be encouraged to establish a proper financial policy for rural water supply and sanitation, based on decentralization ? What support should national, regional and districts authorities provide to the community ? How should this be selected in the development of an appropriate legal framework?

- Should the financial management of rural drinking water and sanitation be kept separate or integrated with other revenue systems? Do methods need to be adapted for schemes that include both water supply and sanitation ?

APPENDIX 25

Table 1: Summary of Community Contributions to Capital and Recurrent Costs in Workshop Case Studies

LOCATION AND TYPE OF SCHEME	CAPITAL COSTS	RECURRENT COSTS
CAMEROUN Gravity-fed piped scheme from protected spring	Capital and labour contribution equal to 20% of total capital cost Trench and pit digging Carrying local materials (sand and stones) Cash contributions: CFA 500 per man and CFA 200 per woman	All recurrent costs paid by community, in accordance with service level: CFA 500 per taxpayer per year for standpost; CFA 5000 per year per house connection; CFA 100,000 per year per institution. Community contributions cover full costs of village plumber, spare parts and operating costs, at less than cost of service from state water corporation.
GUATEMALA Piped schemes with gravity feed or hydraulic ram, handpump schemes, and rainwater harvesting	Cash contributions for initial downpayment Repayment of community loan supplemented by agency donation Trench and pit digging Carrying local materials (sand and stones)	Users make monthly payments which cover all operation and maintenance costs, including employment of a local plumber. Community water boards form local associations to provide mutual assistance in solving problems of operation and maintenance, and local management.
HONDURAS Borehole wells, communal tank networks, independent communal tanks served by tankers	Payment of a cash contribution (30% of development costs) Repayment of a loan into a revolving fund for remainder (70%) Provision of unskilled and semi-skilled labour for construction Provision and carrying of local materials Funding of paid unskilled labour as substitute for own labour	Payment of a monthly fee in accordance with service level: US$1.75 for use of a standpost; US$3.00 for a yardtap. Monthly payments include costs of water board staff and hiring of a plumber.
INDONESIA Piped schemes and rainwater harvesting, public bathing facilities	Full cost met by most communities in most cases Combination of cash and in-kind payments + loans and credit Individuals contribute according to socio-economic status Poorest members often exempt from payments Grant assistance may be arranged if communities have difficulties Provision of local materials + skilled and unskilled labour	Full costs met through user fees, depending on service level and system costs: range from US$5.00 to US$50.00 per household per year. Funds also raised through local revolving funds, lotteries, credit systems, entertainments, etc.
PAKISTAN Gravity-fed piped scheme from protected spring, with yardtaps	Villagers contribute to a common fund to support the work of the Village Organization (VO) as a precondition for support Aga Khan Rural Support Programme secures loans or grants Provision of local materials and labour Additional funds raised by fining those who don't meet communal labour obligations Village funds hire local plumbers to help in scheme construction	Users meet costs of operation and maintenance through continuing contributions to the village fund. Additional funds raised through the imposition of fines for improper use or wastage of drinking water. Village funds used to hire local plumber for repairs as necessary Individuals are personally responsible for maintaining pipes and taps for their own yard connections.
UGANDA Borehole wells with handpumps, protected springs, gravity-fed piped schemes	Community contribution based on negotiation with no set formula Cash contributions usually cover only a small part of costs Provision of local materials and labour Funds may come from cash collections, donations from prominent individuals, auctions, lotteries, raffles, or local taxes	Users pay fees to cover costs of spares and payment of pump mechanic. Volunteer caretakers "paid" by being exempted from communal labour obligations. Additional funds raised through the imposition of fines.
YEMEN Piped schemes based on boreholes with motorized pumps	Communities must have a reliable water source, usually a borehole, before the project begins. This is secured either by the community's own efforts or by requesting assistance from the government or a donor Communities meet about 30% of scheme development costs through labour and other in-kind contributions	Users pay a monthly metered charge, which is enough to cover the costs of fuel, oil, spare parts, and the salaries of scheme operators. When a major breakdown occurs, special collections are made to pay for the repairs.

APPENDIX 26

5. *Demand and Willingness to Pay*

Providing services which people can afford is an obvious pre-condition for cost recovery. Being able to pay for something and being willing to do so, however, do not always go hand in hand. From an economist's point of view, demand is only real (or "effective") when it is accompanied by willingness to pay, in cash or kind, for the goods or services offered. From this point of view, "willingess to pay" and "demand" essentially mean the same thing. Both, however, need to be distinguished from the idea of "felt need". Acceptance of free or heavily subsidized services, which meet people's felt needs, does not prove that there is effective demand for them. Felt need only turns into demand when people are prepared to use their own resources to obtain what is offered. The relationship between demand and felt need is thus a complicated one, since there can be no demand without felt need, but felt need alone is not necessarily enough to create demand. In reviewing the discussion below, it is important to keep this distinction in mind.

Factors influencing willingness to pay

Creating demand for improved services is much more complicated than just getting the price right, though this has an essential part to play. Resources are always limited, and choices have to be made as to how they are used. In recent years increasing attention has been paid to finding out how much people are actually willing to pay for better water and sanitation services, and for what types of improvements. In investigating demand and willingness to pay, it is important that a broad-based approach is taken. Research has indicated that the range of influencing factors is wide. A list of those which have been identified as among the most important is discussed in Box 6 below.

Box 6

FACTORS INFLUENCING WILLINGNESS TO PAY

* Service level
* Service standard
* Perceived benefits
* Relationship to production
* Level of income
* Price
* Relative cost
* Opportunity cost of time
* Characteristics of existing sources
* Reputation of service agency
* Community cohesion
* Policy environment
* Socio-cultural factors
* Perception of ownership and responsibility
* Transparency of financial management
* Institutional framework

(Adapted from Briscoe and de Ferranti, 1988; Katko, 1990).

Service level: The level of service provided by a water supply or sanitation system has an important influence on whether or not people will pay for it, sometimes in surprising ways. The lowest (and cheapest) level of service cannot always be assumed to be the most marketable. In some cases, consumers who are not willing to pay a modest rate for a simple point-source supply, such as a handpump, will gladly pay much more for a higher level of service such as a yard tap or house connection.

Service standard: Standard of service is closely linked to level of service. If a system does not perform consistently, and does not continue to provide an acceptable level of service, willingness to pay is likely to diminish.

Perceived benefits: Paying for a service is effectively a decision to invest. Continuing willingness to repeat this expenditure is dependent on the benefits to be gained. Since some benefits can be easily seen and others cannot, the extent to which possible benefits are perceived and recognized by consumers is important. For example, health benefits are often indirect and many consumers may not perceive them as a benefit at all. Other factors, such as the taste, smell and colour of water from an improved supply, may be perceived as being more important.

Economic and financial benefits, insofar as they are more obvious and direct, may also have a greater influence on people's willingness to pay. If an improved service does not provide perceivable benefits in comparison to an existing source of supply, users are unlikely to be willing to pay for it. Agencies and communities may not share the same perception of the benefits to be gained from service improvements. Within communities there can be important variations too. Different sections of a community may have different levels of interest in improved services, particularly where some stand to gain more than others. An awareness of consumer perceptions, and possible variations within communities, is therefore crucial in developing a sustainable programme.

Relationship to production: Where water can be used for productive purposes, such as gardening or livestock watering, willingness to pay is likely to be higher than where it cannot. Again, however, an improved supply must be able to deliver this advantage to a greater extent than an existing source if this factor is to be of importance.

Level of income: This relates directly to ability to pay. If the cost of a water supply is beyond the means of the consumers, the question of willingness to pay clearly does not arise.

Price: Finding the right price level is important. In rural areas in particular alternative sources of water are usually available, even if of poor quality. The level at which water charges are set is likely to influence people's decisions as to whether to pay for a better service or stick with the old one. A balance needs to be drawn between establishing a price which will meet costs, on the one hand, and which people will be prepared to pay, on the other.

Relative cost: In deciding whether the cost of a service is acceptable or not, people will often compare it to the costs of other services which they value equally, or which they consider to be of a higher or lower priority. The costs, for example, of electricity supply, schooling, or health care, may be used as benchmarks against which the relative costs of water and sanitation services are measured. If the costs are considered to be too high in relation to others, willingness to pay may be affected.

Opportunity cost of time: Where water is free, the basic cost to users, apart from the energy consumed in carrying it, is the time it takes to collect. The extent to which this time is valued may influence whether people are willing to pay for a service which will save time in meeting water needs. In most cases, the time in question is that of women. Men, however, may have a different perception about the value of women's time than women themselves.

Characteristics of existing sources: Where users consider their traditional water sources to be acceptable, it is unlikely that they will be willing to pay for an improved service. Relative factors such as the quantity of water available, perceived quality, distance from home, potential economic uses, and the reliability of the supply, are all likely to influence whether people will continue using existing sources, or pay for an improved supply.

Reputation of service agency: The credibility of an agency providing a service will have an important influence on willingness to pay. In many developing countries, people have had experiences of development efforts which have promised much but, in the end, delivered little. The service agency - whether it is a government department, public enterprise, private company, or community management body - must be able to deliver the goods, and be seen to be doing so by the consumers.

Community cohesion: In rural areas in particular, cost recovery may be managed through voluntary contributions to a common fund. Good cohesion within a community is essential for this, but cannot be taken for granted. Factional conflicts, or lack of trust in the village leadership or office holders, may mean that consumers are unwilling to cooperate in a joint venture of this kind, irrespective of felt needs. This factor is likely to be linked to others, such as the method devised for collecting and managing contributions, the distribution of water points in the community, and so on.

Policy environment: The policy of seeking to provide basic services free of charge in many developing countries has made the covering of costs for water supply and sanitation a difficult proposition. People are unlikely to be prepared to pay for services while they believe that others will get them free, or that the government or some other agency will meet the costs. Many developing countries are now revising such policies, but politicians remain reluctant to make such changes clear. Where a free water policy is abandoned, it is important that new policies are clearly communicated and are implemented consistently.

Socio-cultural factors: Socio-cultural factors may influence willingness to pay in a broad range of ways, and with considerable variation from place to place. In some societies attitudes and beliefs in relation to the natural world and basic resources such as water or land may make people reluctant to pay for something they consider should be free to all. In others, people may object to water being captured (through spring protection, for example), or to wells being sited in certain places. Perceptions about water quality, and what constitutes good water will also vary from place to place in accordance with local beliefs.

Perception of ownership and responsibility: The degree to which people feel responsible for their own water and sanitation services may affect their willingness to pay. If they believe that a water supply system belongs to the government, for example, they may feel that it is the government's responsibility to take care of it. Even when systems have been formally handed over to communities, studies have found that many people still do not accept ownership and responsibility. This factor may often be symptomatic of other problems, such as an inappropriate approach to implementation, inadequate consultation, or dissatisfaction with the type or level of service. A system which is imposed from the outside is unlikely to be fully accepted by a community, and willingness to pay is likely to be adversely affected as a consequence.

Transparency of financial management: This factor may be closely linked to the reputation of the service agency or local management organization and is basically a matter of trust. If people can not see clearly what is happening to the contributions they make towards the upkeep of their water supply or sanitation system they are unlikely to be motivated to pay for it. An acceptable and clear financial management system, with high levels of accountability, should help to instill trust and reassure people that their contributions are being used for the intended purpose.

Institutional framework: The way in which a water or sanitation programme is organized, and the institutional framework developed to support it, can affect willingness to pay. The establishment of water committees which bypass existing authority or local management structures, for example, may limit the effectiveness of such bodies and make people reluctant to support them. A framework which is insufficiently open to users as a whole may also diminish willingness to pay if people feel that their views will not be accounted for in the development and management of systems.

Measuring willingness to pay

In recent years there has been renewed interest in developing practical methods to find out what services people really want and how much they are prepared to pay for them. Income levels in the poorer parts of the world are hard to measure. In marginal urban areas most economic activity takes place in the informal sector and earnings are largely undocumented. In rural areas cash earnings are highly sensitive to seasonal and annual fluctuations and are very difficult to accurately predict. It is easier to find out what people spend, than to find out what they earn. Recent research has concentrated more on investigating what people *will* pay, rather than asking what they *can* pay.

Two basic methods have been developed for finding this out. The first, the *indirect method,* involves analyzing what others in similar circumstances to the target population are already paying for services. The second, the *direct method,* involves asking people to say what they would be prepared to pay in the future for improved services. The relative merits of these two approaches have been discussed by Briscoe and de Ferranti:

> *"The indirect method has one big advantage in that data are drawn from actual practices. It also has several disadvantages: the service to be offered (say, a yardtap) may often not exist in the community, there are often large discrepancies between the apparent value of a service and the amount that individuals are actually prepared to pay, and this is a top-down approach, which designs for rather than with the community.*
> *The major, obvious difficulty with willingness to pay questions [the direct method] is that the answers may be misleading, either because a hypothetical question does not elicit sufficiently serious consideration or because there are perceived advantages to giving false answers" (Briscoe and de Ferranti, 1988).*

The authors note that in 1976 the World Bank concluded that using the direct method for rural water supply was "virtually useless". But, they say, "recent experiences in industrialized countries...have led to major theoretical and methodological advances in understanding the biases in such direct surveys. It now appears that the method has substantial potential for assessing the demand for public services in developing countries" (Briscoe and de Ferranti, 1988).

The direct method of measuring willingness to pay is sometimes referred to as the "contingent valuation" method. The method is vulnerable to bias in three basic areas:

1. ***Hypothetical bias:*** individuals may not understand or perceive correctly the characteristics of the good or service being described by the interviewer.
2. ***Strategic bias:*** the respondent may think he can influence the provision of services in his favor by not answering the questions truthfully.
3. ***Compliance bias:*** the respondent may give answers which are influenced by his desire to please the interviewer (Briscoe et al, 1990).

Researchers have tried to develop techniques to avoid these areas of bias, or at least to minimize their impact on study results. Hypothetical bias, for example, can be minimized by providing adequate information to respondents (eg. by showing pictures or films of proposed services). Strategic and compliance bias can also be minimized, by introducing control mechanisms into the methodology, and taking extra care in the selection and training of interviewers (Briscoe et al, 1990).

In practice, the direct method is much more subtle than bluntly asking people to name a price for future water and sanitation services. A technique which has become popular in recent years is the so-called "bidding game", which has been tried in various forms in a number of recent studies. There are a number of variants of this method, but all involve a process of negotiation between the interviewer and respondent. The game involves moving up and down a range of possible prices for particular types and standards of service until a level is reached at which the respondent expresses willingness to pay a particular amount and no more. In the process, it is possible to get an indication of the level of basic demand for improved services in general, and also an insight into relative demand for different levels of service. This method requires skilful use if valid results are to be obtained.

The bidding game was used as part of a costs and tariffs study for the rural water supply sector in Botswana in 1988, in an effort to determine whether the introduction of house connections would increase willingness to pay. One of the authors of this study noted that the method was used with some reluctance, but "...somewhat to our surprise...we found that for each village there was an agreement within (plus or minus) 2 Pula of what would be an acceptable price." (Widstrand, 1991).

The bidding game has proven useful for sanitation programmes as well as for water supply. A study supported by UNDP and the World Bank in Kumasi, Ghana, produced unexpected results in consumer choice of urban sanitation technologies. It is often assumed that, given the choice, most people would opt for relatively high levels of service and only accept lower technologies at a much lower price:

> *"Somewhat surprisingly, on average, households in Kumasi are willing to pay roughly the same amount per month for a ventilated improved pit latrine as for a water closet and a sewer connection. Many people surveyed felt that factors such as increased water bills and the undependable nature of Kumasi's water system lowered their willingness to pay for a water closet" (UNDP/World Bank, 1990).*

Supporters of both the indirect and direct methods have been quick to note their limitations. A field test using both methods in Haiti (Whittington et al, 1987) found that they produced different results, pointing to the need for further refinement. In spite of a number of reservations, however, the bidding game in particular was found to be very useful.

The authors of the Haiti study recommended that further field tests should be conducted of both direct and indirect methods, and additional checks introduced to test the validity of results. Issues to be investigated include whether people would modify their responses if given more time to consider the questions, or were permitted to consult with family and friends. They also suggest that anthropological studies should be conducted to get deeper background information on responses. The ultimate test is the behaviour of respondents once they are actually required to pay for services (Whittington et al, 1987).

Water vending as evidence of willingness to pay

A third approach to the study of demand is the use of proxy measures. A good example is the use of case studies of water vending to provide indicators of willingness to pay.

Although the service investigated does not usually correspond to proposed service levels in improvement schemes, it is a way of investigating resource availability and payment practices at a general level, may provide an indicator of the value which people actually give to water, and may show what the upper limits of willingness to pay are likely to be.

The unregulated sale of water by vendors is widespread in low-income urban areas throughout the developing world (eg. Okun, 1982; Zaroff and Okun, 1984), and, to a lesser extent, in rural areas too. Evidence that people pay high rates to vendors has been presented to show that they are both able and willing to pay for water services. Furthermore, it has also been shown that "..the cost to the user who buys from vendors is substantially greater not only on a charge per liter but also a monthly basis than the cost to householders who have piped water to a home with several bathrooms, a kitchen and an extensive yard that requires irrigation" (Okun, 1982). In such cases, it can be assumed that people would be more than happy to pay a lower rate for a better level of service.

Studies of water vending practices in Haiti, Indonesia, Kenya, and Honduras (Whittington et al, 1988), and Nigeria (Whittington et al, 1989) have added weight to this argument. Improved services, without subsidies, would enable people in the study areas to obtain water in both more quantity and of higher quality at a lower price than they are paying for supplies from vendors. In Tegucigalpa, Honduras, people in marginal urban areas pay vendors an average of US$14 per month during the rainy season (about 8% of income) to US$21 per month (12% of income) during the dry season (Whittington et al, 1988). By contrast, higher income households connected to the municipal water system pay only US$3.10 to US$4.10 per month for a much higher level of service and a much larger quantity of water (UNICEF, 1991a).

In many places, water vending generates very high levels of revenue, which could be put to far more efficient use. In Tegucigalpa it is estimated that water vending produces an annual revenue in the range of US$11-13 million.

> *"If government agencies could attract even 15 or 20 per cent of the outlay that now goes to water vendors, they could provide a lower-cost, permanent or interim service to the **barrios marginales** through independent, non-conventional water supply systems, that would pay for themselves within the course of a few short years" (UNICEF, 1991a).*

Studies of water vending often show that available resources are not being put to the most productive use. They provide only limited evidence, however, of what people can really afford to pay.

In crowded urban areas access to water supplies can be extremely limited and, unlike almost all rural areas, alternative free sources of supply are difficult to find. People who buy from vendors often have few other choices. Water must be bought at the expense of other things, which are likely to be basic needs in themselves (UNICEF, 1991a). Even at a much lower level of cost, people may still have to forego vital needs. Many studies of water vending fail to take this into account. It can be assumed that wherever people are already paying for water supplies they will always be happy to pay less. Studies of water vending, however, rarely tell us how to persuade people who do not yet pay that they should do so.

