

Tools for assessing the O&M status of water supply and sanitation in developing countries



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1. Introduction

Problems with the operation and maintenance of water supply and sanitation have long been recognized as key constraints to the sustainability of these services. In order to address these problems in both urban and rural areas of developing countries, this document proposes a framework for management and tools for assessing the status of operation and maintenance (O&M) through measurement and evaluation of performance. These proposals have been developed from earlier work by the Working Group on Operation and Maintenance of the Collaborative Council for Water Supply and Sanitation.

The term “Operation and Maintenance” has been used as a general concept covering a wide range of activities carried out by utilities, government and communities in order to sustain their services and to maintain existing capital assets. Specifically, in the present context:

- **Operation** refers to the procedures and activities involved in the actual delivery of services, e.g. abstraction, treatment, pumping, transmission and distribution of drinking-water.
- **Maintenance** refers to activities aimed at keeping existing capital assets in serviceable condition, e.g. by repairing water distribution pipes, pumps and public taps.

Nine tools are described in this document. They are targeted at:

- policy-makers (including staff of international development agencies) who need to optimize the investments in water and sanitation by developing improved management strategies which give a higher profile to operation and maintenance;
- professional staff employed in utilities, local government (both urban and rural), and nongovernmental organizations (NGOs) who are involved in the development of programmes to improve the actual operation and maintenance of water supply and sanitation facilities.

How the tools will help

The nine tools can be used to measure and evaluate the effectiveness of operations and maintenance (O&M) of water supply and sanitation services. Performance is measured using carefully selected indicators to assess the status of O&M and to highlight successes and failures. Managers can use the information on performance to help them formulate policy and implement plans which are relevant to the problems that have been exposed, and conversely to avoid unnecessary actions. The tools will help policy-makers and professionals to:

- establish management objectives for O&M performance;
- develop a framework for performance measurement, including systems for reporting;
- carry out measurement and reporting of performance;
- prepare action plans to improve performance;
- implement the action plans;

- continue to monitor and report on performance; and
- update and implement the revised action plans.

All the tools must be used with discretion, based on a proper understanding of the local situation. The nine tools are as follows:

Tool 1: Effectiveness of the O&M management system

Tool 2: Guidelines for an audit of O&M

Tool 3: A framework for assessing the status of O&M

Tool 4: Guidelines on O&M performance evaluation

Tool 5: Guidelines on O&M performance reporting

Tool 6: Guidelines for the selection of performance indicators

Tool 7: Performance indicators for water supply and sanitation

Tool 8: Potential information sources

Tool 9: Participatory information-gathering.

Before describing these tools and how to use them, we shall first discuss:

- the relevance of performance monitoring and evaluation of O&M;
- the way in which different management systems for O&M influence the assessment of O&M performance; and
- some constraints due to ineffective management systems.

2. Monitoring and evaluating performance

The concept of monitoring the performance of operation and maintenance and using the results to improve the situation is not widely known or practised in many countries. How performance indicators can be developed and how they can be used will now be described.

Performance indicators can be defined as *variables whose purpose is to measure change in a process or function*. They are normally used in one of two ways. They may be collected at regular intervals to track the way in which a system is performing or an activity is unfolding. Or, they may be used to assess the change resulting from a particular activity or project. In the first case, performance indicators are used to **monitor** the progress of the process; in the second case, their purpose is to **evaluate** the outcome of the project or process. Evaluation requires the situation to be assessed both at the beginning and at the end of the project or process, which means that baseline data relating to the proposed performance indicators must be collected before the project or process starts. Such baseline information, collected before the start of the project or process, can and should be used to help make decisions on what needs to be done. This information should, wherever possible, include relevant data from previous initiatives in order to take advantage of past experience.

Indicators may be quantitative or qualitative in nature. For example, the operating

pressure in a pipeline and the informal water costs are both quantitative indicators. In contrast, a community member's perception of his or her satisfaction with the existing water supply or sanitation is essentially qualitative. For comparative purposes, it is usually necessary to find a way of placing a quantitative value on qualitative indicators. It is arguable that processes which cannot be measured cannot be managed, and it is widely accepted by governments and international agencies that quantitative information is needed if choices are to be made between a range of possible options. A common response to the need to quantify indicators is the use of 'ranking scales' in which, for instance, the person's satisfaction with a process, activity or situation might be ranked on a scale ranging from "very happy", through "happy", "indifferent", and "unhappy", to "very unhappy". Such ranking scales, which must be established at the time the indicators are identified, should be introduced and applied to the overall monitoring and evaluation system. Box 1 presents some key points concerning performance indicators.