Women and willingness to pay

Whatever method is used to investigate demand and willingness to pay, the questions must be directed at the right people. In spite of many years of the promotion of their role in the sector, the implications for women of paying for water have received very little attention.

The implicit assumption made in most discussions of cost recovery is that the "household" will pay, with men being assumed to be the principle providers. In many places this may not be true and men and women may have separate access to and control over resources. They may also be responsible for taking care of different categories of expenditure within the household, rather than meeting all needs in a collective way.

If users are expected to pay for water and sanitation, it is necessary to find out who will actually pay the bill. In a project in Western Kenya it was assumed for a long time that male household heads were responsible for the payment of household expenses and could easily afford to pay for water supplies. The fact that cost recovery rates were disappointing was something of a mystery. It was later found that it was often women, with much lower income levels, who took a large part of this responsibility, and many simply could not afford to pay. Affordability studies had been targeted at the wrong group, and had produced quite misleading results (FINNIDA, 1991).

Partnership and action research

In spite of the difficulty in finding flawless methods, water and sanitation programmes can derive considerable benefit from investigating demand and willingness to pay. Flaws in methodology become more damaging the greater the distance between the researcher and the subjects of research. Imperfections in methodologies become less important as the level of partnership increases. Research which is strongly action-oriented, and brings together communities and agencies in not only providing answers, but also in posing questions, analyzing the information produced and agreeing on practical solutions, is much more likely to produce the right results.

Many of the factors influencing willingness to pay are qualitative, rather than quantitative. Conventional research methods may fail to get to the heart of many of them. More collaborative approaches, with full community involvement, are likely to be more fruitful. People often have much clearer ideas about their service needs than outsiders may think. Allowing them the freedom to define their own needs, identify service requirements for themselves, and negotiate resources coverage agreements on their own behalf, should strengthen the prospects for sustainable development.

APPENDIX 27

Table 2 Summary of Financing Options

What?	*When?*	*What for?*	*Who organizes?*	*How?*
Voluntary funds	In communities with a tradition of fund-raising, seasonal income, and a good knowledge and control of payments according to household capacity and benefits.	Financial contributions to construction; occasional larger contributions to maintenance and repair of simple systems with public water points.	Traditional leadership, voluntary organizations e.g. women's groups, tap organizations.	Targets are set and funds collected periodically through meetings, house-to-house collections, bazaars, etc. Funds are collected in advance or when required.
General community revenue	In communities with own sources of income and a water supply with public facilities.	Annual maintenance and repair, financial contributions to construction; depreciation and expansion where possible.	Local government, community water committee or subcommittee.	Reservation of funds based on the estimated costs and net annual income of the community; cost-reduction or income generation where necessary.
Cooperative funds	Water supply initiated and financed through production cooperative or village revolving fund; no direct payments for water used.	Annual maintenance and repairs; repayment of construction loan; depreciation and expansion where possible.	Cooperative's executive committee, community water committee or subcommittee.	Reservation of funds based on estimated costs and income from cooperative ventures and/or member fees; cost-reduction and/or member fees; cost-reduction or income generation where necessary.
Flat rates	Families have private taps, or share taps with well-defined social group, have fairly reliable incomes, and benefit more or less equally.	Repayment of community loan for construction annual maintenance and repairs; depreciation and expansion where possible.	Water committee or subcommittee, board of water users cooperative, local government, tap users' committee.	Project agency advises on initial rate for approval by users; rates are collected and administered by the local water organization.
Graded rates	In communities with appreciable differences in water use and benefits and sufficient community spirit to divide user households into different payment categories.	Repayment of community loans for construction annual maintenance and repairs; depreciation and expansion where possible.	Community water organization with support from promoters or other social experts assisting the project agency.	Private tap owners are classified in high and low rate categories, using local indicators of water use and wealth; users sharing taps may pay lower or equivalent individual rate.
Mixed rates	In communities with large differences in payment capacity and water use, with high- and low-income households living in separate sections.	Repayment of community loan for construction; annual maintenance and repairs; depreciation and expansion where possible.	Water agency with community water committee or subcommittee.	Surpluses or private taps are use to finance the costs of free public taps in poorer sections.
Water metering	In large communities with limited water resources and an efficient administration.	Repayment of community loan for construction; annual maintenance and repairs; depreciation and expansion where possible.	Water agency and/or community water organization.	Meter reading, billing and rate collecting by separate workers or payment through banks, at central government offices or local branches.
Vending instead of a piped distribution network	In communities where a socially valuable vending system can be improved, where other solutions are technically, economically or politically impossible.	Contribution towards financing of the recurrent costs of the agency, and financing of vendor service costs, including upkeep of hygiene and simple repair.	Water agency with paid operators, women's groups or water sellers' cooperative.	Water is sold from metered taps at controlled prices; when buying prices are subsidized, selling prices may equal private rates, the difference forming the vendors' income.
Vending as part of a piped distribution network	In communities where group connections or cross subsidies between private and public taps have not worked.	Contribution towards financing of the recurrent costs of public taps and the service of the vendors, including upkeep of hygiene and simple repairs.	Water agency with paid operators or socio-economically appropriate concessionaires, e.g. women heads of households.	Water is sold from metered taps at controlled prices; when buying prices are subsidized, selling prices may equal private rates, the difference forming the vendors' income.
Coin-operated taps	Not recommended because of their great sensitivity to breakdown and interference.			
Direct or indirect water taxes	In communities where the transfer of sufficient funds to the water organization is assured and taxation can be related to water use and costs.	Annual maintenance and repair; repayment of construction loan; depreciation and expansion where possible.	Local government service organization for a specific area, e.g. a low-cost housing scheme.	Taxes are used exclusively for financing one or several basic services; categories of payment are based on level of service or housing conditions.

Source: van Wijk-Sijbesma, 1989.

APPENDIX 28

1.3 Key Elements of Maintenance Management Systems

MMS includes a number of interconnected components. The key elements of an idealized MMS, illustrated in Figure 1, are summarized below. Chapters in this manual cover each of these topics in greater detail.

Planning and Organizing. During the initial startup, and annually thereafter, the maintenance staff will have to spend time and effort to plan their activities and organize themselves for maximum effectiveness. This process involves setting goals, identifying and describing tasks, outlining resource requirements (staff, materials, equipment, and other inputs), preparing annual plans and budgets, defining schedules, and organizing and training staff. From this base, the work can proceed logically and directly. The year's activities can be monitored in this context, and plans for the future can be made based on the progress achieved.

Preventive maintenance planning is crucial to the overall planning process. Based on an inventory of all equipment to be maintained, a clear definition must be made of all tasks to be performed. Task specifications must then be developed that detail the procedures to be performed, their frequency, and all required inputs (labor, materials, equipment). Then, the total resource requirements can be estimated, and a schedule of all tasks at all sites can be compiled. These results form the core of an annual plan and budget on the basis of which the work can proceed in an organized, planned fashion.

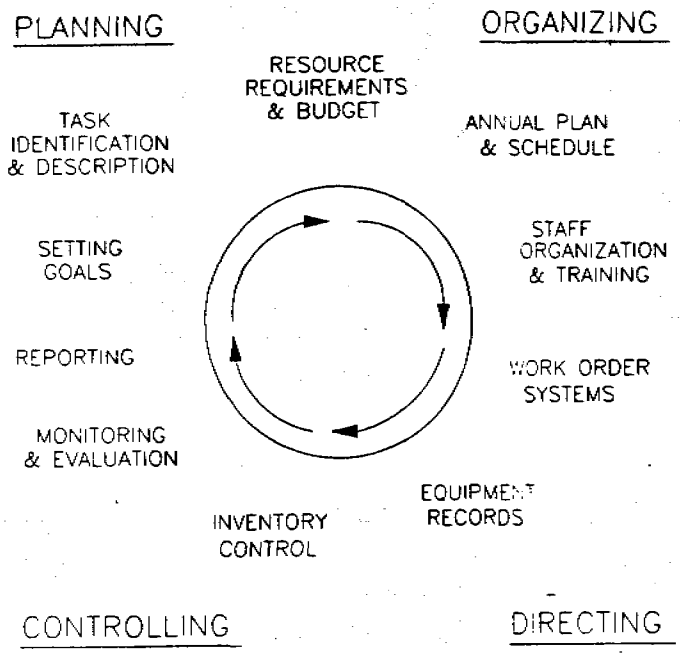
Work Order Systems. A key component of a MMS is the ability to direct maintenance personnel to do planned work at the right times. Using a system of written work orders allows a water system operator or maintenance manager to direct the staff according to plan. The work orders direct the staff, but they are not detailed technical instructions. The PM task descriptions and repair manuals provide the instructions. Once issued, work orders must be tracked to ensure that work is completed in a timely fashion. Work orders also serve as a place to record data on time spent, materials used, and costs incurred. Many organizations contract out repairs or other maintenance work to private firms. This option should be examined carefully. All such contract work should be linked to the work order system.

Equipment Records. Detailed information on the equipment being maintained and the work performed on it must be stored in detailed equipment records. Equipment must be inventoried and assigned identification numbers. Equipment history files should be developed for the storage of equipment specifications, manuals, a log of the work performed, and the actual completed work orders. The exact form of these files will depend on the type of equipment being maintained and its geographic distribution.

Materials Inventory Controls. Maintenance personnel must have easy and rapid access to the required spare parts, supplies, tools, equipment, and other inputs necessary to perform their work. Preventive or corrective maintenance work should not have to wait for some part to come in. While it would be easy to purchase and store every conceivable part and supply, that would be prohibitively

Figure 1

An Ideal Maintenance Management System



expensive. The staff must decide on the most important issues, such as how to balance the cost of delays and how to deal with the cost of supplies. Good inventory control is necessary and is based on using paper forms for tracking the receipt and issuing of materials, using ledgers for monitoring stock, and using a streamlined ordering process.

Monitoring, Evaluating, and Reporting. As work progresses, results and costs must be monitored, evaluated, and reported. The monitoring enables managers to gauge progress, identify weak spots, and plan corrective action. Reporting enables the managers to convey these findings to other maintenance personnel, engineering staff, top management, and outside interested parties. This process feeds directly into the planning and organizing process described above.

1.4 Successful Maintenance Management

The attributes and requirements of a successful MMS can be defined as follows.

Simplicity. The system must be easy to understand by those who use it. The purpose of all forms and procedures must be understood by all, otherwise they will not be used. Lengthy paperwork should be minimized.

Completeness. The system must provide periodic, reliable information concerning the status of all maintenance work that is under way or pending, including both PM and CM. All maintenance work must be planned, directed, controlled, and reported on by the same system.

Flexibility. Although paperwork should be uniform and carefully followed, the managers must be open to changes that will improve the system. Opportunities for improvements are almost always available. Improvements should be adopted incrementally, however. In the beginning, a very basic system should be put in place, and the system expanded or improved as time goes on and the staff develops.

Clear Responsibilities. All staff must know what their responsibilities are, and each job must be allocated to a specific person. When a task arises, it should be clear to all which staff member has responsibility for the job.

Compliance. All staff must comply with forms and procedures and perform the tasks demanded of them within the MMS. People tend to ignore paperwork and often forget to write things down. Paperwork may seem less important than "getting the job done," but detailed records enable the whole system to work well.

Decentralization. The responsibility for day-to-day running of the system should be decentralized. Some operations and maintenance (O&M) functions, such as accounting or procurement, may best be centralized, but the actual control and monitoring of the work should be decentralized as much as possible.

Full Support of Top Management. Upper management and external oversight agencies must give full support to the allocation of human and financial resources to the

maintenance management system. Top management must give the maintenance manager the authority and control over the resources required to implement the system. This is particularly true in the early stages of implementation; otherwise, the system will not be able to achieve its goals.

Strong Leadership. It is essential that the maintenance manager, who will have responsibility to start up and run the MMS, be a strong leader. He or she must ensure that all clerks, craftspersons, and others involved fulfill their responsibilities under the system. The manager must motivate staff to do good work. He or she must strive to keep work on schedule and ensure that necessary follow-up work is done.

Sufficient Transport. Whether in a rural or urban context, the maintenance staff requires sufficient and reliable transport for people, materials, parts, and tools. If transport is often unavailable or unreliable, work will be greatly hampered and delayed. Activities will take longer than expected, and staff will not be able to keep up with schedules. Vehicles often break down, causing transport problems. This manual does not focus on vehicle maintenance or management, but vehicles should be treated like other equipment to be maintained--a schedule of tasks should be developed, maintenance work ordered, parts and supplies stocked, records kept, and performance monitored and evaluated.

Rapid Information Flow. Communications regarding problem notification, work orders, difficulties in completing work, and maintenance reports must be rapid so that personnel have the latest information and can respond rapidly.

Link to Operations. Operations personnel and maintenance personnel must work together in a mutually supportive way. Operators can assist in PM and CM activities, inform maintenance personnel of problems, and advise on parts stocking, PM schedules, and other aspects. Maintenance, of course, keeps things running so that operators can do their work.

1.5 Layout of This Manual

This manual is organized into chapters, which correspond to elements in the ideal MMS shown in Figure 1. Several chapters cover a number of elements in that circular diagram, and several focus in detail on just one. To help the reader keep the whole picture in mind, Figure 1 is repeated at the start of each chapter, in reduced size, with the topic of the chapter highlighted. The reader can immediately see which topic is to be discussed and how it fits into the entire maintenance system.

In each chapter, the basic elements are introduced and explained, sample forms are given, and a discussion follows on how to develop and utilize the forms and procedures. Readers may adapt the sample forms to their own situation. For convenience, the forms also appear in Appendix A.

1.6 Intent of This Manual

This manual is primarily written for government agencies that have the lead responsibility for maintaining water and sanitation systems. It is generally intended for medium-sized to large organizations, to help them manage a staff to ensure better maintenance.

This manual can be useful to agencies of various organizational structures--simple or complex, centralized or decentralized, single autonomous entity or large, national agency with offices at many levels. Perhaps the simplest water utility structure would be a municipal water authority with its own intake, treatment plant, distribution system, and maintenance office and staff. Such an organization could apply these MMS components directly and easily. At the other end of the spectrum of applicable agency structures would be a national water supply agency that runs many small town or village water systems through a series of local, regional, and national offices. Multilevel agencies are more complex, but the procedures and forms presented here should apply, with some adaptations.

This is not a guide for villagers on how to maintain their own handpump, a guide on training village caretakers, or a guide for agency managers on how to elicit community participation in O&M. Those must be the subjects of other manuals.

The manual is written for new or existing water and sanitation agencies. In most cases an improved MMS will be worked into an existing organization. Rarely is a new agency begun "from scratch." Sometimes two agencies are merged, or a large one divided. This restructuring may provide a good time to incorporate improved maintenance management.

These guidelines should be useful for top management, maintenance managers, and other maintenance personnel in water and sanitation utilities. Top management can learn about the basic components and benefits of good maintenance management, which should convince them of the need to support it. Maintenance managers can learn the techniques they will have to adapt and apply. The manual may also be useful in training lower level maintenance personnel in these methods. Specific chapters can be useful for specific personnel, such as the chapter on inventory controls for the storekeeper and the section on work orders for crew foremen.

This manual explains all aspects of a maintenance management system. Yet the information cannot be taken directly and implemented. Managers will have to study these guidelines and adapt the procedures and forms to their own situations. It is intended to be a useful guide, not a packaged system to adopt blindly.

It is also important to note that these procedures are somewhat complex and cannot be implemented overnight. At the start, it will make sense to adopt a simplified version of each MMS component. Applying the techniques to a single pilot plant or system is a sensible approach. Over time, each MMS component can be refined and improved. As experience is gained and procedures refined or adapted, a more widespread implementation can be made. It will take a large

APPENDIX 29

from: Jordan & Wyatt (1988) Estimating O&M costs for water supply systems in DCs WASH rep. 48

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Chapter 2

ELEMENTS OF O&M COSTS

2.1 Introduction

This manual will focus on those elements which contribute directly to the cost of operating and maintaining a water supply system. In this section, the individual elements that constitute O&M costs will be analyzed separately, including:

- Labor
- Materials
- Chemicals
- Utilities
- Transport
- Private Contractors
- Others.

Methods for estimating costs for each of these elements will be developed, and the worksheets used to combine the elements into a single estimate will be presented in Chapter 3. Examples are shown in Chapter 4.

While performance of these procedures has no firm prerequisites, a variety of data should be collected prior to starting the estimate. First of all, the estimator must have a general orientation to the institution which will operate the system. He or she must know the basic operating procedures within the organization in order to make the estimate. Second, detailed information on the engineering design will be indispensable for estimating material, chemical, and utility costs. Third, an O&M plan for the system will greatly simplify the estimation process. It should outline the personnel required, their duties, tasks to be conducted, frequency, etc. Such planning is often not carried out, but it is very important to both good O&M performance and accurate cost estimation. Fourth, any records on costs of other systems, as well as frequency of O&M tasks (both preventive and corrective), will be very useful. Unfortunately they often are not available. Lastly, unit cost data for materials, transport, fuel, etc. will be very useful.

2.2 Labor

2.2.1 Estimating Personnel Requirements

The number of personnel required to operate and maintain a new system will, of course, vary widely. A water system which includes full treatment will require substantially more personnel for O&M than a piped system being fed from a capped spring. A more important issue that must be resolved prior to estimating staffing costs is to determine the staffing practices of the agency responsible for the water system. Each type of system requires a certain

APPENDIX 30

Background information

1. Purpose of monitoring

Monitoring O&M aims to provide information to be used to maintain or improve O&M performance, to ensure or increase efficiency, and to establish favourable conditions for organizational sustainability. Users of monitoring data can be classified in two groups:

- Actors in O&M (Including community members etc)
- Managers and planners at different levels

For a monitoring system to serve its purpose, its users should be involved in deciding which information is essential and which data will be collected to serve these information needs. Therefore, while developing monitoring systems, the main purpose of the programme or organization concerned must be kept in mind. The purpose of O&M organizations or programmes for rural water supply and sanitation is to ensure the functioning of installations for the design life of systems and beyond. Management of O&M aims to achieve this purpose efficiently by minimizing costs and involving different partners or actors in such a way that O&M will be sustained in the future.

The volume of data collected should be as small as possible. The data should be easy to store and analyze to make them accessible for the above target groups.

In the past, efforts to develop monitoring and management information systems for O&M in rural areas have often failed because the developed monitoring systems were not sufficiently simple, too costly and not user friendly. Most of these systems were top down and followed a blue print approach. As it was often not sufficiently clear what information was really needed for those who carry out O&M tasks and for day to day management of O&M, the data were not used. Another reason has often been that the monitoring data were not reliable and not verifiable. Thus, for successful monitoring the following principles need to be applied:

Keep it simple and do not collect more data than really needed.
Make sure in advance that these data can be processed and used timely without increasing over-all costs.
Ensure flexibility by a bottom-up approach.

For an operational monitoring system, it is essential to develop a set of monitoring indicators which are accepted and used both by actors in O&M and managers at various levels in the organization or organizations concerned. Some of these indicators would be used more specifically for a management information system. The various indicators must measure the performance of the O&M system, its efficiency and if possible progress towards organizational sustainability of O&M. Indicators are often developed by first defining targets or results in terms of quality, quantity, time and place.

2. Types of indicators

Basic performance indicators for O&M in rural areas mainly relate to the state of functioning of installations and to the functioning of key components of an O&M system, such as the provision of spare parts. These indicators serve to monitor progress towards planned results (Progress monitoring in result areas)

Managerial indicators combine the above basic performance indicators with data reflecting the use of human and other resources (Resource monitoring). These indicators are important for a management information system. Often monitoring of costs (Financial monitoring) is a good way to monitor the use of resources.

In construction programmes this would compare with monitoring of physical progress (basic performance of a programme) in combination with financial progress.

Policy implementation indicators may be used to monitor progress towards organizational sustainability along policy lines. Use of policy indicators may help to strike a balance between achieving long term sustainability of O&M and short term improvement of O&M performance.

Policy implementation indicators relate to the impact of an O&M programme on its institutional environment (impact monitoring). In construction programmes this compares with monitoring of socio-economic impact (health, wellbeing, income) of drinking water supply and sanitation provision.

In the case of O&M programmes and organizations concerns progress the desired impact or long term goal is to ensure the organizational sustainability of O&M. This term has been defined in other modules (see working sheet)

Examples of the above three types of indicators are given on "supporting material" pages of this sub-module.

3. Methodology

A monitoring system for O&M is developed by :

- identifying which information is needed by those who carry out or supervise the actual O&M tasks,
- determining how they could realistically collect and store this information, and
- defining who will verify the information and how.
- ensuring that this information can be easily processed and used by managers and planners

The above implies that the information needed at the field level suits the needs of managers and planners provided it is processed and combined with other information concerning the use of resources.
In practice, monitoring systems are developed locally by trial and error. It is often useful to consult other programmes and compare basic indicators. Testing indicators and data collection mechanisms on a small scale is essential.

Those who collect and verify the information are the actors in an O&M system. Monitoring systems requiring additional field personnel are not sustainable.

An example of the setting up of a monitoring system is the WASAMS monitoring system developed by WHO & UNICEF, see supporting material.

4. Summarizing lecture

This summary aims to highlight the main issues and to propose an approach to develop a monitoring system for O&M.

Use of monitoring data

It is important to concentrate on data which really measure the performance of O&M. Not all information can be included in the monitoring system. Data will be collected if they are of direct use to those who collect the information. For more elaborate data collection, evaluation studies are needed. Evaluation studies may show if monitoring data are reliable and meaningful.

Indicator development

There are different types of indicators. Basic performance indicators form the basis of a monitoring and management information system. The number of indicators must be kept small. An indicator which is not objectively verifiable is not an indicator, and should not be included in a monitoring system. Social or behavioral aspects of O&M cannot really be dealt with in a monitoring system as they are not objectively verifiable. These aspects can be covered as part of evaluation studies.

Towards monitoring of O&M

The suggested approach towards better monitoring of O&M is to work from the bottom up, and to start small.
The following steps are proposed:

- Identify the basic O&M tasks including provision of equipment and spares
- Identify the information needed to organize the work of staff at the lower levels.
- Identify basic performance indicators for O&M
- Test the indicator at a small scale for a limited period and ensure that the intended users of information give feed-back.
- Carry out evaluation study to verify if the monitoring data are significant (reflect the status of O&M in the area concerned).
- Adapt the indicators and apply at larger scale
- Start building up management information system including development of management indicators, and also policy implementation indicators if appropriate.

APPENDIX 31

3. *Benefits of Improved Water and Sanitation*

The more benefits which can be obtained from water and sanitation improvements, the greater the prospects for resources coverage and sustainability will be. Obtaining benefits is important to supporting agencies, who must justify public investment in the sector, and to users, who will only be interested in improvements if they have something to gain. In the case of users, this is of decisive importance if they are being asked to pay.

Few people involved in water and sanitation development programmes doubt that providing improved services is beneficial. Having a clean water supply and adequate sanitation facilities are necessary conditions for any meaningful improvements in quality of life. Simply providing these services, however, has often not proven sufficient to ensure that the full range of possible benefits is obtained. Even where benefits are obtained, it has often been difficult to provide clear proof of this. The demands for increased user contributions make this more than just an academic argument.

Properly implemented water and sanitation improvements should always lead to advantages, and possibly to significant benefits and desirable long-term effects (see Box 5). The advantages should be direct and immediate. These include: the delivery of water in greater quantity and closer to home on a more reliable basis; better water quality; and generally improved environmental health conditions, through the protection of water sources and the hygienic disposal of human waste. Although these advantages may be seen as benefits in themselves, they often create a situation where greater benefits can be achieved, and are not always enough in themselves to justify investment or motivate people to pay.

Box 5

POTENTIAL BENEFITS FROM IMPROVED WATER AND SANITATION SERVICES

Intervention

* Improved water and sanitation services

Advantages

* Improved water quality
* Increased water quantity
* More convenient and reliable service
* Improved environmental health conditions

Potential benefits

* Improved safeguards against water and sanitation-related diseases
* Reduction of workload for women and children
* Improved health knowledge
* Improved hygiene behaviour
* More water for production
* More time for production
* Improved technical skills in community
* Improved management skills in community
* Improved social status
* Increased food production
* Increased general production
* Improved community management capacity

Long-term effects

* Reduced mortality and morbidity from water and sanitation-related diseases
* Higher nutritional status
* Increased income
* Increased demand for development
* Improved health
* Improved standard of living
* Improved quality of life

Exploiting these advantages and achieving concrete and highly valued long-term benefits to health and standards of living is complex. Pathways must be created from the direct advantages to real benefits and long-term effects. The development of any of these will depend on a host of variables, including the types of service provided, the implementation approach adopted, users' recognition of potential advantages, how systems are used, general resource availability, and changes in behaviour. At no point will one step in such a pathway automatically lead to another. Lasting benefits will only be obtained if they are actively and systematically pursued. The benefits of improved water and sanitation services are usually treated in two broad categories:

1. Benefits to health.
2. Savings in time and effort, leading to economic and social benefits.

Health benefits

In 1842, the campaigner Edwin Chadwick argued that public investment in improved water and sanitation in Britain would be justified through the growth of a more healthy and productive population (Chadwick, 1842). Chadwick's argument was supported by improvements in knowledge about the links between water and health, and in particular the discovery of the role of water in the spread of cholera (Aziz et al, 1990).

More than a century later, at the beginning of the International Drinking Water Supply and Sanitation Decade (1981-1990), an United Nations report expressed much the same hope (Falkenmark, 1982). At the same time, it was recognized that both achieving this aim, and proving it, were going to be extremely difficult. The fanfare accompanying the launch of the Decade inevitably oversimplified the complex problems involved. As the financial crisis in the sector has deepened, the need to seek concrete proof that benefits are being obtained has become a stronger felt need. In the process, the assumed benefits have been called into question, and the confidence expressed by Chadwick is no longer so clearly echoed in current discussions.

The difficulties in showing health benefits as a direct result of water and sanitation improvements have been interpreted in different ways. Some have argued that the links are so hard to prove that improved health cannot effectively be counted as a benefit (Churchill, 1987). Others have been more optimistic. In a review of almost 40 years of experience, Esrey and Habicht acknowledge that flaws are to be found in virtually all attempts to measure health benefits related to water supply and sanitation interventions, and that "improved studies are needed". They nevertheless conclude that "..one can infer from the current literature beneficial health impacts following improvements in water and sanitation." (Esrey and Habicht, 1986). An earlier review of 67 studies from 28 countries showed median reductions of between 16-37% in diarrhoea morbidity among young children as a result of improved water supplies and sanitation. The studies were reviewed on the basis of the individual and combined effects of improvements in water quality, water availability, and excreta disposal (Esrey et al, 1985).

Health benefits do not flow directly and automatically from improvements in water and sanitation services. To be achieved, they need to be explicitly defined as a goal, and equally explicitly pursued by support agencies and, most crucially of all, by users themselves. The key to attaining better health as a benefit is linked to patterns of behaviour, as much as to technical interventions. Improving services creates possibilities for health improvement but further action is required, including the development of appropriate and carefully planned hygiene education programmes (cf. Boot, 1991), if positive effects are to be achieved.

Benefits from time savings

While governments and aid agencies justify investment in the water and sanitation sector on the basis of health, users are often more aware of other benefits such as the added convenience of improved services and the time savings which can be obtained (Cairncross, 1988).

Saving time means that collecting water may be less burdensome, particularly for women, and that more effort can be directed towards productive activities. Economic and financial benefits can also be obtained by increasing water availability and making it more readily accessible for productive uses (eg. livestock watering, garden irrigation, etc.). Improved services can also lead to cash savings, for example when a new system replaces water vending and delivers water at lower cost. The linking of water and sanitation improvements with increased levels of income appears to be more attractive than trying to pin down health benefits, which are often less easy to recognize. Furthermore, if improved services lead directly to monetary gain, ability to pay by definition will increase, and the argument that people should pay for services is easier to support.

The value of time gains may be understood differently, depending on your point of view. Men and women, for example, may have quite different perceptions of the value of women's time. Some evidence points to this as an important factor, though more research is still needed (Kamminga, 1992). Even if women do value time savings more than men, this does not mean that they will be free to exploit them or that this will lead to increased willingness to pay. The agency view of the value of time may also differ significantly from that of the users.

> *"Saving time has a greater or lesser value to a household, depending on what its members can do with the extra time. Regardless of what the members actually would do with the time, a valid measure of its value to them can be inferred from how much they could earn if they used it in income-producing work" (Churchill, 1987).*

This analysis relates to the opportunity cost of time, or what can best be done with available time to obtain the optimum advantage from it. In practice, however, the economic value of time may have less meaning than other factors. As Feachem and his co-authors noted in their study of rural water supplies in Lesotho (Feachem et al, 1978), people in subsistence economies do not always think primarily in monetary terms. The idea that "time is money" can be baffling in contexts where other benefits, such as increased leisure and status, have more meaning.

Like health improvements, the benefits of time savings are rarely automatic. In a literature review of the potential benefits for women of improved rural water supply, Kamminga notes a range of possibilities but cautions that none can be presupposed. The possibility of deriving economic and financial benefits from improved water and sanitation services is no guarantee that they will be realized or that any benefits gained will be equitably distributed. It is clear, however, that benefits are often there for the taking, if they are actively pursued (Kamminga, 1992).

Negative effects of water and sanitation programmes

As well as creating potential benefits, attempts to improve water supply and sanitation services can also lead to serious negative effects. In assessing the actual and potential costs of programmes, possible negative effects also need to be considered. While benefits must be actively pursued, negative consequences must be equally actively avoided.

The list of possible negative consequences is extensive (van Wijk-Sijbesma 1981), and underlines the importance of taking as much note of the possible damaging effects of improvement programmes as the potential benefits. Rather than creating better health conditions, for example, attempts to improve services may increase health risks due to unintended environmental and ecological effects. These may even threaten the security of water resources themselves. Unintended consequences for economic conditions can include a widening rather than narrowing of the gap between rich and poor. In respect of social conditions, negative impacts can be felt by the poor and by women, and projects may create division rather than solidarity in communities, and greater rather than lesser dependence on external agencies.

The pursuit of benefits

Moving to an approach to water and sanitation improvement based on user demand, with a strong emphasis on resources coverage, means that new ways must be found to actively pursue and optimise the benefits to be obtained. Improved systems must be seen as vehicles for the delivery of benefits, rather than as ends in themselves. From this point of view, the installation of new water and sanitation systems is the beginning rather than the end of the development process.

Benefits must be pursued as strongly by users as by support agencies. This means that a shared perception is needed both of the benefits to be pursued and the means of pursuing them. Partnership is vital to ensure that common goals are identified and agreements made as to how they are to be reached. Joint monitoring is also crucial to both ensure that goals are being reached, and that all benefits obtained are clearly recognized. Complaints that users are not making the best use of service improvements make no sense if common goals have not been set, potential benefits are unrecognized, and clear actions are not undertaken to achieve them.

APPENDIX 32

THE DEVELOPMENT OF THE DEEPWELL HANDPUMP PROGRAMME IN INDIA

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Introduction

Drilling boreholes in hard basalt formation was introduced in India in the rural water supply programme in the early 1960's by the Jalna based Church of Scotland's "War on Want" mission. While the drilling of boreholes was very successful the hand pumps fitted on these boreholes were of poor quality. They were locally manufactured cast iron copies of European and American handpumps, meant for family use rather than community use and broke down frequently.

Design improvements to handpumps were carried out by various non-government organizations in the late 1960s and early 1970s and by 1974 several thousands deepwell handpumps, mainly of three different designs i.e. Jalna, Jalwad and Sholapur were installed in many states in India. These pumps did not have standardized drawings and interchangeability of parts was impossible even for pumps of the same desig.1.

In early 1974 UNICEF carried out a spot survey to determine the status of boreholes drilled with UNICEF provided drilling rigs. The survey revealed that at least seventy five percent of the handpumps were broken down at any given time. It was clear that unless substantial improvements were made in handpump design, quality, installation, and maintenance, no useful purpose would be served by drilling more expensive boreholes. The high failure rate of handpumps was in fact eroding the confidence of people in the deepwell handpump programme as a reliable source of safe and continuous water supply. The issues that needed urgent attention were:

- Design and development
- Standardization
- Local capacity building
- Quality control

- Installation
- Maintenance

The Government of India (GOI) and World Health Organization (WHO) organized a handpump workshop in June 1975 to discuss various issues related to deepwell handpumps. The participants in the workshop were Chief Engineers (Public Health Engineering) from various states and representatives from Mechanical Engineering Research and Development Organization (MERADO), Richardson & Cruddas (1972) Ltd., (a Government of India undertaking) UNICEF and bilateral agencies. The workshop unanimously recommended that there was an urgent need to develop a reliable and sturdy deepwell handpump.

During 1977-1989, the rural water supply programme experienced a miraculous expansion and a very high success rate. The achievements can be summarized as follows:

- Development of the India Mark II deepwell handpump and its adoption on a national scale;
- Preparation of a national standard;
- Establishment of local manufacturing capacity;
- Establishment of a quality control mechanism including vendor selection;
- Installation of 1.5 million India Mark II deepwell handpumps; and
- Development of VLOM India Mark III deepwell handpump.

This spectacular success was possible due to the adoption of certain approaches/strategies by the GOI, UNICEF and bilateral agencies. This paper discusses the various approaches/strategies followed by the GOI, non government organizations, UNICEF and bilateral agencies and how various issues were successfully resolved.

Development of an Appropriate Handpump

Prior to 1975 several handpump designs were available. These were the Mahasagar (cast iron single and double guide pumps with a number of pivot points), Jalna and Sholapur pumps. These pumps

had a high frequency of breakdown (over 75%) and were not sturdy enough for community use. The quality of manufacture was often poor and the components used were not interchangeable.

A collaborative national effort involving Tamil Nadu Water Supply and Drainage Board (TWAD), MERADO, Richardson & Cruddas and UNICEF was initiated by the Government of India in late 1975 for the development of a sturdy and reliable deepwell handpump. While the design support was provided by MERADO, (a design and development organization), the manufacturing and field monitoring were provided by R & C, a manufacturer, and TWAD Board (a state level organization responsible for providing water supply and sanitation facilities) respectively. UNICEF coordinated the development efforts and worked as a catalyst.

The criteria set out for the handpump development effort were:

1) Trouble free operation for at least one year and capable of drawing water from boreholes with Static water levels of up to 150 feet;
2) Number of people to be served - 500 persons per pump;
3) Design must be suitable for local manufacture and should not involve import of components or materials;
4) An adult must be able to operate the pump without undue effort;
5) Design to permit maintenance by people with low engineering skills; and
6) The design must be sturdy and vandal proof.

The Sholapur handpump which was then considered as the best handpump was taken as the basis for the development of a new pump. This pump design was strengthened substantially to overcome weaknesses. The design evolved as a result of intensive consultations and discussions between MERADO, UNICEF and R & C. By early 1976, ten prototype pumps were installed near Coimbatore, in Tamil Nadu State, for field testing and monitoring under the joint supervision of the TWAD Board and UNICEF. This area was selected for field testing of prototype handpumps as it had a deep water table (25-45 mts) and

usage was very high (12-16 hours). Encouraged by the field trials, a decision was taken in 1977 to field test 1000 pumps of the same design in various states. By 1978 it was very clear that a sturdy, reliable and easy to operate pump had been developed. In recognition of its Indian origin and the many Indian organizations and individuals who contributed so much to the development, this pump was called the India Mark II. The development of this pump achieved all the criteria with the exception of maintenance by people with minimal engineering skills.

Although the emergence of the India Mark II was a major breakthrough in terms of reliability and ease of operation, it relies heavily for all below ground repairs on a centralized mobile team equipped with a motorized van, special tools, heavy spares like connecting rods, riser pipes etc. and 3-4 semi-skilled workers. Due to the cumbersome maintenance procedures involved in all the below ground repairs it is not feasible to develop a village based maintenance system that is replicable.

Keeping in view the need to carry out most of the repairs at the village level the UNDP/World Bank Water and Sanitation Program, in collaboration with the GOI, TWAD Board, R & C and UNICEF implemented the Coimbatore Handpump Field Testing Project with the objective to carry out potential improvements to the India Mark II handpump. Four and half years (1983-1988) of intensive research and development work and close field monitoring resulted in the development of a VLOM (Village Level Operation and Maintenance) derivative of the India Mark II handpump known as the India Mark III handpump. This pump design facilities the extraction of the plunger assembly and foot valve assembly without having to lift the rising main. This design feature simplifies the maintenance procedure for the below ground repairs significantly.

Research and development is a continuous process and is essential to permit continual improvements in design to overcome field problems and to improve reliability and performance. At the national level a "Hand Pump Committee" has been constituted by the Department of Rural Development (DRD), GOI: with members from GOI, MERADO, State Governments, bilateral and multilateral agencies

to coordinate all research and development efforts. This ensures planned research and development efforts, dissemination of information on a national level and operationalization of field proven design improvements.

Need for Handpump Standardization

While the initial prototype pumps were being field tested in 1976-1977 various copies, imitations and substandard versions of the India Mark II design began to appear in the market. Initially, UNICEF distributed the production drawings. With the objective of standardizing on the India Mark II handpump a decision was taken by the GOI to request the Indian Standards Institution (now known as Bureau of Indian Standards) to prepare a national standard on the India Mark II handpump. Normally, a national standard does not specify dimensions and other details of components and sub-assemblies. But keeping in view the special circumstances and to ensure 100% interchangeability of components, the Bureau of Indian Standards (BIS) agreed to deviate from the usual norms. The first national standard on the India Mark II, IS: 9301 - 1979, appeared in the year 1980. This standard apart from dimensional details specifies material of construction, quality control procedures, type test, routine test, warranty clause and a procedure for quality certification by BIS. Preparation of handpump standards and review of the existing handpump standards is entrusted to a "Handpump Committee", constituted by BIS with representatives from BOI, state governments, manufacturers, bilateral and multilateral agencies and NGOs. The India Mark II standard was revised in 1982, 1984, 1986 and 1989.