Further guidance on criteria for developing performance indicators is given under Tool 6 (Guidelines for the selection of performance indicators, page 26).

BOX 1

Key points concerning performance indicators

The following points must be kept in mind when using performance indicators:

- The indicators should be truly representative of the quantities and characteristics they are intended to represent.
- They should be verifiable, i.e. it should be possible to check the accuracy of the values of the indicators.
- The indicators should provide information which can be used by decision-makers; this will often mean that they are presented quantitatively.
- The information must be available in time to influence decisions.
- The indicators should be linked into the system to allow feedback of information for the decision-making process.

3. Operation and maintenance management

The various institutional arrangements for delivering water supply and sanitation services have important implications for managing the operation and maintenance of, for example, the following:

- large, relatively sophisticated urban water supply and sewerage schemes, managed by a specialist utility and possibly involving the private sector;
- less complex water supplies in small towns, managed by urban local government;
- rural water supply and sanitation, managed by government rural development departments;
- rural and peri-urban water and sanitation schemes, managed by NGOs, community-based organizations (CBOs) and user groups with few or no links with government-managed systems; and
- facilities at household level, which are self-contained and entirely the responsibility of the family.

A succinct and informative overview of maintenance management models for rural water supply and a series of field-based case studies to illustrate these different models have been published by WASH (Water and Sanitation for Health, 1993). They describe a spectrum of models involving the community, various levels of government, and the private sector. Experience shows that there is a wide range of approaches; the differences

TABLE 1. O&M MANAGEMENT SYSTEMS

Management system	Examples	Implications
Centrally managed <ul style="list-style-type: none"> • Private service connections to individual plots which require supporting external infrastructure 	<ul style="list-style-type: none"> • Piped water supply • Sewerage 	Public institutions have statutory responsibility for service delivery and O&M
Community-managed <ul style="list-style-type: none"> • Non-private facilities which are shared by members of a community or user groups; depending on the technology adopted, these may or may not require supporting external infrastructure 	<p><i>With external support infrastructure:</i></p> <ul style="list-style-type: none"> • Piped water to public standposts • Sewered communal or shared latrines <p><i>Without external support:</i></p> <ul style="list-style-type: none"> • Communal handpumps or wells • Communal latrines linked to pits or septic tanks 	A group of users is responsible for O&M; if there is external support infrastructure, the roles and responsibilities for O&M need to be carefully defined between the community and the external agencies. In some cases, e.g. rural piped water, user groups may be responsible for the whole system including external infrastructure
Household-managed <ul style="list-style-type: none"> • Private on-plot services which do not require supporting external infrastructure 	<ul style="list-style-type: none"> • On-plot wells, handpumps • Latrines linked to on-plot pits or septic tanks 	Responsibility for O&M of privately owned on-plot facilities rests with the owner or plot-holder, and there is much less of a management issue here

mainly relate to the degree of involvement of the user community, the role of different public sector institutions and levels of government, and the involvement of the private sector. Table 1 shows three systems of management responsibility with respect to O&M. In practice, it is the links between these different systems which are important, whereby the roles and responsibilities are clearly understood by all

In *centrally managed systems*, either a utility or local government authority (municipal or rural) undertakes all the activities as part of a planned programme of work. This could be implemented as follows:

- by using the direct labour force commonly employed by such institutions; or
- by using a tender-contract system and departmental works procedures to involve external private sector micro-contractors and local labour; or
- by developing more innovative approaches for private sector involvement, such as term contracting for services; anything more complex than this (e.g. concession

arrangements) is likely to be beyond the capacity of all but the largest and most efficient of urban utilities.

The limitations of this approach relate to both the capacity and performance of the institution and the extent of the service coverage, particularly when poor urban settlements and remote rural areas are covered. The lack of strategic O&M planning for the medium to long term is especially common. The actual and potential levels of institutional capacity and support for O&M are generally greater in urban than in rural areas (WASH, 1993). Box 2 identifies some specific problems. A major problem to date has been to set up functioning management systems for the O&M of rural water supply and sanitation systems. In remote areas, all too often the community is left to its own devices without the necessary initial or follow-up support from external agencies.