The BIS provides a permanent forum at the national level for the preparation of new standards and an ongoing review of the existing standards.

The advantages of standardization were:

- There was uniformity in production and interchangeability of components improved significantly;
- Many manufacturers were ready to invest in good jigs and fixtures and tooling;

- Procurement was made simple as just a reference to the standard defined the pump in all details; and
- Inspection became more systematic.

Developing Local Production Capacity

Local production of quality pumps is one of the important elements responsible for the success of the rural water supply programme. At the request of the GOI, UNICEF undertook the role of developing and qualifying manufacturers. The procedure followed was:

1. Potential manufacturers were selected by assessing their manufacturing, organizational, and financial capacity/capability through questionnaires and works' inspection by an external inspection agency.
2. Each potential manufacturer was given a trial purchase order for 25 India Mark II pumps.
3. Technical assistance was provided to manufacturers to enable them to overcome initial teething problems.
4. The batch of pumps produced by a manufacturer was checked against the trial purchase order and also the jigs, fixture, and gauges were inspected by an external inspection agency at the manufacturers works.
5. On acceptance of the batch of pumps and approval of the manufacturing process by an external inspection agency, the name of the manufacturer was included in the UNICEF list of approved suppliers.

The GOI and various state governments issued the tender documents for the procurement of India Mark II handpumps only to UNICEF approved manufacturers. This prevented entry of incompetent manufacturers into the market.

Today there are over 45 UNICEF approved manufacturers of India Mark II handpumps located in several states. The overall annual manufacturing capacity is 300,000 pumps. The advantages derived by establishing adequate local production were:

- Pumps were available at short notice and the programme did not suffer due to non-supply of pumps in time;
- Prices were very competitive;
- Spare parts were available easily all over the country;
- Manufacturers were able to export pumps to over 30 countries in Asia, Africa and Latin America thereby earning valuable foreign exchange;
- Additional employment was created; and
- The pace of implementation of the programme was accelerated.

With a view to establishing a national mechanism all the UNICEF approved manufacturers were advised in 1983 to obtain a licence from the BIS for the manufacture of ISI certified India Mark II handpumps. All the approved manufacturers have obtained the BIS licence and manufacture ISI certified India Mark II handpumps. This mechanism will prevent entry of unscrupulous and incompetent manufacturers as all the state governments insist on the supply of ISI certified India Mark II pumps.

Quality Control of Manufacture and Installation

Vendor selection and development of local production was the first step to ensure the manufacture of a quality handpump. However, this in itself does not guarantee a purchaser the supply of handpumps confirming to the specifications. The inspection of handpumps and spares at the manufacturers' works by an independent inspection agency before despatch was therefore considered absolutely essential. For this purpose UNICEF provided, at their cost, services of inspection agencies to all the state governments for inspection of India Mark II pumps and spares ordered by the state government from the UNICEF approved manufacturers.

This was perhaps the most crucial decision that assured the supply of quality India MarkII pumps and spares during the last 13 years. This factor has contributed immensely to the success of the rural water supply programme. Every year some 150,000 - 200,000 India Mark II pumps and spare parts are inspected at the manufacturers works by UNICEF approved inspection agencies (Crown Agents and SGS (India) Pvt. Ltd.).

In order to establish a national mechanism the BIS have been requested to inspect all the India Mark II handpumps at the manufacturers works and certify the pumps before despatch. BIS is now inspecting the pumps offered by the manufacturers. In fact, at present the pumps are very often inspected by the BIS as well as a UNICEF approved inspection agency. This mechanism will ensure supply of quality India Mark II handpumps even after UNICEF withdraws the quality control support.

A supply of quality handpumps alone is not enough if the installation is not carried out properly. To improve the quality of installation the following steps were taken by UNICEF in consultation with the GOI and state governments.

1. Preparation of installation and maintenance manuals and training materials for trainers, mechanics and handpump caretakers.
2. Development of special tools which made the installation and maintenance easier.
3. Human resource development through a large number of training programmes.

These steps helped to improve the quality of installation significantly and also helped in the standardization of the installation procedure.

Maintenance and Community Management

The Mark II handpump is a mechanical device used by the community and therefore needs good maintenance support to ensure its continuous operation. Although this pump does not break down frequently, it relies heavily for all the below ground repairs on a mobile team often placed at block/district level and consisting of a motorized van with special tools, heavy spares like connecting rods and riser

pipes and 3-4 semi-skilled workers. The cumbersome maintenance procedures involved in all the below ground repairs of the India Mark II virtually rules out the possibility of the development of a village based and community managed maintenance system. The maintenance is therefore looked after by the State Government through one of the following maintenance systems namely three tier, two tier, and Trysem. All these maintenance systems depend on mobile teams located several kilometers away from the villages. It is estimated that due to delay in the reporting of breakdowns and the long response time of the mobile teams, the India Mark II on an average remains inoperative for over 30 days annually. The down time could be eliminated if most of the repairs were carried out at the village level itself.

With the emergence of the India Mark III handpump (a VLOM version of the India Mark II) it is possible to establish a village based and community managed maintenance system, as over 90% of the repairs can be carried out by a village mechanic with the help of a pump user and fewer tools.

A national workshop on "Potential Improvement to India Mark II Handpump Design" organized by the GOI on 24-25 May, 1990 at New Delhi recommended the introduction of the India Mark III handpumps on a large scale and also the establishment of a village based and community managed handpump maintenance system.

Lessons Learnt

The pragmatic approaches and strategies adopted during the last fourteen years ultimately led to the successful implementation of the world's biggest deepwell handpump programme in India involving some 1.5 million India Mark II handpumps. The main lessons learned from this experience can be summarized as follows:

1. Community handpumps should be sturdy, reliable and easy to operate.
2. The pump design should allow most of the repairs at the village level with few tools and minimal skills.

3. Standardization brings with it several advantages like reduction in cost, reduced inventory and training requirements, and interchangeability of components. It also helps in the procurement and inspection of goods.
4. Building of a local manufacturing capacity is a must and should be encouraged wherever feasible. Careful selection of potential manufacturers followed by technical assistance helps in building a local manufacturing capacity.
5. Quality control is perhaps the most important factor for the success of any programme. Expenditures on quality control is essential and economically beneficial as costly repairs at site are avoided.
6. Installation must be carried out properly. Defective installations are always a source of perennial maintenance problems.
7. The centralized maintenance system comprising a motorized van and crew and located several kilometers away from the village is expensive, complex, inefficient and difficult to sustain.
8. Human resource development (HRD) is essential for the success of a programme. Expenditure on HRD is never a waste as it creates a permanent asset.
9. For a long term sustainability it is necessary to decentralize the maintenance system. Most of the repairs must be carried out by the users themselves or a village mechanic at the village level.

APPENDIX 33

TECHNOLOGY SELECTION FOR LESOTHO'S RURAL WATER SUPPLY PROGRAMME

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Introduction

Lesotho is a small mountainous country with a population of 1.6 million. It is landlocked and completely surrounded by the Republic of South Africa. The total area of the country is 30,350 square kilometres of which two-thirds is high mountains and hills with elevations ranging from 1500 to 3500 metres. Due to its varying topography the country is divided into three characteristic regions, namely the lowlands, the foothills, and the mountains.

Significant development of the rural water supply subsector in Lesotho only occurred after independence in 1967. Prior to this there was no rural coverage. The new government gave top priority to the rapid installation of new water supply systems and embarked on a campaign inviting villages to undertake joint ventures. The villagers were to collect and contribute some funds to the Government and provide free unskilled labour, while the government for its part would top up the funds to cover the capital costs and provide the necessary technical expertise.

With limited technical and institutional capacity and experience, the Government installed several rural water systems. The technology was chosen on the basis of simplicity of installation and installation time. The technologies selected included windmill systems, polyethylene pipe and the use of corrugated iron tanks for storage. These systems collapsed quickly as the windmill systems were inappropriate, the polycthelene pipe was not suitable for the topography and the tanks rusted.

Having realized these problems, the Government in 1975 established the Village Water Supply Section (VWSS) in the Ministry of Rural Development and sought out external assistance to strengthen the institutional capabilities of the section. Swiss technical assistance was provided in 1978 and the Swiss

developed standards for planning, design and construction of rural water supply systems. The major objective was to reduce operation and maintenance costs and requirements.

Systems Type

The technology in use by VWSS includes four different water supply facilities. Depending on the availability of water sources and the population size of the given village(s), the system is chosen on the basis of its operation and maintenance requirements. The preferred order of preference is:

1. Waterpoint (Spring protection): This facility comprises a spring collection completely sealed against direct human and animal pollution and a collection pipeline (1 to 2 pipe lengths of 6 metre length) leading to a storage tank which feeds a public standpost. The system is most common in the mountain areas where springs are readily available and are in close proximity to the village (average distance for people to walk is 300 metres) and population sizes are small (ranging from 50-200 people). Per capita cost of construction is about U.S. 8.00 in 1990 prices. Operation and maintenance requirements are almost zero as all that is required is an occasional flushing of the system. However, if leakage of the spring catchment occurs this may require recapturing the spring and reconstruction. This happens very rarely and is not really a major concern.
2. Gravity system: This system is an expansion of a waterpoint. It often includes multiple spring protection, several storage and distribution tanks, a distribution network and multiple public standposts. It has effectively no running costs and requires a minimum of maintenance as the quality of the structures is high and durable. However, it does demand a high level of management by the community, especially if several downstream villages are connected. The cost of maintenance is often not a financial one but rather requires a large input of community participation for regular inspection and preventative maintenance.
3. Handpump system: This is the third option where springs are not available. It is less expensive, having a per capita cost of US$ 16.00 as compared to a power-pumping system which costs US$

32.00 per capita (1990 prices). Also, it provides flexibility in that when one pump stops functioning, others are still available for use. Concentrated efforts to install this system began in 1982 and now there are over 2,000 handpumps installed. Initially, the pumps were the American made Moyno largely because the programme was supported by USAID. Recently, South African Monos have been installed. Fortunately, as both pumps are progressive cavity with a rotor and stator they have interchangeable major components. VWSS has standardized on the Moyno pump although the Mono is preferred because of the ease of availability of spare parts. Neither the Moyno nor Mono are VLOM as they require special skills and equipment to repair.

The VWSS has realized the heavy maintenance requirements for handpumps and has adopted the following maintenance strategy.

- Although the villagers are not able to carry out actual repairs, they have the responsibility for reporting to the VWSS pump breakdowns and must ensure the proper use of the handpump (i.e. keeping pump surroundings clean and preventing children from playing with the pump).
- VWSS has overall responsibility for maintenance and stocks spare parts and maintains an adequate level of trained maintenance staff.
- The VWSS is striving to get private sector involvement in maintenance to the maximum extent possible.
- VWSS continues to implement a system of cost recovery which at this stage aims to recover 50% of the direct costs of maintenance.

4. Power pumping system: It is VWSS policy to avoid power pumping and windmills whenever possible. These systems are very few in number (no more than 10% of the total VWSS existing systems) and the experience so far is that they breakdown frequently and have high running costs.

Power pumps require a high level of organizational capacity for collecting the needed cash contributions and a more complex financial accounting by the villagers.

Standardization

Village Water Supply Section standards for level of service, design and construction of structures, choice of equipment and construction materials have all been developed in order to minimize operation and maintenance even if these initially require high capital investment costs.

The overall standards of service are designed to meet the people's needs for 10-15 years without requiring a major expansion of works.

Gravity systems are designed for 30 litres per capita consumption, a maximum walking distance of 150 metres to the nearest public standpost and a maximum of 150 people per standpost. The VWSS only installs public standposts and discourages the installation of private (yard or house connection) taps. Handpumps are designed to serve 75-100 people per handpump. They are located within a 200 metre-radius around the village.

These design standards were developed to help overcome operation and maintenance problems and include the requirement that piped water systems should not connect an excess number of villages. However, when this is unavoidable every effort is taken to provide each village with individual distribution chambers and separate main distribution lines.

The Village Water Supply Section enforces a very high quality of construction and workmanship. Standards are well elaborated for construction masons, foremen and supervisors through construction manuals. Standard plans have been prepared for all structures such as storage tanks, siltboxes, valve chambers, public standposts and handpump slabs.

The Village Water Supply Section installs basically one type of handpump (Moyno or Mono). In addition the Section uses only galvanized iron piping for its pipelines and pump riser mains. This is a result of the ruggedness and rocky terrain of Lesotho. No exceptions are made simply to avoid problems

of maintaining a variety of spare parts and fittings. All structures are either of stone or brick masonry work.

Conclusion

Gravity water systems which require the least degree of operation and maintenance are the primary technology choice in Lesotho. Where this is not possible handpumps are the second option. When handpumps are used the VWSS undertakes to organize, with community support an adequate operation and maintenance system and strives to recover 50 percent of the costs of this maintenance. Power pumping systems are avoided if at all possible as they require a high level of village organization, management and financial organization.

COMMUNITY MANAGEMENT OF RURAL WATER SUPPLIES BY THE GHANA WATER AND SEWERAGE CORPORATION

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Ghana

Introduction

Ghana is located in West Africa with a population estimated to be about 15 million of which around 70% is rural. Water supply coverage for the rural population is estimated to be 40 percent and for sanitation coverage is about 16 percent.

Water supply programmes have, in the past, favoured urban supplies as is attested to by a 90% coverage. The rural water sector has benefited from two large borehole projects, 3,000 boreholes in southern Ghana with German support, and a programme which constructed 2,600 boreholes with Canadian International Development Agency (CIDA) support in the upper regions.

The present rural water supply coverage of about 54% in the upper region of Ghana is a result of the CIDA/GWSC (Ghana Water and Sewerage Corporation) water programme which started in 1974. The aim of the programme was to provide potable water supplies which will ultimately improve the health of an estimated 1.2 million people.

Initially when the programme was started, community involvement regarding the choice of technology and the location of the boreholes was a low priority; so many of the efforts to improve the supply in the early stages concentrated on the technical aspects with little input from social organizations. The concept of cost recovery was also neglected. The result was a system with a poor operation and maintenance performance record.

The Ghana Water and Sewerage Corporation (GWSC) maintenance tariff system is currently operating satisfactorily with support from CIDA. The down time for a breakdown rarely exceeds three

weeks. Spare parts are available, although it occasionally takes up to six months to deliver them. Local GWSC Personnel are capable of handling most maintenance situations.

The real problem lies with GWSC's weak financial base for rural water supplies, as the collectible tariff is grossly inadequate to meet operation and maintenance costs. This paper reviews the major constraints to effective operation and maintenance and describes the strategy which has been adopted for community management.

Major Constraints

In the early stages of the programme the users had no input into the choice of technology or the location of water points and this constituted one of the major problems. Also, some of the wells were drilled during the rainy season when the water tables were high, and these wells have either gone dry or are yielding below expectations. These factors combined led to 5% of the wells being either out of use or very low yielding and have resulted in an understandable reluctance by the people to pay.

There has also been a search for a suitable handpump leading to the introduction of over 15 different types of pumps since 1974 which has further constrained the villagers level of involvement in maintenance and operation.

Efforts are now being made to reverse the situation. A massive water-health education programme has been on-going for the last four years to raise the awareness of the users by instilling a sense of ownership and care for water points and pointing out the benefits of potable water. The object is to demonstrate the health risks of using polluted water sources.

There are also well advanced plans to redevelop wells that have been low yielding due to either encrustation or silting. A community management pilot project was also established in parallel with the water-health education programme to determine the willingness and ability of the users to assume management responsibilities for their water points.

A New Strategy for Community Management

Experience gathered from the GWSC based maintenance tariff system, indicates a continuing heavy requirement for external financial support for operation and maintenance because the users are unable to meet tariff obligations. In an attempt to make the beneficiaries partners rather than just recipients of the water service, the Bolgatanga community management project was established in 1988. The project is funded by the Canadian International Development Agency (CIDA), and executed by the World Bank/UNDP Water and Sanitation Programme, GWSC and other local agencies. The project is designed to ascertain if communities are willing and able to assume management responsibilities for their water supply points with tariff collection being an important element.

One of the tasks of the project is to transfer management skills to user communities and to develop strategies that will enhance a smooth transfer of knowledge and skills at both institutional and community levels. The existing social-cultural values of the people are considered to be very important. The approach therefore allows for ideas to originate from the community through dialogue during regular meetings. These ideas are used as the basis for training the water and sanitation management committee (WASAMC). This strategy is aimed at maximising community participation and enhancing capability in assuming management and maintenance responsibilities.

Uniformity in approach and adherence to some traditional norms contributes immensely to winning community admiration and support. Sound financial management has been identified as one essential ingredient for the success of a sustainable programme. Although lack of money has often been cited as a drawback to development, it is really poor management of funds which cripples most development efforts. A simple accounting and banking system has been instituted by the communities with the assistance of the project to eliminate the misuse of funds collected by community members.

A management structure that fits into the existing local institutional structure has been established, which aims to involve all community members. The WASAMC which is the main community based

action group responsible for the day to day management of the water and sanitation facility comprises seven members of whom at least three are women. Women in the project area have demonstrated a high sense of responsibility by leading many committees. They are also the main contributors to the community pump maintenance fund.

Training programmes have been organised for village based technical personnel and for the core committee members on basic repair and management skills in order to prepare them to better undertake maintenance and repair activities. This strategy is not without its problem and two major ones, one community based and the other institutional have arisen.

In the communities there are conflicts and disagreements within the committees. Some of these originate from long standing family disputes but most are due to poor communication. In some instances there are financial management conflicts between the committee and the community due to poor record keeping. This problem is due to the low literacy level in the rural areas and adult literacy and planned management training will hopefully reduce these problems.

The institutional problems are rather more difficult to define. Clear roles for partner agencies and the communities have not been established with respect to operations and maintenance. It is not clear if the community is expected to undertake all operation and maintenance responsibilities. Spare parts supply and distribution is a pre-requisite for community management. It is not yet known whether GWSC will encourage private sector involvement and whether the private sector will be interested in the supply and distribution of spare parts since to this point this has been the sole responsibility of GWSC. Another critical issue is whether the inter-agency approach will survive. Some departments in government are not in favour of this approach and instead support narrow departmental interests. This can have adverse effects on human and material allocations to the project. Commitment of all agencies therefore depends on government commitment and support for such a programme. All these issues need to be addressed before sound community based management can be instituted.

Achievements

In spite of these problems some real success has been attained. Progress made has been tremendous particularly in the area of popular participation and fund mobilisation for maintenance. People who formerly did not pay tariffs now pay more into the community accounts. Communities are able to carry out routine maintenance and repairs on their pumps and to assume responsibility for preventative care. Generally there are improving signs of the willingness and ability by communities to manage their own water supply and the prognosis for the future is very favourable.

APPENDIX 34

3.20 Star Diagram

A useful means to delineate the differences between O & M management models is to show the relative importance of the various actors involved in managing the systems. A star diagram (Figure 5) presents this graphically for the national government WSS agency, the regional government WSS agency, the private sector, and the community organizations in each country.

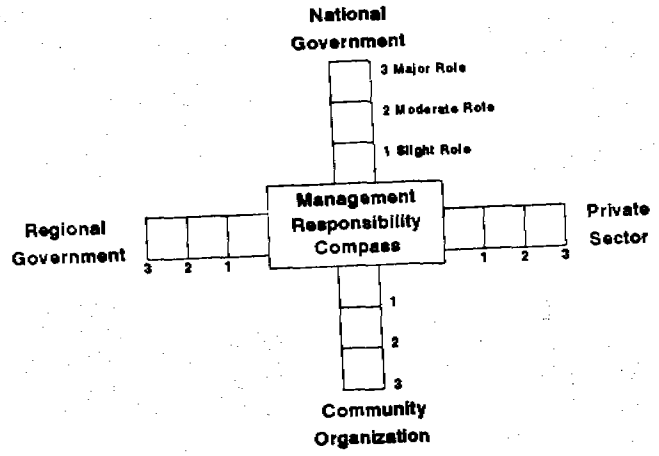


Figure 5

Star Diagram: Responsibility of Actors in O&M Management

4

CASE STUDIES

4.1 Botswana

4.1.1 Description of O&M Management System

Background

Botswana was one of the poorest countries in the world until the discovery of diamonds in the 1970s brought about a dramatic change. At first, the effects of this new wealth did not reach beyond the diamond-producing towns. But the Government of Botswana drew up a series of National Development Plans to spread the benefits of mineral exploitation throughout the country. The goals for employment and rural development included the construction and maintenance of water supply facilities in the villages.

Basic Principles

The policy has been designed to:

- provide safe piped water to urban and rural dwellers,
- retain government responsibility for operation and maintenance,
- collect user fees in urban areas, and
- subsidize both construction and O&M costs in rural areas.

It has resulted from a realistic assessment of economic conditions in the country, which, with neighboring South Africa, offers employment opportunities for those with technical skills. Few people with good technical training remain in the rural areas. The government's desire to encourage people to stay and the prevailing lower income levels justify the subsidies to rural water users. The high cost of pumping water and of collecting user fees in these areas has led to increased funding for training, staff, and equipment from national sources.

In the large urban areas, a parastatal (the Water Utilities Corporation) develops water sources, installs water systems, and collects user fees to offset all costs.

Roles and Responsibilities of Parties Involved in Maintenance

Prior to independence in 1966, the few public water supply facilities were operated by District Councils. During the next 15 years, several new facilities (using diesel-driven Mono pumps) were added, initially with donor funds and technical assistance, and later with contributions from diamond-generated revenues. The government, believing that the District Councils would not be able to operate and maintain these new water systems, established the Borehole

Preventive Maintenance Service (BPMS) at 11 depots around the country to provide both preventive and corrective maintenance and repairs for public and private water systems. Although this service was subsidized, bad roads, long distances, and the increasing number of rural water systems (both public and private) conspired to render it ineffective. Planners became convinced that the District Councils would have to develop the capacity to operate and maintain rural water systems themselves.

In 1979-1980, District Council Water Maintenance Units (WMUs) were established as part of the Works Department in each district. By the late 1980s, several of the WMUs were upgraded to full department status within the District Council infrastructure. The WMUs and Water Departments (WDs) have primary responsibility for O&M, work in coordination with other government entities, and are empowered to contract with the private sector for purchase of equipment, supplies, and services. Village organizations have little or no responsibility for their water systems, except to appoint a pump operator who is paid by the District Council.

There are thirteen WMUs and WDs throughout Botswana, one in each district except for the largest district, where five subdistrict WMUs have been created. Several districts have also created subdepots to service water systems in remote areas. The WMUs and WDs have received considerable training and funding support (from both international donors and internal sources) since the mid-1980s, and are providing major and minor repair as well as maintenance services. All District Councils have trained mechanics, vehicles, and spare part inventories. In several of the better organized districts, a regular schedule of preventive maintenance is followed.

There are other agencies engaged in the operation and maintenance of rural water supplies. The water engineer and his staff at the Ministry of Local Government and Lands (MLGL) and the Department of Water Affairs (DWA) within the Ministry of Mineral Resources and Water Affairs (MMRWA) support the WMUs and WDs. The water engineer makes field visits and provides advice, and his office also oversees the budget process, establishing budgets and distributing funds for special projects (such as Drought Relief and Water Supply Rehabilitation), and acts as a liaison with the Department of Water Affairs at the national level.

DWA is responsible for the design and installation of facilities which, once completed, are turned over to the District Councils. The councils, through the MLGL water engineer's office, are given assistance in water system rehabilitation and upgrading when this becomes necessary because of population increases, drought, and aging equipment. Since the District Councils do not have borehole drilling or cleaning capability, DWA provides emergency services when borehole yields decline due to aquifer depletion, borehole collapse, or any other well-related problem. The services of the Borehole Repair Service—the renamed and reconfigured BPMS—are also available but are rarely used.

The District Councils have budgetary discretion to contract for private sector services. Yearly contracts with oil companies for the delivery of fuel and lubricants are typical in Botswana. Council departments also maintain accounts at various equipment and spare parts suppliers. In addition, several specialty repair shops rebuild fuel pumps or provide machine shop services.

Responsible Actors

In Botswana, a few national government employees have sole responsibility for all O&M activities. The responsibilities of these actors are shown in Figure 6.

Their duties are described below:

- *Pump Operators*: complete daily O&M checks including tightening drive belts, cleaning the engine and pump house, changing oil, and making entries in the pumping logbook. (Pumping logbooks have not yet been introduced at all sites.) Report all problems to the senior operator or, in case of emergency or breakdown, directly to the chief technician of the WMU or WD.
- *Senior Operator from the WMU or WD*: supervises all pump operators and reports O&M problems to the chief technician for action.
- *Chief Technician of the WMU or WD*: oversees all O&M operations at the council level. This includes scheduling work crews, procuring spare parts and equipment, prioritizing maintenance and repair work, developing and implementing budgets, maintaining borehole and village water system records at the District Council offices, and maintaining liaison with DWA and MLGL's water engineer at the national level.
- *Water Engineer at MLGL*: oversees the disbursement of funds to the WMUs and WDs for special projects. Oversees the work of the DWA in support of rehabilitation and drought programs.

WMU technicians are responsible to superiors at the District Council level and the water engineer to superiors at the Ministry level. These superiors have final budgetary authority and occasionally bring pressure to bear on O&M issues. While this has not been a significant problem, it has affected decisions.

4.1.2 Issues Relating to O&M Management System

The issues relating to O&M of rural water systems considered in Chapter 2 are briefly discussed as they apply in Botswana.

Capacity of Traditional Community Organizations

Since the construction, operation, and maintenance of rural water facilities in Botswana are the responsibility of the central and regional governments, community organizations have no

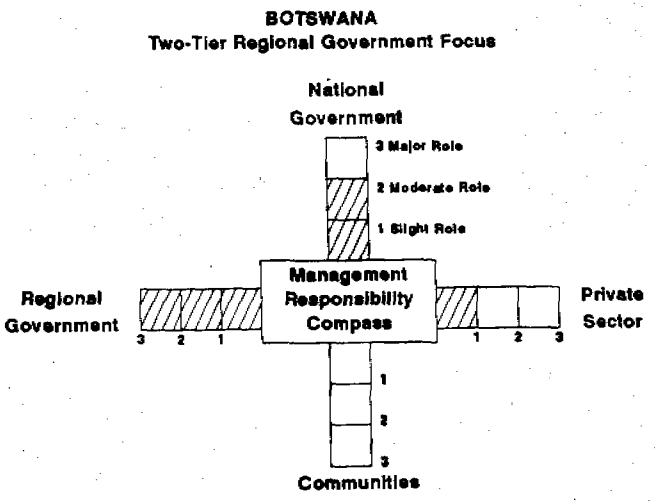


Figure 6

Botswana: Responsibility of Actors in O&M Management

formal role in operation and maintenance. However, each village has a Village Development Committee and a Village Health Committee which, through the District Council and elected members of the National Assembly, can lobby for improved service from the WMU or WD or petition for rehabilitation, system extension, etc. The functioning democracy in Botswana ensures that these petitions cannot easily be ignored.

Key Community Skills

Basic mechanical and bookkeeping skills can be found in most communities. Many men have worked in South African mines, and often pump operators are among these. Most villages have one or more small shops whose owners or operators have basic bookkeeping and accounting skills. Village leadership can be dynamic or relatively lethargic, depending upon the social position, education, vision, and personality of the headman.

Health Education and Community Participation

Health education activities are conducted by Ministry of Health extension agents working through the Village Health Committees. They are reasonably well trained but often are not highly motivated. Water quality, cleanliness, water storage, nutrition, family planning, and sanitation are among the subjects they cover. There is little coordination of these efforts with O&M, in which the community takes almost no part. Community participation in O&M activities at the village level is nearly nonexistent.

Participation of Women

Because the men of the village are often away as expatriate workers, women have established themselves as forces within many communities. They serve on village committees and are community decision makers, and in some villages work as regular or relief pump operators.

Complexity of Technology

Diesel pumping systems are widely used in Botswana. There are no gravity-fed systems and very few handpumps as the water table is generally deep. Several villages have solar pumps. Water sources outside the range of possible contamination by village pit latrines are difficult to find. This, combined with efforts to limit the distance to a water tap, has led to relatively complex water systems that require a deep-well pump driven by a diesel engine often located several kilometers from the village.

Availability of Spare Parts

Spare parts are readily available for all models of engines and Mono pumps used in rural water systems. WMUs and WDs maintain stocks of drive belts, pipes, and pipe fittings, and most have spare engines for replacement. Any parts not available at the WMUs and WDs usually can be obtained within several days from suppliers in major towns. Since Botswana is a member of the Southern Africa Customs Union and its currency is freely convertible, spare parts are readily obtained from manufacturers or suppliers in South Africa.

Standardization of Equipment

The DWA has standardized all new equipment to include Lister/Petter diesel engines and Mono positive displacement progressive cavity pumps. This standardization has greatly

simplified O&M by reducing the spare parts inventory and limiting the training of mechanics to the makes and models in use.

Requirements Shared with Other Sectors

The government and private agricultural sectors are the other two principal users of water pumps. There are a few large irrigation systems confined to areas in the eastern part of the country and a network of several thousand privately owned and equipped boreholes used for stock watering. The government owns and operates over 250 boreholes at border posts, police stations, and research farms. Most private farms and all government boreholes are equipped with Lister/Petter engines using Mono pumps, although older reciprocating pumps are still in use. More recently, some private farmers have begun to use Yanmar and Kubota diesel engines because they are cheaper to purchase. Again, this standardization has led to improvements in both the availability of spare parts and the skill levels of mechanics.

Cost Recovery Mechanisms

There is no attempt at cost recovery for water supply in rural Botswana, since the cost of collecting fees on the scale for urban users would exceed the fees collected. To charge more than the prevailing rate for urban water users would go against government policies of equity for rural dwellers. Mineral revenues and a large current and capital account surplus allow the government to fully subsidize rural water supplies.

Ability and Willingness to Pay

Since rural water users pay no fees, there is no need to determine ability or willingness to pay. Private connections in larger towns are charged for water delivered, but users do not pay the full cost of water consumed. In a survey of several of these towns, fee collection rates were considered very good, ranging from 80 to 90 percent of fees charged. Should national fee policies change, the lack of a fee structure at the village level would make the introduction of fees difficult.

National and Regional Economies

The strength of the national and regional economies has had a significant impact on the success of O&M systems. The government has the resources to provide a high level of service and to finance technician training, the procurement of spares and equipment, and the rehabilitation of older or inadequate systems. Since the local currency is freely convertible, external procurement of equipment and supplies poses no problem.

Logistics and Transportation

Logistics and transportation are a constant difficulty. Rural water systems are often 100 kilometers or more from service centers. When spares are not available in service center stores, long trips are necessary to procure them from major urban centers. Recent improvements of the rural road network and the vehicle fleet have helped, but transportation and logistics continue to be a time-consuming nuisance.

Government Leadership

The democratically elected government of Botswana is strong, and a vocal opposition helps keep priorities in line with the needs of the people. A five-year planning process outlines government policies and goals as well as specific projects. The government funds many of these projects and seeks donor assistance for others. This process provides a consistent basis for development.

Strength of Government Agencies and Staff

The population of Botswana is just over one million, which does not provide a large pool of educated and talented civil servants. A number of expatriates are employed in line positions in various ministries, but a gradual nationalization is being attempted without compromising the strength of these agencies. Leadership and guidance at the upper levels of the ministries managing water resources and water supplies are strong. Unfortunately, it is difficult to retain high quality staff at the lower levels. Competition from the private sector is strong, offering opportunities for professional growth, higher compensation, and the chance to live in the major towns.

Regional Autonomy

Most rural water system construction is planned at the national level and all operational decisions are made at the District Council or regional level, where O&M management systems are developed and implemented. Certain procedures must be standardized to facilitate WMU and WD links to the water engineering office of the MLGL and the rehabilitation and emergency support provided by the DWA. In general, there is a high degree of regional autonomy for settings priorities and work schedules according to regional technical needs and political pressures.

Policies and Legislation

Policies and legislation affecting the water sector are clearly spelled out in the National Development Plan and the laws of the country, but there are concerns about the continued

development of new water systems. Limited water resources and the cost of constructing and operating systems in ever smaller villages pose significant challenges. Villages of even a few hundred are currently slated for diesel-driven pumps and piped water delivery.

Communication and Information Sharing

Communication and information sharing are very good, largely because of the MLGL water engineering office. Data from monthly status reports provide the basis for national plans and funding. Most of the WMU technicians trained together and have remained in contact. Telephone communication takes place between the WMUs and WDs and the water engineer and the offices of the DWA. An annual week-long seminar for WMU technicians brings them together to share problems and solutions.

4.1.3 Effectiveness of O&M Management System

In general, the O&M management system in Botswana is very effective. No more than 10 percent of the water systems are out of service at any one time, and response to breakdowns is on the order of two to four days. With a reserve of several days of elevated water storage, some villages continue to have water during breakdowns. Given differences in technician skill and district size, some districts provide more efficient service than others. On average, the number of breakdowns per borehole per year is 3.5. However, in districts with preventive maintenance schemes, the rate has fallen to one per borehole per year.

This success has been gained at considerable expense. In 1987, the recurring cost was $2,500 to $3,500 per borehole, which included salaries, building maintenance, tools and equipment, spares, and fuel. The per borehole cost for spares alone was between $450 to $650. These costs are considerably more than most governments are willing or able to meet to assure reliable water supplies for rural communities. The single most important factor in the success of the O&M program in Botswana is that the government can afford to bear these costs from the national treasury and does so. Other significant factors include equipment standardization, availability of spare parts, and good communication among District Council technical personnel, the MLGL's water engineer, and the DWA.

4.1.4 Future Problems and Trends

The current phase of rural water supply construction is drawing to a close with the completion of the Swedish International Development Agency (SIDA) supported Village Water Supply Program. The focus is on the rehabilitation of systems constructed early in the program (late 70s), which were not built to today's standards and may not serve today's populations. The completion of this program also will mean the scaling down of donor assistance in the sector.

Over the past several years, donor support has largely been in the form of technical assistance, with all capital and recurrent costs being met by the Government of Botswana. The change will have implications for sector capability. In the past, the government has contracted with the private sector for services it has difficulty providing, particularly in the design of water systems. The private sector may be used even more in the future.

Given the success of the rural water supply program in Botswana, there appear to be few problems. However, difficulties could arise from the government's assumption of complete responsibility. Rural dwellers have gained high expectations of service at no cost, and elected officials eager to keep constituents happy could pressure government agencies and District Councils to expand services to ever smaller communities. Already, some villages of less than 300 are scheduled to have their own systems. If the government can no longer finance the construction and O&M of rural water supply facilities, it will be difficult to introduce a fee structure, even for only partial cost recovery.

At present, there is no serious consideration of introducing water user fees in the villages. The emphasis is on completing the construction of systems in progress and rehabilitating existing systems. There also is a growing effort to upgrade training programs, provide career opportunities for skilled individuals at the WMU and WD level, and institute countrywide recordkeeping and preventive maintenance programs. This may be difficult with the withdrawal of technical support from donors (due in large part to the success of programs and the decreasing financial need of the country). Although many Botswanans are very capable, the program has been significantly aided by expatriate skills.

Finally, there are efforts to more closely link the water supply programs to health education and health awareness. The separation of DWA in MMRWA and health workers in the Ministry of Health, as well as the emphasis on the construction and O&M of water systems, have caused this aspect to be neglected. Botswana has a well-focused, well-organized, and well-functioning O&M management system that depends in large part on adequate funding, standardization of equipment, and ease of procurement. This is quite unique in the developing world and highlights the wide range of factors that must come together to make O&M work smoothly.

4.2 Yemen (Former Yemen Arab Republic)

4.2.1 Description of O&M Management System

Background

Rural water services and O&M management have evolved out of Yemen's civil war from 1962-1970. During this period, local organizations developed in many rural areas, creating and maintaining services (including water supply) with local resources. After the war, the government gave these organizations the status of Local Development Agencies (LDAs), and they continued to operate projects with funding from *zakat*, (the Islamic tax), special local

purchases fuel, lubricants, and spare parts; may also provide transportation for mechanics to come out and investigate breakdowns and make repairs.

- *Private Sector Suppliers*: sell fuel and lubricants, usually at black market prices; procure spare parts, often available only at some distance from the village, perhaps as far away as Khartoum.
- *NCRWRD District or Regional Offices*: provide mechanics for most repairs, particularly in the western region. Transportation, parts, and consumable items are provided through the village committee. The arrangement works reasonably well if the villagers are well connected. Otherwise, the water supply system is often in very poor repair or not operating at all.

This description applies largely to western areas. In the north, the fact that construction costs have not been met by the NCRWRD and ownership is retained by the villages gives these villages much more autonomy in managing O&M.

4.3.2 Issues Relating to O&M Management System

Community Organizations and Key Community Skills

The NCRWRD does not formally recognize community participation in its O&M structure. Yet the operation of wateryards is carrying on mainly because community members are willing to pay additional fees, while continuing to tolerate the delays and frustrations of an economy in disarray. Some relationship must be maintained with the NCRWRD, in spite of its failure to perform its O&M duties. But the complete breakdown of water supply systems in some villages is evidence that a reliance on community organization and leadership is wiser. In the north, as surveys indicate, water systems operate well because of their community-based O&M management.

Cost Recovery Mechanisms and Ability and Willingness to Pay

In the western region, there is an adversarial relationship between the villagers and the NCRWRD. The NCRWRD claims the villagers do not pay enough and abuse their water systems, and the villagers claim the NCRWRD collects fees but provides no service. The fees that the village committees collect over and above the NCRWRD tariff enable the purchase of spare parts and fuel that the NCRWRD is no longer providing.