In rural areas, the traditional model of centralized management tends to be unresponsive and expensive to operate (Arlosoroff et al., 1987); it is clear that the

institutional problems associated with centralized maintenance may run very deep.

The *community-managed approach* involves the residents and community groups who undertake to manage aspects of neighbourhood and village-level work; this could involve people doing things themselves and/or hiring labour for routine and skilled tasks (see Box 3). There is relatively little documented experience of this in the urban sector. The evidence suggests that this approach has limits because:

- the activities have to reflect both the willingness to participate and the capacity of the residents; and
- major repairs require a degree of technical and contractual input, and therefore risk, which the residents may not be prepared to assume.

The community management option requires a clear understanding of the roles and responsibilities, such as:

- how to interface with formal institutions operating in the city in order to cover the eventualities of major works; and
- the definition of minor as opposed to major O&M tasks and the responsibility for action.

BOX 2

Some typical institutional problems

- Inter-agency disagreements about responsibility are a significant barrier to good O&M.
- It is common for the agency responsible for construction to hand the system over to a different agency for O&M.
- O&M requires special skills such as the need to relate to predominantly poor customers and develop innovative solutions.
- Particular problems arise in that there is often no real link between the service charges and/or local taxation paid by consumers and the level of operational service supplied. This financial structure means that there is little financial leverage, if any, which the consumers can exert.

(See Watson 1995, WELL 1998)

BOX 3

Community-managed maintenance in urban areas

- For collective maintenance to work, *more* (rather than less) interaction between residents and the responsible institution is required.
- Collective maintenance is not a means by which ineffective institutions can shelve their responsibilities for O&M.
- Arrangements for shared responsibility did not work well in a situation where the residents looked after the tertiary sewers and the agency maintained the trunk sewers. This separation of tasks left a large grey area in which the responsibilities were unclear.
- There are instances of residents in poor urban communities who contributed towards the cost of hiring a sweeper for latrine cleaning and removing solid waste. These examples of *residents managing a service* will help to move away from the traditional idea that poor people have to do everything themselves.

(See Watson 1995, WELL 1998)

BOX 4

Assumptions underlying successful VLOM

- The assumption that supporting community-based O&M (such as VLOM) is a less onerous task than running a centralized maintenance system has not been borne out in the field.
- There is little evidence that governments have facilitated VLOM effectively on their own, but the experience in India with maintenance gives some cause for optimism.
- An innovative, community-based system is unlikely to thrive if it has to be supported by government departments which are usually characterized by chronic under-funding, poor management and low motivation.

(Refs. Talbot 1997, WELL 1999)

A lot of attention has been given to the community management of facilities in rural areas. Instrumental in this was the concept of VLOM—originally “Village Level Operation and Maintenance”, which subsequently became “Village Level Operation and Maintenance Management”. VLOM was based around the use of standardized handpumps, with all routine inspections and minor repairs being carried out by trained people or ‘caretakers’ from the community. A support mechanism for the reporting and repair of serious faults has to be put in place, but with minimum intervention by external agencies.

There are success stories where there was a very high level of support from NGOs. However, as VLOM was introduced in response to a perceived failure of the centralized approach due to inadequate government services, the real test of VLOM is whether or not it can succeed in an ordinary government environment (see Box 4).

Despite the interest and efforts to develop community-based approaches for service delivery, serious problems have been found. Community support cannot be a substitute for weak government institutions; therefore, the need for effective government institutions cannot be avoided. Wherever such problems exist, and where there are no NGOs or other agencies to fill the gap, sustainability will always be difficult.

In *household-managed systems*, the responsibility for O&M of privately owned on-plot facilities rests with the owner or plot-holder. In this respect, on-plot facilities have several big advantages, such as:

- a powerful incentive for householders to keep their facilities in optimum working order;
- repairs are carried out by the householders;
- householders finance all the O&M costs;
- clear opportunities exist in urban areas for small private-sector local contractors;
- improving O&M performance is not an issue here, as it is for management by community groups or centralized institutions.

The household is the focus for sanitation activities in both urban and rural areas, as it is within the family that the main impacts of sanitation are felt. O&M activities are concerned with the functioning

of latrines and their pit or septic tanks. Problems can arise for the wider community if household activities have an adverse impact on the local environment, e.g. malfunctioning latrines or tanks discharging untreated sewage off the plot.