National Economy

The weak national economy affects the management of rural water supplies like every other activity in the country. Currency controls and commodity shortages have created a flourishing

black market. Fuel and spare parts are in short supply, as are sugar, flour, tea, and all consumer goods, but most items are available at inflated black market prices. Little is imported legally, and more suppliers of foreign equipment have no spare parts on the shelf. Some reconditioned or smuggled parts are available in the marketplace, but government agencies are forbidden to purchase them. The use of many makes and models of engines and pumps complicates parts procurement. Shortages of fuel and spare parts also make transportation undependable and expensive.

Villages in the northern part of the country have somewhat less difficulty operating and maintaining their water systems. Many of the workers who have gone abroad come from there and family connections are strong. Spare parts bought overseas can be sent directly to villages in the north through family and village connections in Khartoum. Also, the fact that the water systems in these areas are locally owned means that they are less dependent on the NCRWRD for O&M.

Strength of Government Leadership and Government Agencies

The many changes in the administration and in the leadership of government agencies in recent years have weakened them to the point where they are no longer effective. In addition, the economic climate has led many capable managers and technicians to seek employment abroad. Unfortunately, those in decision-making positions are unwilling to recognize this decline. A restructuring to give villagers in the western region a more active role in O&M management would greatly strengthen water supply services.

4.3.3 Effectiveness of O&M Management System

Maintenance systems in Sudan generally are very weak, largely because of the faltering economy. Shortages of fuel, spare parts, and replacement equipment plague all areas. If water supply facilities continue to operate, it is because of the resourcefulness of many Sudanese and the fact that villagers have taken O&M management into their own hands. In the northern region, the villagers own their equipment and the NCRWRD role is limited to design, construction, and servicing assistance. In the western region, where donors and the government provide a much larger share of the initial costs, the NCRWRD retains ownership and formal responsibility for O&M, which is unsatisfactory because of poor service, the adversarial relationship between the village and the government, and the unwillingness of the NCRWRD to formally recognize village contributions to O&M.

4.3.4 Future Problems and Trends

It is difficult to tell what the future holds for rural water supply in Sudan. The absence of hard currency funds and total dependence on donor support place the NCRWRD in a vulnerable position. There are those in this agency who recognize the need for improving O&M management systems, including the encouragement of more structured village participation, but there are few indications of real change. Perhaps change will come about as the situation becomes even more desperate.

4.4 Belize

4.4.1 Description of O&M Management System

Background

There are two types of rural water supply systems in Belize, which differ greatly in level of service, community involvement, maintenance responsibilities, engineering, and cost. The first are the piped water systems consisting of a water source (drilled well or spring), electric or diesel pump sets, storage tanks, and house-to-house connections. Families install outdoor yard taps or full indoor plumbing according to their means.

Currently, there are 19 such systems in the country, typically serving 500-1500 people through 75 to 200 connections. They have been designed by the urban Water and Sewerage Authority (WASA), constructed by private contractors, and are operated by community water boards with support from the Rural Water Supply and Sanitation Program (RWSSP) in the Ministry of Natural Resources. Much of the funding has come from USAID. The responsibilities of actors in O&M management, for which WASA has prepared a manual, are shown in Figure 9.

The second type of rural water supply uses handpumps, approximately 600 of which have been installed in shallow drilled wells. Many of the larger communities have several handpumps, each serving two to 10 families. The first model of choice was the U.S.-made cast iron Dempster, but more recently the Indian-made steel Mark II model has been favored for its reliability. Prior to 1985, pumps were installed and maintained by the Ministry of Health, but they are now installed by the RWSSP and maintained jointly by the communities and RWSSP regional maintenance crews.

The RWSSP has a central office near Belize City (shared with the main WASA depot) that includes a large store for handpump parts, a vehicle and well rig repair shop, and administrative offices. It also has regional offices in three of the six districts in the country, with each regional crew responsible for two districts. The regional facilities are smaller, but include an office, a depot for vehicles and supplies, and, in some districts, stores with parts and tools.

The responsibilities of actors in O&M management for the handpump systems are shown in Figure 10.

CARE has installed several piped water and handpump systems with support from USAID and UNICEF and follows the same approach as RWSSP. However, CARE has more personnel and resources to support its projects.

While considerable progress has been made in extending coverage, there are still many communities without improved water supplies where families use hand-dug wells, surface water sources, and, most commonly, simple rainwater catchment devices. Recent projections estimate the need for approximately 30 more handpumps to reach full rural water supply coverage.operated by local families themselves. Recent projections estimate the need for approximately 30 more piped water systems and 700 more handpumps to reach full rural water supply coverage.

Piped Water Systems

The three-tier O&M management of piped water systems places primary responsibility in the hands of community Boards of Management (BOMs). Regional government offices at the second level provide technical and managerial support and training, and the central government at the top oversees regional government operations and sets water and sanitation policies. The communities can use private mechanics.

The BOMs have a manager, treasurer, secretary, several representatives from the community, and a paid staff. These elected bodies set budgets and tariffs, collect and manage funds, and decide on system expansions. The typical system has an operator to run the pump, do minor repairs, keep logs, and perform other basic O&M tasks, a billing clerk, and, in some cases, someone to keep the books and handle cash.

The BOMs essentially are independent of the government, and operate and maintain the systems with their own resources. If the operator has a problem, the BOM will call upon private mechanics or equipment and parts suppliers and solicit the advice of the regional government office. There have been few breakdowns or maintenance problems because the systems are still quite new and most use reliable electric pumps. In the beginning, the regional and even the central government would provide money or equipment to fix a breakdown or other serious problem, but this practice has been discontinued, except when a community has a legitimate need.

Communities with piped water systems benefit from considerable training, technical support, and monitoring in all aspects of system operation, including O&M, budgeting, financial management, administration, community involvement, and health and hygiene education.

The O&M budgeting and cost recovery system is an important element of the piped water management system. The regional offices (or CARE) work with communities to establish budgets in the first year or two, with ample provision for all O&M costs, including electricity

APPENDIX 35

4.3 Sudan

4.3.1 Description of O&M Management System

Background

The rural water supply in Sudan has been affected significantly by the economic decline, administrative restructuring, and political instability prevailing in the country. Equipment, funding mechanisms, and O&M methods, vary by geographical area. In the northern part of the country along the Nile, the rural areas are quite prosperous and traditionally have met their water needs with their own resources. In the western desert region, government assistance has been necessary. The areas in the south, the east, and between the Blue and White Niles have their own characteristics. This case study confines itself to the northern and western parts of the country.

Basic Approaches

The government believes that rural water supply systems should be self-financing over the long term. For political and practical reasons, the western provinces of Kordofan and Darfur have received most attention, and the region is the focus of the National Corporation for Rural Water Resources Development (NCRWRD), which is responsible for the construction of boreholes and for all O&M tasks. In this area deep boreholes are required. A government employee operates and maintains the water source (called a wateryard), and a clerk collects user fees that ostensibly cover the cost of operating the wateryard and making necessary repairs.

The NCRWRD also has offices in the north but mainly provides design assistance and some construction management, because water is close to the surface here and villagers are affluent enough to fund most, if not all, of the cost for construction. The NCRWRD is not involved in O&M management to nearly the same degree as in the western provinces. The regional offices are sometimes called upon for service, but the villages are free to use private sector sources for spares and technical help.

The slow but steady economic decline in Sudan has deprived the NCRWRD of the resources to provide adequate O&M service for the rural systems. In addition, charges of favoritism and the misuse of funds, the rising cost of the national infrastructure, and evidence of corruption have made many villagers cynical and untrusting of the NCRWRD. Today, little or no O&M service is provided even though fees are collected, fuel allocations from the government are minimal, and little foreign exchange is available to buy equipment or spares.

In the western region, which has depended heavily on government support for O&M, the villagers have developed their own O&M management systems to keep water flowing. Many have set up water committees to collect fees in addition to those collected by the government wateryard clerks, and are using the money to purchase fuel, lubricants, and spare parts from

the black market if necessary. The NCRWRD does not recognize these village organizations but is willing to accept the help they provide. NCRWRD mechanics perform maintenance and repairs but often require the villages to supply transportation and even tools.

Roles and Responsibilities of Parties Involved

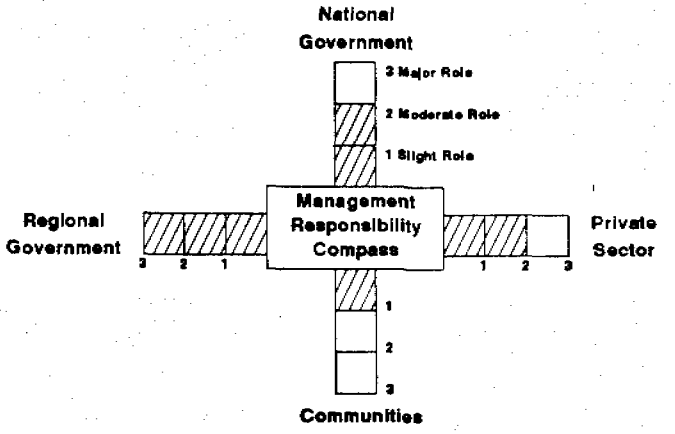
The responsibilities of actors in O&M management are shown in Figure 8. The NCRWRD, now largely unresponsive to village needs, has formal responsibility and claims that with adequate funding it would be more effective. The various duties and responsibilities are as follows:

- *Pump Operators*: attend to daily operation and maintenance, lubrication, and minor repairs; preventive maintenance does not appear to be part of the task.
- *District Workshops*: responsible for maintenance and repair including light machining, and engine and pump overhauls; maintain an adequate stock of spare parts; perform field repairs.
- *Regional and Provincial Offices—O&M Section*: perform heavier machine shop work on engines and pumps as well as on vehicles and drilling rigs; maintain a larger stock of spare parts and arrange procurement from national stores as necessary; make fuel and lubricant deliveries when supplies are available. These offices perform field repairs where District Workshops have not yet been established, and collect fees through a circuit schedule of visits to villages.
- *National Headquarters—O&M Section*: remits O&M funds collected to the Ministry of Finance and Economic Planning; organizes fuel and lubricant deliveries to regional offices; makes off-shore purchases of supplies and spare parts when funding is available.

This structure has resulted in a large centralized bureaucracy no longer responsive to local needs, and has spawned an informal alternative whose effectiveness is a function of the local NCRWRD representative's attitude and village skills in financial management and politics. The elements of this organization at the village level are as follows:

- *Pump Operator*: attends to daily operation and maintenance, lubrication, and minor repairs.
- *Village Committee*: monitors the operation and maintenance of the wateryard and collects additional fees, either regularly or as needed;

SUDAN
Formal: Three-Tier Regional Government Focus



SUDAN
Informal: Three-Tier Community Focus

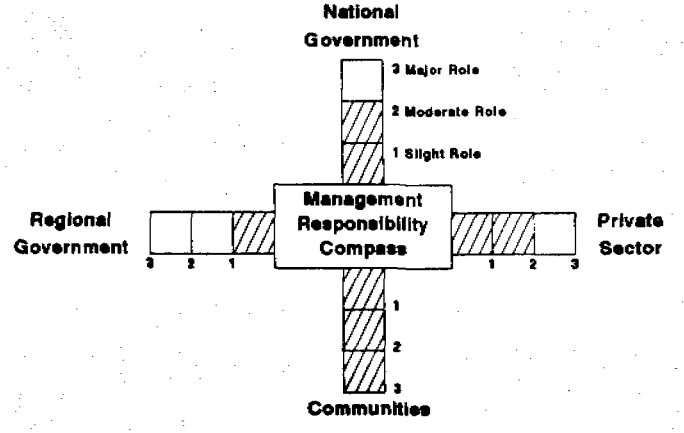


Figure 8

Sudan: Responsibility of Actors in O&M Management

purchases fuel, lubricants, and spare parts; may also provide transportation for mechanics to come out and investigate breakdowns and make repairs.

- *Private Sector Suppliers*: sell fuel and lubricants, usually at black market prices; procure spare parts, often available only at some distance from the village, perhaps as far away as Khartoum.
- *NCRWRD District or Regional Offices*: provide mechanics for most repairs, particularly in the western region. Transportation, parts, and consumable items are provided through the village committee. The arrangement works reasonably well if the villagers are well connected. Otherwise, the water supply system is often in very poor repair or not operating at all.

This description applies largely to western areas. In the north, the fact that construction costs have not been met by the NCRWRD and ownership is retained by the villages gives these villages much more autonomy in managing O&M.

4.3.2 Issues Relating to O&M Management System

Community Organizations and Key Community Skills

The NCRWRD does not formally recognize community participation in its O&M structure. Yet the operation of wateryards is carrying on mainly because community members are willing to pay additional fees, while continuing to tolerate the delays and frustrations of an economy in disarray. Some relationship must be maintained with the NCRWRD, in spite of its failure to perform its O&M duties. But the complete breakdown of water supply systems in some villages is evidence that a reliance on community organization and leadership is wiser. In the north, as surveys indicate, water systems operate well because of their community-based O&M management.

Cost Recovery Mechanisms and Ability and Willingness to Pay

In the western region, there is an adversarial relationship between the villagers and the NCRWRD. The NCRWRD claims the villagers do not pay enough and abuse their water systems, and the villagers claim the NCRWRD collects fees but provides no service. The fees that the village committees collect over and above the NCRWRD tariff enable the purchase of spare parts and fuel that the NCRWRD is no longer providing.

National Economy

The weak national economy affects the management of rural water supplies like every other activity in the country. Currency controls and commodity shortages have created a flourishing

black market. Fuel and spare parts are in short supply, as are sugar, flour, tea, and all consumer goods, but most items are available at inflated black market prices. Little is imported legally, and more suppliers of foreign equipment have no spare parts on the shelf. Some reconditioned or smuggled parts are available in the marketplace, but government agencies are forbidden to purchase them. The use of many makes and models of engines and pumps complicates parts procurement. Shortages of fuel and spare parts also make transportation undependable and expensive.

Villages in the northern part of the country have somewhat less difficulty operating and maintaining their water systems. Many of the workers who have gone abroad come from there and family connections are strong. Spare parts bought overseas can be sent directly to villages in the north through family and village connections in Khartoum. Also, the fact that the water systems in these areas are locally owned means that they are less dependent on the NCRWRD for O&M.

Strength of Government Leadership and Government Agencies

The many changes in the administration and in the leadership of government agencies in recent years have weakened them to the point where they are no longer effective. In addition, the economic climate has led many capable managers and technicians to seek employment abroad. Unfortunately, those in decision-making positions are unwilling to recognize this decline. A restructuring to give villagers in the western region a more active role in O&M management would greatly strengthen water supply services.

4.3.3 Effectiveness of O&M Management System

Maintenance systems in Sudan generally are very weak, largely because of the faltering economy. Shortages of fuel, spare parts, and replacement equipment plague all areas. If water supply facilities continue to operate, it is because of the resourcefulness of many Sudanese and the fact that villagers have taken O&M management into their own hands. In the northern region, the villagers own their equipment and the NCRWRD role is limited to design, construction, and servicing assistance. In the western region, where donors and the government provide a much larger share of the initial costs, the NCRWRD retains ownership and formal responsibility for O&M, which is unsatisfactory because of poor service, the adversarial relationship between the village and the government, and the unwillingness of the NCRWRD to formally recognize village contributions to O&M.

4.3.4 Future Problems and Trends

It is difficult to tell what the future holds for rural water supply in Sudan. The absence of hard currency funds and total dependence on donor support place the NCRWRD in a vulnerable position. There are those in this agency who recognize the need for improving O&M management systems, including the encouragement of more structured village participation, but there are few indications of real change. Perhaps change will come about as the situation becomes even more desperate.

4.4 Belize

4.4.1 Description of O&M Management System

Background

There are two types of rural water supply systems in Belize, which differ greatly in level of service, community involvement, maintenance responsibilities, engineering, and cost. The first are the piped water systems consisting of a water source (drilled well or spring), electric or diesel pump sets, storage tanks, and house-to-house connections. Families install outdoor yard taps or full indoor plumbing according to their means.

Currently, there are 19 such systems in the country, typically serving 500-1500 people through 75 to 200 connections. They have been designed by the urban Water and Sewerage Authority (WASA), constructed by private contractors, and are operated by community water boards with support from the Rural Water Supply and Sanitation Program (RWSSP) in the Ministry of Natural Resources. Much of the funding has come from USAID. The responsibilities of actors in O&M management, for which WASA has prepared a manual, are shown in Figure 9.

The second type of rural water supply uses handpumps, approximately 600 of which have been installed in shallow drilled wells. Many of the larger communities have several handpumps, each serving two to 10 families. The first model of choice was the U.S.-made cast iron Dempster, but more recently the Indian-made steel Mark II model has been favored for its reliability. Prior to 1985, pumps were installed and maintained by the Ministry of Health, but they are now installed by the RWSSP and maintained jointly by the communities and RWSSP regional maintenance crews.

The RWSSP has a central office near Belize City (shared with the main WASA depot) that includes a large store for handpump parts, a vehicle and well rig repair shop, and administrative offices. It also has regional offices in three of the six districts in the country, with each regional crew responsible for two districts. The regional facilities are smaller, but include an office, a depot for vehicles and supplies, and, in some districts, stores with parts and tools.

The responsibilities of actors in O&M management for the handpump systems are shown in Figure 10.

CARE has installed several piped water and handpump systems with support from USAID and UNICEF and follows the same approach as RWSSP. However, CARE has more personnel and resources to support its projects.

While considerable progress has been made in extending coverage, there are still many communities without improved water supplies where families use hand-dug wells, surface water sources, and, most commonly, simple rainwater catchment devices. Recent projections estimate the need for approximately 30 more handpumps to reach full rural water supply coverage.operated by local families themselves. Recent projections estimate the need for approximately 30 more piped water systems and 700 more handpumps to reach full rural water supply coverage.

Piped Water Systems

The three-tier O&M management of piped water systems places primary responsibility in the hands of community Boards of Management (BOMs). Regional government offices at the second level provide technical and managerial support and training, and the central government at the top oversees regional government operations and sets water and sanitation policies. The communities can use private mechanics.

The BOMs have a manager, treasurer, secretary, several representatives from the community, and a paid staff. These elected bodies set budgets and tariffs, collect and manage funds, and decide on system expansions. The typical system has an operator to run the pump, do minor repairs, keep logs, and perform other basic O&M tasks, a billing clerk, and, in some cases, someone to keep the books and handle cash.

The BOMs essentially are independent of the government, and operate and maintain the systems with their own resources. If the operator has a problem, the BOM will call upon private mechanics or equipment and parts suppliers and solicit the advice of the regional government office. There have been few breakdowns or maintenance problems because the systems are still quite new and most use reliable electric pumps. In the beginning, the regional and even the central government would provide money or equipment to fix a breakdown or other serious problem, but this practice has been discontinued, except when a community has a legitimate need.

Communities with piped water systems benefit from considerable training, technical support, and monitoring in all aspects of system operation, including O&M, budgeting, financial management, administration, community involvement, and health and hygiene education.