People in rural areas may prefer a household facility such as a well or simple handpump if the aquifer is shallow. Some communities who would be unwilling to maintain a communal pump may be quite happy to invest in this option, which has been dubbed ‘FLOM’

(family-level operation and maintenance) (Waterkeyn, 1993). Family handpumps are common in the Indian subcontinent and are installed without external support. While not robust, they are cheap and simple to fix and their popularity makes viable the commercial supply of spares. However, the affordability of family water supplies depends upon the availability and accessibility of groundwater.

It is unfortunately not possible to focus all service provision at poor households. In urban areas, as the per capita water supply increases, so does the need for adequate sullage drainage and there soon comes a point at which on-plot disposal is not feasible. However, there are big advantages if O&M rests with households who have a real incentive, because they have invested in the system and will benefit from it. Household-centred approaches are possible to some extent in both rural and urban areas, and suffer few of the problems and drawbacks of centralized and community-based O&M management. But there are many situations where there is simply no effective institutional support of any sort, and communities and households have to manage as best they can.

4. Management constraints

Inadequacy of O&M in many situations is due to the absence of an effective management system. The problems that arise may be of a very basic nature, as illustrated in Box 5.

There are fundamental issues regarding the management of O&M which have to be addressed at the institutional level. They include:

- a clear understanding of roles and responsibilities;
- a knowledge of the infrastructure asset base and its condition;
- a system for forward planning of O&M;
- sound financial management with adequate resources; and
- management information systems to furnish information for planning.

Until these problems are addressed, the tools for improving specific aspects of performance cannot be applied to any great effect. Issues such as overhauling the management information system, developing clearer financial management procedures, instigating an infrastructure inventory and condition surveys, and developing planning procedures have been discussed by WHO (1994).

There is an additional but less tangible ingredient for success—that is, the culture of the organization must recognize, believe in, and champion the importance of operation and maintenance if there is to be real performance improvement. Engendering the right cultural environment, in which staff appreciate the very concept of O&M, is not a simple task, as illustrated by the following anecdote from South Asia (M.D. Smith, personal communication, 1993).

“The likely consequences of a policy resulting in poor maintenance were outlined; the engineer was then asked what would happen, as the scheme would eventually cease to function. He replied that (the government organization) would request further aid to rebuild the scheme.”

BOX 5

Typical problems facing centralized O&M management

Lack of management information systems

■ *Financial reporting* systems may make no distinction between capital and recurrent expenditure. The only way to retrieve information is by a detailed examination of all works carried out.

■ *Technical reporting* systems have no means of classifying the work undertaken into capital, operation, and maintenance.

Inadequate financial management

Many organizations are financed through transfer payments from higher level government departments. They do not know what their financial allocations are at the start of the year and do not have separate budget lines for O&M. They operate on a pay-as-you-go basis without effective budgeting procedures; the first call is on staff salaries, and spending stops when the money runs out.

Unknown asset base

There are no inventories of assets which are under the control of the organization. Consequently, condition surveys are not carried out, and O&M workplans are not based on an assessment of needs.

Lack of a planning process

The above problems make it very difficult, if not impossible, to develop effective strategic and short-term plans for O&M. Failure-based maintenance is the order of the day, with little scope for preventive or even routine maintenance to be effective. Strategic planning for O&M is necessary to ensure that the optimum value is obtained from the infrastructure assets.

5. The tools and how to use them

The tools are structured around two central themes:

- **Theme 1:** the need for a functioning management system for O&M.
- **Theme 2:** measuring and evaluating O&M performance.

In the absence of an effective management system, it is unlikely that tools for evaluating specific aspects of performance will produce any great effect. Three possible models for management of O&M are:

- centralized institutional or utility-style management;
- community-based approaches;
- household-based approaches.

Having a sound management system (Theme 1) is vital, and Tools 1 and 2 provide some general guidance. However, the primary focus of this document is on performance evaluation (Theme 2), which is considered in detail. All the tools are linked to these themes, as described below.