The O&M budgeting and cost recovery system is an important element of the piped water management system. The regional offices (or CARE) work with communities to establish budgets in the first year or two, with ample provision for all O&M costs, including electricity

APPENDIX 36

from WHO (1990) Proceedings of meeting of OSM Working Group

36

OPERATIONS AND MAINTENANCE OF RURAL WATER SYSTEMS IN ZAIRE

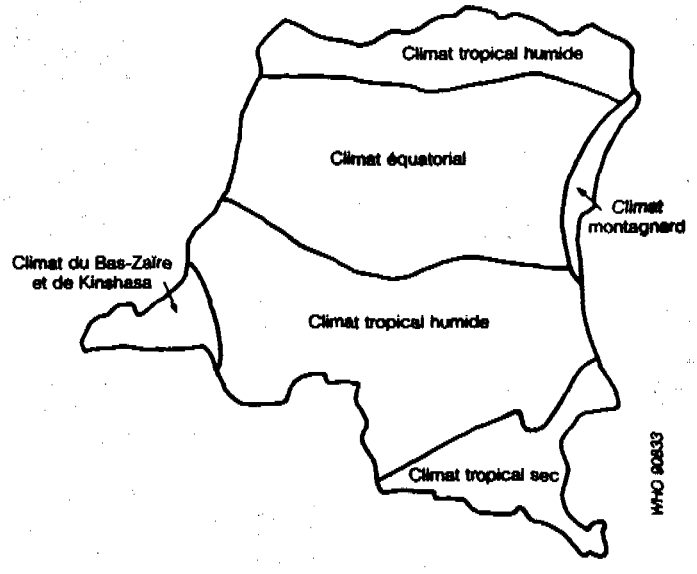
Lukono Sowa
National Rural Water Service, Zaire

Introduction

Zaire, located on both sides of the equator between 50° 20' latitude north and 13° 27' latitude south and 12° 31' longitude west and 31° 16' longitude east, is the largest country in Central Africa.

Zaire, stretching over 2,345,409 km^2, has a narrow window on the Atlantic Ocean to the west which coincides with the mouth of the Zaire River. It is bordered to the northwest by the Congo, to the north by the Central African Republic, to the northeast by Sudan, to the east by Uganda, Rwanda, Burundi and Tanzania, to the South by Zambia and to the southwest by Angola.

FIGURE 1
Climats du Zaïre



The central basin is bordered on all sides by areas of high relief. In the north, plateaus range between 600-800 m and in the south, between 1,000-2,000 m. To the east, the relief is created by the collapse of the occidental Rift Valley and by massive volcanoes reaching 4,500-5,000 m.

The geographic setting of Zaire between 5° latitude north and 13° latitude south and its distance from the sea in the middle of a vast continent determines the basic characteristics of the Zairian climate. There are four distinguishable climates (Figure I).

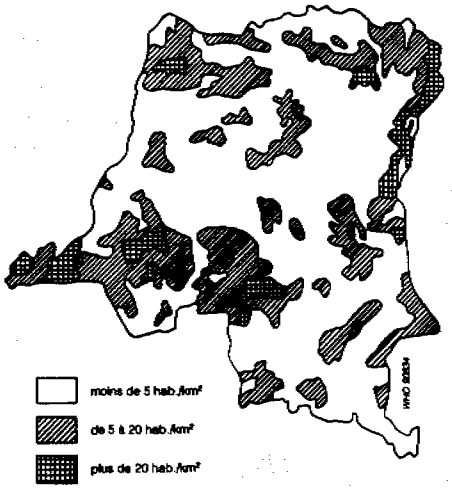
The equatorial climate is hot and humid. Annual rainfall everywhere is greater than 1,500 mm and on rare occasions exceeds 2,200 mm. Temperatures vary little and humidity is permanently above 85 percent.

The humid tropical climate extends on both sides of the equator. Annual rainfall is between 1,200 mm and 1,800 mm and nowhere do temperature ranges exceed 3°C. Humidity is between 70 and 85 percent.

The dry tropical climate is characterized by an annual rainfall which is between 1,200 mm and 1,500 mm, temperatures variations of up to 8°C, and low atmospheric temperatures and humidities.

The mountain climate is characterized by declining temperatures at increasing altitudes. At 2,000 metres, temperatures are between 15-16°C. At 4,500 m, at a temperature of 0°C, only mosses and lichens are able to survive

FIGURE II
Population rurale du Zaïre



The population of Zaire is presently estimated to be 35 million; 65 per cent of whom live in rural areas. The growth rate is estimated to be 2.7 percent; however, the rural growth rate is 2 percent due to rural out-migration and to a very high child mortality. Population density is around 13 inhabitants per km^2 (Figure II).

Water Supply

The tectonic movements which affected the African continent resulted in the creation of a basin in the center of Zaire which drains the entire country. This basin is underlain by porous rock capable of retaining subterranean water and forms a natural underground water reservoir.

Generous rainfall, substantial water flows, and the geological structure of the country are such that Zaire does not face a shortage of water resources for domestic use. Problems are related rather to water quality and its availability for domestic use.

Public health problems in Zaire are complex and numerous, including the prevalence of diseases such as malaria, diarrhoeal and respiratory diseases, infectious diseases (tuberculosis and leprosy), and parasitic diseases (bilharziasis and tripanosomiasis). Measles is especially devastating among small children.

Recent health statistics revealed a very high number of diseases directly or indirectly related to water quality and poor sanitary conditions.

"Health for all by the year 2,000" is the objective adopted by the Executive Council to remedy this situation. "Primary Health Care" is the strategy which will enable Zaire to achieve this objective.

The country has been divided into 306 rural and urban health zones; 100 of these zones are already functioning. A health zone consists of:

- a reference hospital for treatment of diseases which cannot be treated at health centers.
- about 20 health centers, each serving about 5,000 people in rural zones and 10,000 people in urban zones.

- development committees led by volunteers chosen by the community.

Rural Water Supply

Activities to provide potable water to rural inhabitants of Zaire began around 1948 when "le Fonds du Bien-être Indigène" (FBI) was created in order to implement "all activities able to enhance material and moral development of "la Société Traditionnelle Indigène" of the Belgian Congo.

This agency pursued such activities until 1964, although most water construction projects were discontinued in 1959. The FBI capped and improved 1,355 springs, installed 1,634 hand pumps and constructed 138 km of water adductions thereby serving 771,372 people. In addition, the FBI financed 385 spring cappings, 441 hand pumps and 5 small water adductions. During this period, the FBI was directly responsible for maintaining water systems. Later, beneficiaries were given this responsibility. However, they were given no preliminary training by the technical division of the agency and thus were unprepared to carry out this operation and maintenance task.

The financing of maintenance costs were assured by a "water tax" included in the income tax. With the withdrawal of the FBI there was no longer any agency to maintain these installations and since the local populations were unable to do so, the systems deteriorated. There were a few scattered efforts, supported by religious, non-governmental organizations, and REGIDESO (the national water company), to continue installation and maintenance of potable water systems.

In 1977, the Department of Rural Development resumed the activities of the FBI including provision of potable water to rural zones.

In 1978, in reaction to endemic diseases and drought in some areas of eastern and western Zaire, rural water brigades were created with financial assistance from UNICEF.

Strategies and objectives were only vaguely defined at this time. It was not until the 1980s with the advent of the International Decade for Water Supply and Sanitation that objectives to reach 70 percent

of the urban population and 35 percent of the rural population were set. The percentage of the latter was increased to 50 percent under the most recent seven year plan.

The strategy to achieve the above objectives was not defined until the middle of the decade during the National Symposium on Rural Water and Sanitation organized in 1985 by the National Action Committee for Water Supply and Sanitation. This strategy was revised in 1987.

The past decade has witnessed an increase in potable water service to 20.5 percent; this figure was realized in late 1989, whereas at the end of 1987, it was 16.3 percent. Implementation of water system activities received an impetus in early 1985 due to generous financial inputs mostly from USAID and to the creation of the National Rural Water Service (SNHR). SNHR was established to complement activities of the REGIDESO (Water Supply Agency) and non-governmental organizations (NGOs).

To date, 5,068 springs have been capped 1,115 wells drilled and equipped with handpumps and 80 water adductions, (90 percent gravity fed) constructed. These installations provide potable water to nearly 4.1 million people.

Funding for the implementation of the rural potable water supply programme in Zaire is assured by a combination of the following agencies.

- The government of Zaire
- The beneficiaries
- Bilateral cooperation:
- United States Agency for International Development (USAID),
- Belgian Cooperation
- Japanese Agency for International Cooperation (JICA)
- Multilateral cooperation:
- United Nations Children's Fund (UNICEF)
- United Nations Development Program (UNDP)

- African Bank for Development (BAD)
- European Funds for Development (FED)

Community Participation

In Zaire, community participation is considered to be the means by which communities which are going to benefit from developmental assistance actively participate in all aspects of planning, implementation, and evaluation to solve problems which they have identified.

Zaire believes that active participation allows communities to better solve problems and provides them with the necessary means to continue solving problems with a decreasing dependency on outside assistance.

The experience in Zaire is that projects are only successful if the community served participates actively in project design and implementation and that projects are only sustainable if inputs, motivations and activities are related to resources already existing in the community.

Communities must participate in every aspect of project development including:

- analysis of actual situation
- identification of problems
- analysis of targeted problem
- choice of action plan to solve targeted problem
- design of plan of action
- implementation
- follow up and evaluation.

Community participation means entirely entrusting the management of water systems to the benefitting community.

The various agencies involved seek to motivate the community and instill a sense of self-management with activities conducted through existing community organizations. Several indicators are used to measure community participation:

- Acquisition and transportation of construction materials (sand, stone, gravel, etc.)
- Financial contribution of beneficiaries in relation to village income and required operating costs
- Self-organization for operation and maintenance of water systems
- Participation in construction
- Logistical support of technical team at the construction site
- Establishment of a water committee.

Operations and Maintenance of Water Systems

The WASH (Water and Sanitation for Health) Project recently assisted the SNHR in defining an operations and maintenance programme for rural water systems. This strategy has now been implemented in an organized fashion in rural areas.

A nation wide forum regrouping all parties concerned met under the auspices of the National Action Committee for Water and Sanitation to formulate guiding principles for a common national approach to operations and maintenance of water systems. After much discussion, the group was able to agree on the following principles:

- responsibility for maintaining water supply systems rests with the community;
- a financial contribution prior to construction is a key indicator of the local community's willingness to assume responsibility for maintenance of water systems;
- community participation in the design, construction, and operations of potable water systems is essential to ensure sustainability

The following are currently involved in the operation and maintenance process:

- Technical service
- Beneficiaries

1) The technical service is responsible for animating and sensitizing the villagers through development committees; for construction and follow-up of water systems; for ensuring proper functioning of systems which may require maintenance beyond the competence of the local repairman; and for establishing a reliable supply chain of spare parts.

2) The beneficiaries are responsible for establishing a committee to manage water systems; maintaining cleanliness of water source, designating individuals to receive technical training, appointing person to be responsible for maintenance, and assuming any recurrent maintenance costs.

A comprehensive "programme d'animation", taking into account the specificity of the most common systems in a given region (province), must be developed in order to accomplish the above.

One example of the programme which is worth describing is the installation of pumps.

In the south-western Lualaba region, where there exists an intensive programme of drilling and spring capping, the following procedure is used:

Each village slated for the installation of one or more pumps or spring cappings receives the visit of an animator who organizes a series of 6 preliminary small group meetings with the villagers.

1) Informal Presentation Meeting: The animator notes the problems and importance of water as well as possible solutions.

2) Formal Presentation Meeting: He/she explains the different options and probable costs.

3) Acceptance Meeting: He/she focuses on the necessity of contributions from the villagers and on the choice and placement of the pump.

4) Committee Constitution Meeting: Discussions are held concerning the role of committee members, the committee's nature as a voluntary organization, elections, and the contract to be signed between the technical agent and the village.

5) Construction Meeting: The animator reiterates the villagers obligations; ensures that the basic maintenance kit (containing high mortality spare parts) has been purchased; describes briefly drilling and pump installation procedures including a few comments on local maintenance. Once the basic maintenance kit has been purchased (Z20,000 or $40 per household), the animator advises the village of the probable drilling period and informs the technical team.

Three months following the installation of the pump, the animator returns to the village to ensure that the pump is functioning correctly and that it is being used properly. The animator also checks to be certain that the designated caretaker is maintaining the pump as instructed. This inspection visit is undertaken in collaboration with the health zone staff.

The animator also examines financial records.

In addition to animation activities which take place before, during and after installation of the pump, training of different levels of personnel is also undertaken:

- Regionally: training of animators
- Locally: training of artisan-repairmen, committee members, storekeepers, treasury clerks

Another important point concerns the spare parts supply chain (basic tools and maintenance kits). The tools and spare parts are distributed by the National Headquarters to the Rural Water Stations (Regional), Rural Water Station: - Health Zone, Religious Organizations, NGO or Other Community Organizations and to Health Centers or other NGO and to Artisans and Repairmen.

Another example of the programme and process is a gravity fed adduction. Since 1978, several water systems have been established in North Eastern Zaire, North and South Kivu, and many other

systems are now being constructed. To date, these systems continue to provide water for local communities without the technical assistance of the agency which installed them, i.e. SNHR (the National Rural Water Agency) and various NGOS. How can the maintenance of these systems be organized? The response to this question is found in the procedures adopted by SNHR to ensure the operation and maintenance of these installations.

During the design of the water system, the community actively participates via the Development Committee which exists in the village or is created by the health zone or other parties concerned. At this time two or three people are appointed by the community to work with SNHR in the installation of the adduction system. They participate in the entire construction phase and are familiar with all systems. These individuals, often volunteers, are trained to repair leaks and replace faucets. Generally, the villagers all contribute to cover the cost of a breakdown which is repaired by the local repairman. The repairman often has his own water supply point in his yard and is thus motivated to promptly repair breakdowns. This is often also true of the village chief and other key persons.

The operation and maintenance system in effect is estimated to be approximately 90 percent satisfactory as evidenced by cleanliness of water supply sources, number of pumps functioning, motivation and promptness of villagers in contributing to maintenance costs, villagers' social organizations and needs expressed by other villages.

However, despite these achievements, there are specific constraints to full success. These include:

- Lack of attention to community priorities
- Inadequate funds allocated exclusively to activities related to the maintenance of systems
- Very rapid fluctuation in price of spare parts, and handpumps
- Pursuit of Project objectives within a fixed period while ignoring the time necessary to change the beneficiaries traditional attitudes and practices. This is very often due to a lack of communication between the technical service and the animators.

Conclusions

In Zaire, the strategy and system for maintenance of gravity fed adductions and spring cappings works well; however, for pump installations it is still too early to tell. Furthermore, it has been realized that the overall success of rural water projects depends less on the technical success of water installations and more on the absolute necessity of operations and maintenance of water systems being assumed by the beneficiaries themselves and this is being increasingly emphasizing in projects.

Future activities to enhance the operations and maintenance capacity are to:

- Interest local enterprises in the production of handpumps and spare parts adapted to rural conditions in Zaire by encouraging informal sector small entrepreneurs interested in repairing pumps to expand
- Continue training animators, artisan-repairmen, development committee members and treasury clerks and
- Encourage external support agencies to fund the operation and maintenance of water systems.

APPENDIX 37

* *Guatemala : Agua del pueblo*

"Community management in rural water and basic sanitation programmes". Fabian Gonon, Agua del Pueblo, Quetzaltenango, Guatemala.

Main points

- Without community management, Agua del Pueblo's projects would not work
- Using a community management approach for water and sanitation improvements opens up many possibilities to promote development in general.
- Community networking and pooling of resources of crucial importance - agency alone cannot meet all support needs.
- Formation of intermediate cadres of trained technicians essential for success
  Promoting community management has had very beneficial effects for Agua del Pueblo (AdP) in institutional terms. AdP has grown and strengthened as an organization because of its interaction with communities and the learning which has taken place as a result of this. Communities themselves have helped AdP to make the transformation from being supporters, and to understand what a genuine partnership means.
- In reaching agreements with the community, strong emphasis is placed from the beginning on financial sustainability. This is a basic principle, and is reinforced by the signing of contracts between communities and AdP.
- The main lessons learned are that community management is a concept and not a formula. It is very flexible and takes shape according to local conditions, and goes far beyond the "technocratic" approaches.

* *Uganda :*

"Community management systems for rural water supply. Case study in Uganda". Kiwe L. Sibunya, UNICEF, Kampala, Uganda.

Main points

- Team building within an inter-sectoral context is very important.
- "Process" indicators are needed to reward and recognize non-technical inputs and outputs and motivate field staff to actively support the community management approach.
- Communities should be allowed to stand on their own feet. this may mean the agency has to "stick to its guns", even when things may look very shaky. Communities will eventually realize that they have no choice but to take responsibility for themselves.
- There is no prescriptive approach to community management. Flexibility is important, and communities must be allowed to improvise their own solutions.
- Community management should be promoted not just as a means to an end, but a good thing in itself.
- Community management may be more cost effective, but not necessarily cheaper than other approaches.
- To ensure that agencies can provide the necessary back-stopping, more "social" inputs are required in the professional training of technical staff. Project engineers need a broader perspective, and broader skills.
- The questions of integrating hygiene education and sanitation, and strengthening the role of women, still leave much unanswered.
- The case studies in general show that there can be many spin-off benefits from community management. These need to be better understood, quantified and documented.

* *Indonesia:*

"Community self-financing for water supply and sanitation systems. A promising approach to community management and financing of water and sanitation facilities". Hadi Sucipto and Dan O'Brien, CARE, Jakarta, Indonesia.

Main points

- Community management can be implemented in many different ways, depending largely on what the community chooses to do.
- Women's organizations can be a valuable resource for strengthening the role of women.
- Skills are often transferred spontaneously between communities.
- Skills are further developed by people themselves.
- Communities in Indonesia are both able and willing to pay for improvements and have a strong sense of ownership and responsibility.
- Communities have used the funds they raise for water and sanitation for other development purposes, such as the establishment of "health insurance" schemes.
- The private sector is a vitally important resource, including banks and financing institutions to provide capital and credit.
- Community management is difficult but worthwhile, and highly appropriate for developing countries.
- The state has a very important role to play in supporting community management and making it possible.
- Good training/learning tools are very important for the success of community management.

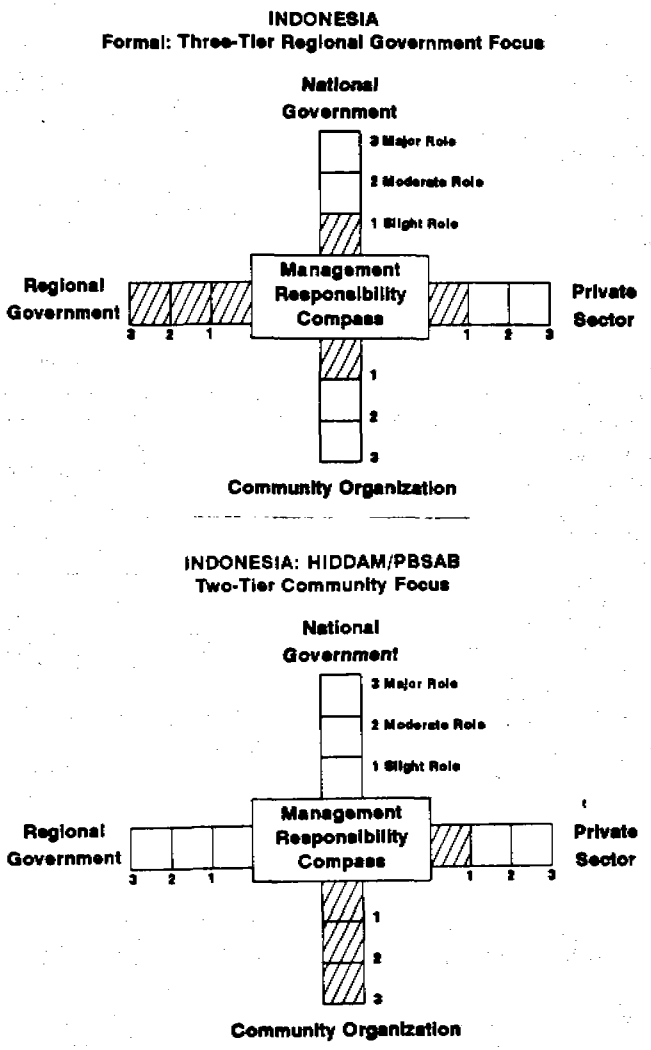


Figure 12

Indonesia: Responsibility of Actors in O&M Management

Health Education and Community Participation

The impetus for an improved water supply generally is convenience, and there is little concern for the connection between water quality and good health, even where rural water projects have attempted to stress this.

Community participation depends on who builds the system. In government-sponsored projects, the villagers provide labor for construction and in some cases food and temporary lodging for the workers. There is little sense of community involvement and ownership. However, in partially or wholly self-financed projects, communities participate in all aspects from raising funds to designing and constructing the system. They are responsible for O&M management when the system is complete, a significant factor in its continued functioning and use.

Participation of Women

Women have a limited role in maintenance, particularly in the more religiously conservative communities, despite a government mandate that their participation should be encouraged. Women are involved in the Family Welfare Movement, but there is scope for their contributions in decisions about the location of taps, bookkeeping, fee collection, and management.

Complexity of Technology

The wide geographical and geological variations in the Indonesian archipelago, as well as differences in hydrologic environment and village size, explain why the technology ranges from rainwater catchments, dug wells, and handpumps to gravity-flow systems, slow sand filters, hydraulic rams, and diesel or electric driven pumps. Generally, the simplest technology that can deliver water is the one used. Community systems commonly have several storage tanks in an extensive pipe network. However, many rural communities still make do with untreated surface water, a practice with obvious health implications.

Availability of Spare Parts

Gravity-flow systems require few supplies other than replacement pipes, fittings (shutoff valves, taps, float valves), and cement, and the availability of spares does not affect continued system functioning. However, where diesel, electric, or hand pumps are used, the availability of spare parts can be a serious problem, particularly in remote parts of the country.

The Indonesian government is pursuing a policy of promoting growth in the industrial sector, and the rupiah is freely convertible. Therefore, many fairly complex items such as pumps and motors are now being built or assembled in the country, and those that are not can be imported without difficulty although procurement may take time.

Standardization of Equipment

The wide range of technologies required in conditions peculiar to the country permits little standardization of equipment and materials. Cipta Karya does use a consistent design similar to that used by PVOs and others. Standard sizes for pipes and fittings are followed, but these items are supplied by different manufacturers. However, standardization does not appear to affect the success or failure of O&M programs. In fact, experience in the design and construction of water systems for the IKK (district centers) suggests that uniform standards may hamper effective O&M because they are unsuitable in the diverse technical and social conditions prevailing.

Cost Recovery Mechanisms

In areas managed by BPAMs or PDAMs, fees are set according to a nationally mandated formula based on the type of equipment installed, the size of the community, and other factors affecting operating costs. However, the funds collected are not administered by the community and often are not sufficient to cover the overhead expenses of these agencies as well as adequate O&M costs. When revenues fall short, the systems that perform reasonably well are given priority and the rest are left to fend for themselves.

The self-financed systems have a range of fees usually collected monthly or annually (post-harvest) by household. However, there is considerable variation in the systems. In a number of villages with few recurrent expenses, fees are collected only as needed, an arrangement that can lead to problems when repairs are costly or if a demand is made before the harvest when communities are cash-poor.

Ability and Willingness to Pay

The progression of the CARE/Indonesia programs towards 100 percent self-financing is an indication that even poor rural communities are able and willing to pay for services. Banks and other institutions (particularly equipment suppliers) are ready to provide credit at commercial rates, with land certificates as collateral to finance system construction. There have been instances of default, but as a rule these loans are repaid. Financing O&M through a fee structure decided by the villagers is not a major problem. However, as the O&M fund increases, villagers feel they don't need such a large reserve and collection rates fall. This is particularly true for gravity systems, where O&M costs initially are very low, and for new systems that have not yet had maintenance problems.

Fee collection rates for systems managed by BPAMs or PDAMs are also an indication of ability and willingness to pay. They vary widely but appear to depend on the service and quantity of water provided. If service is sporadic and water pressure is low, users are less willing to pay.

National and Regional Economies

The Indonesian economy is prospering, but most of the wealth and the benefits of this prosperity accrue to the urban areas, although the regions beyond Java benefit indirectly. The rural areas are poor but able to mobilize resources to meet priority needs. However, there is a tremendous need for services that the central government is still unable to meet despite the thriving economy.

Logistics and Transportation

Logistics and transportation for the delivery of O&M services, as for the whole rural infrastructure, are complicated by the island setting of the country. The INPRES program was designed to ease this problem by giving responsibility to district level agencies.

Government Leadership

Under successive Repelitas, or national development plans, the water sector has greatly improved services. However, it has focused on the water delivery systems in the larger towns and cities, while many rural areas, for lack of funds and clear operational programs at the district and village levels, have been left without access to improved water supplies.

Strength of Government Agencies

The structure of the Indonesian government is very complex. Each Ministry has a headquarters and 27 provincial offices under which are regency/municipalities, districts, subdistricts, villages (desa), and hamlets (dusum). There are more than 60,000 gazetted villages and many more that are not so recognized. The large number of villages and the geographical spread of the agencies responsible for rural infrastructure (including water supplies) make communication and control and coordination of programs difficult. Funding limitations, particularly at the subdistrict and village levels, and limited staff capability and skills pose further impediments. These problems are manifest in the ineffective O&M services provided by the PDAMs and BPAMs which have led the villages to finance and operate water supply systems outside formal government control.

Regional Autonomy

Beyond general policy guidelines and funding allocations by the central government, the provincial and district offices have considerable autonomy in carrying out their tasks. Where villages have constructed systems on their own or with help from nongovernment sources, they have control over O&M management.

APPENDIX 38

from Roark et al. (1993) Models for Management of O&M of RWS&S facilities 38

4.6 Indonesia

4.6.1 Description of O&M Management System

Background

Indonesia, the fifth most populous nation in the world, has substantial oil and gas deposits that have fueled recent growth in urban areas, particularly on the island of Java. However, agriculture remains the major component of the GDP and 70 percent of the population still lives in rural areas. The regional administration operates at four levels: provincial, municipal, district, and subdistrict. Five-year plans, known as Repelita, are the basis of national development in all sectors. Since the second plan, Repelita II (1974), rural water supply programs have been part of the national development agenda. Successive plans have increased emphasis on the solution of socioeconomic problems, more equitable distribution of the benefits of growth, and, more recently, greater participation of the private sector and greater efficiency in operation and maintenance. However, these principles have not yet been uniformly applied at the operational level of all government programs.

Basic Principles

The basic principles espoused in the national development plans stress the need for decentralized decision-making and authority for rural water supply programs. Repelita IV (1984) formally recognized this in the following statement:

> Planning and responsibility for rural WS&S development activities should be decentralized, including the determination and inclusion of community priorities in program and project planning and implementation.
>
> Operation and maintenance programs which help insure the long-term sustainability of projects should be developed.
>
> There should be increasing use of local government and community resources in project implementation and greater consideration of cost recovery goals in project planning.

Repelita V reiterates this emphasis on community responsibility, but the planning process makes it difficult to put this commendable idea into practice. The central government must approve all budgetary allocations. A request for assistance from a community wanting a water supply system must pass through five levels of the bureaucracy. At each stage, it can be denied or modified without reference to the intended beneficiaries. Designs are finalized and construction managed with little input from the community. As a result, there is little sense of ownership and of responsibility for operating and maintaining the system. The rural water supply sector in Indonesia must find a better way to put its support of self-help into practice. Some areas are now showing signs of promise as sustainable operation and maintenance management methods are being introduced at the local level.

Roles and Responsibilities of Parties Involved in Maintenance

The current formal O&M roles and responsibilities correspond with those for the construction of rural water supply systems. Since the first development plan, Repelita I (1969), the design and construction of rural water supply and sanitation projects have been a function of the central government, exercised initially by the Ministry of Health and, since 1984, by the Ministry of Public Works through the Directorate General of Human Settlements *(Cipta Karya)*. Actual construction is carried out by private sector contractors. Operation and maintenance initially are the responsibility of the Regional Water Supply Organization (BPAM), which uses a formula to set tariffs for each system and class of user that are paid to the Ministry of Public Works. Normally, after five years, the systems are handed over to the Regional Government Water Enterprise (PDAM), which assumes the responsibility for collecting fees to cover O&M.

In 1974, the INPRES (Instruction of the Government—National Subsidy for Local Development) program was introduced under the Ministry of Home Affairs to provide local governments with the funds to meet the high priority needs of rural communities. Pumped water systems, spring protection, and artesian wells have been constructed under this program. But the original intention of transferring responsibility to the user community was rarely carried out, and operation and maintenance are still under the direction of PDAM. The government has suspended funding for the INPRES program, which has been plagued by weak community recordkeeping, reluctance to relinquish responsibility to local agencies, poor quality control during construction, and cumbersome financial and management lines of responsibility. However, donor supported projects are continuing under this umbrella.

As regards O&M, the budgets of both BPAM and PDAM are inadequate for the services they are expected to provide, and the condition and profitability of a system frequently determine whether BPAM will transfer it to PDAM. Both agencies mainly provide emergency repairs and many systems fall into such bad shape that eventually they operate only sporadically, if at all, unless community leaders are motivated to take over. However, there is a growing emphasis on including community members in the O&M process from the outset.

Community leaders in many villages, frustrated by the backlog of requests for government assistance in constructing water supply systems, have taken matters into their own hands. These self-financed projects, sometimes constructed with technical and financial assistance from PVOs such as CARE, have a greater chance of providing sustainable benefits than those constructed by the government. CARE has adopted a model that makes a village water management committee responsible for O&M.

O&M Management

O&M management falls to BPAM or PDAM, and, as explained, which of them takes responsibility, depends on how well established the system has become. Although the Repelitas have stressed community participation, these two agencies have primary responsibility, at least until the cost and effort to continue maintenance become excessive. At

that point, the system either falls into disrepair and disuse or village leaders take it upon themselves to operate it as well as they are able.

The CARE/Indonesia Experience

CARE/Indonesia, over a number of years, has developed a model for assisting communities interested in establishing their own water systems. It encompasses community organization, system design, construction oversight, and training in financial management, community health, etc. A central feature is community management of O&M through the Association of Drinking Water Users (HIPPAM-*Himpunan Penduukan Pemakai Air Minum)* or the Village Water Management Committee (BPSAB). The HIPPAM is a legal organization set up with the express purpose of managing the water delivery system and providing health education to villagers. In 1989, the government recommended that the HIPPAM model be adopted nationwide, but not all provinces have been willing or able to do this.

Where HIPPAMs exist, communities have taken over responsibility for O&M and have set up management structures appropriate for the technical sophistication of their systems and the skills and financial capacity of their members. Management covers construction, operation, maintenance, and financial affairs, and sometimes the services of contractors or voluntary community labor. The formal and informal models of O&M management are shown in Figure 12.

4.6.2 Issues Relating to O&M Management System

Capacity of Traditional Community Organizations

The traditional village structure has always incorporated self-help community action, now winning government recognition and support. Village organizations are responsible for village government, health, education, and in many areas for mobilizing the financial and human resources to meet priority village needs. These organizations must maintain links with government agencies at the subdistrict level in order to work within the official administrative structure.

Key Community Skills

The growth of village organizations has given a larger voice to educated people, often religious leaders, teachers, or businessmen. However, the technical skills to construct and maintain water systems are not always available and may have to be brought in from outside the immediate community to ensure proper standards of maintenance and repair.

Policies and Legislation

Repelita V, the current development plan, continues a high level of government involvement in the water supply sector while clearly identifying increased community participation as a major objective. Under the present system of project and budget approval, project plans may be altered on their way to the central government without any reference to the intended beneficiary communities. This process, which can result in a project very different from what was originally envisioned, is a major impediment to effective community participation and management. Rural communities are at a further disadvantage, since attention to the needs of urban areas first leaves them little chance of inclusion in government sponsored projects to improve water supplies. The acceptance of the HIPPAM model for local control of O&M in one province is a positive step in policy development.

Communication and Information Sharing

Communication, information sharing, and coordination in the sector are poor. The number of government agencies at the subdistrict, district, provincial, and national levels adds to the problem. Several studies have pointed out the need for improving interdepartmental and intersectoral coordination.

4.6.3 Effectiveness of O&M Management System

The government approach expressed in the Cipta Karya water development program has not been effective in providing sustainable water supply systems at the district level and below. Maintenance shortcomings have been attributed to insufficient revenues, a poor understanding of good management practice, limited technical staff, and a highly bureaucratic organization.

The INPRES program, intended to address the needs of rural areas, has not been considered a success for reasons explained earlier. However, an evaluation of the program in 1987 indicated that 39 of 44 community systems (piped water and springs) in three provinces were in continuous service. The general dissatisfaction with the program arose from a much lower use of handpumps and rainwater catchments. The successful community systems led to recommendations for simple, passive technologies. Unfortunately, the government has not seen fit not to continue funding the program.

However, the new interest in self-financed systems holds considerable promise. In selecting such projects, CARE/Indonesia emphasizes motivation, availability of financial resources, and the involvement of villagers in all phases of design and construction. The flexibility of the community-managed maintenance model, although untested over the long term, has the potential to ensure competent management of the water systems.

4.6.4 Future Problems and Trends

The Government of Indonesia is moving towards more active community participation, recognizing that villagers in some areas are willing to commit considerable resources to developing their own water systems. However, government agencies need to be sensitive to the desire for village control over fee collection and financing of O&M.

The success of the CARE/Indonesia program and the HIPPAM model for O&M management has aroused the interest of the Asian Development Bank and the World Bank. The World Bank is developing the Water Supply and Sanitation Project for Low Income Communities, which will build on the experience of the INPRES program and the community self-financing approach of CARE/Indonesia. Village participation in the financing, construction, and O&M of their own water systems, with technical assistance in design and construction supervision and training in system management and community health, provides a workable model for the rural water sector in Indonesia.

4.7 Benin

4.7.1 Description of O&M Management System

Background

The Republic of Benin has seen considerable change in the past five years. Recent elections have installed a government that has begun economic reforms to rescue a country on the verge of financial ruin in 1989. Benin offers an example of an O&M management system successfully implemented at the project level and now embodied in national policy.

The Benin Rural Water Supply and Sanitation Project, begun in 1987 as a joint effort by USAID, UNICEF, the Peace Corps, and three government agencies, aimed at improving the health and living conditions of rural populations in selected regions. Its primary objectives were:

- drilling boreholes and equipping them with handpumps;
- constructing demonstration latrines;
- creating and training village committees for self-management of the water and sanitation systems;
- providing education and training in health and hygiene;
- reducing the incidence of guinea worm disease in the heavily infested project zone; and

- establishing a system of O&M with private sector participation in repair and spare parts distribution.

In accomplishing all these objectives, the project has provided a model for a national water and sanitation policy.

National Policy

This policy is guided by the following key principles:

- WSS facilities must be constructed only where the demand for them and the ability to maintain them have been demonstrated.
- The maximum participation of local government and community organizations must be fostered.
- Communities must be given primary responsibility for managing their WSS systems, including financing the O&M and at least part of the capital costs.
- Health education and sanitation facilities must be accorded equal importance with water supply as essential components of health improvement.
- Women must be encouraged to play a larger role in community management.
- Handpumps must be limited to three models to allow competition but still maintain regional standardization.
- Research must continue to seek the cheapest means of providing water and sanitation facilities, with particular emphasis on solar energy, large diameter wells, and piped water systems.
- The private sector and nongovernmental organizations must be given a larger role.

Project-Level O&M

Since the Rural Water Supply and Sanitation Project has been so successful, a description of its operating elements will provide some useful insights into O&M management. At the national level, the Water Agency in the Ministry of Energy, Mines, and Water Supply heads the sector and collaborates with the Ministry of Health and departments of social affairs and sanitation. The project has established an interministerial coordinating committee that includes representatives of the principal government implementing agencies, the Ministry of Planning, and all donor organizations, and the technical assistance contractor. The committee periodically reviews the project work plan and any pressing issues that require approval or solutions.

The regional offices have considerable independence. One position in particular, that of field agent for the various government offices, is critical for the efficient functioning of the sector. The field agent is responsible for day-to-day contact with the communities and is the catalyst for establishing health committees to manage all sector activities at the village level. The agent trains the committees, conducts courses in health and hygiene, monitors ongoing activities, and sees to it that the private sector repairman and the spare parts distributor provide good service. The field agent, in summary, is the pivotal link between the government, the communities, and the private sector.

There is one repairman for about 20 villages, trained and certified by the project and paid at rates fixed by the Water Agency. Preventive maintenance is required every six months, and transportation is provided by the village whenever the repairman is needed. Spare parts are stocked by local businesses within a reasonable distance of the villages. A national level importer assures entry of spare parts and distribution to the regional businesses.

The community maintains a bank account for its O&M fund and potentially may obtain loans, although the processing of community loans has not yet become functional.The community is fully responsible for managing its system as the de facto owner. A health committee oversees O&M activities, ascertains the needs and interests of people regarding water, sanitation, and health, and is responsible for collecting the user fees decided by the community. Communities must establish an O&M fund as a prerequisite to the construction of a WSS system. All management decisions, such as how the system is to be used and who may use it, are made entirely by the community.

When the pump breaks down, the health committee summons the repairman and pays him from the fund or occasionally with money raised at the time. Sometimes the repairman will provide his services on credit. The responsibilities of the various actors in O&M management are shown in Figure 13.

4.7.2 Issues Related to O&M Management System

Key Community Skills

The project has spent considerable time in training health committee members (president, secretary, treasurer, and advisors), pump operators, and repairmen, believing that training is essential for sound O&M management.

Health Education

Health education has covered the role of potable water and latrines in disease prevention, guinea worm disease control, village sanitation, and personal hygiene. Since rural literacy rates are low, many communities request adult literacy programs once their WSS needs have been met.