Theme 1. The need for a functioning management system for O&M

Purpose: to give an overview of the issues and recommend points for further action. (These tools should be read in conjunction with *Operation and maintenance of urban water supply and sanitation systems* (WHO, 1994), which describes in detail the setting up and implementation of management systems)

Application: mainly centralized management systems, but with useful lessons for large community-based management schemes

Description:

- Tool 1 Effectiveness of the O&M management system
- Tool 2 Guidelines for an audit of O&M

Theme 2. Measuring and evaluating O&M performance

Purpose: to assess the status of O&M through performance evaluation

Application: centralized and community-based management systems, but the performance indicators also apply to household-based management systems

Description:

- Tool 3 A framework for assessing the status of O&M
- Tool 4 Guidelines on O&M performance evaluation
- Tool 5 Guidelines on O&M performance reporting
- Tool 6 Guidelines for the selection of performance indicators
- Tool 7 Performance indicators for water supply and sanitation
- Tool 8 Potential information sources
- Tool 9 Participatory information gathering

In the description that follows, the nine tools are linked and cross-referenced, and recommendations for action and further guidance are given for each tool. This approach enables the user to choose one of the themes or both to investigate the status of O&M.

6. References

1. Arlosoroff S, Tschannerl G, Grey D, Journey W, Karp A, Langeneffer O, Roche R. *Community water supply—the handpump option*. Washington DC, World Bank, 1987.
2. Talbot R. *Goals, roles and innovations in India*. In: Proceedings of the 23rd WEDC (Water, Engineering and Development Centre) Conference, 9–13 September 1996, New Delhi, India. New Delhi, WEDC, 1997:11-15.
3. WASH (Water and Sanitation for Health). (1993) *Models of management systems for the operation and maintenance of rural water supply and sanitation facilities*. Arlington (USA), WASH, 1993 (Technical Report 71).
4. Waterkeyn A. Pipe dream or pump dream? *Waterlines*, 1993, 11 (4):19–21.
5. Watson G. *Good sewers cheap?* Washington DC, UNDP/World Bank Water & Sanitation Programme, World Bank, 1995.
6. WELL (Water and Environmental Health at London and Loughborough). *Operation and maintenance: situation analysis and action plan. Cuttack Urban Services Improvement Project, 1998*. London, 1998 (WELL Task 34 Report).
7. WELL (Water and Environmental Health at London and Loughborough). *Review of VLOM for rural water supply: lessons from experience*. London, 1999 (WELL Task 162 Report).
8. World Health Organization. *Operation and maintenance of urban water supply and sanitation systems*. Geneva, WHO, 1994.

Tool 1: Effectiveness of the O&M management system

This tool is aimed primarily at centrally managed systems and assumes that the key O&M institutions have been identified. Four steps are described below.

Step 1. Recognizing water supply and sanitation as a service industry

Water supply and sanitation are usually managed by the public sector as a ‘service industry’, where performance evaluation is much more difficult to quantify than in a manufacturing industry. Breakdowns that reduce the quality and quantity of the supplied water may lead to environmental health problems, which are difficult to quantify in monetary terms. This complicates the O&M management function, because it is difficult to choose objectively between, for example, policies advocating more investment in O&M and those that ensure fewer or shorter breakdowns.

In addition to the difficulties in quantifying performance, the generally low profile and status of O&M add to the problems of generating the political will to allocate sufficient resources to ensure adequate performance. However, the following preliminary inquiry has first to be made:

Is there an O&M management system in place?

Commentary

The importance of operations and maintenance management has been described in the introduction. The key point about a management system is that it can set objectives for levels of performance, and then act on the information collected in order to achieve those objectives. However, some basic initial questions have to be addressed.

Key points/Questions

- Establish who is responsible for O&M, and what the actual and perceived roles and responsibilities are.
- Explore whether a management system (central or community-based) for O&M is already in place and being followed.
- Find out if this system is generating action plans which are being used to improve the performance of O&M; these can be integrated into a formal planning process, or developed as local community-based action plans.

Step 2. Functioning of the O&M management system

For performance measurements to be effective, it is important that a functioning management system for O&M is in place. In practice, it is difficult to measure the effectiveness of a management system. The following qualitative criteria are proposed as a means of assigning a “level of perfection” to describe the thoroughness of the management system (Marcelis, 1984):

Structure of the management process

- How far are decisions taken according to established procedures?
- How are priorities and objectives set; are these widely understood within the department or organization?
- Is it clear what resources will be mobilized and what actions will be undertaken to achieve the objectives within a particular time frame?

Feedback process

- To what extent are the outcomes of these decisions checked against the corresponding objectives?
- Can the plans be modified if it becomes clear that the objectives are not going to be met?
- Are the plans actually modified when such problems come to light?

Forecast horizon

- How far ahead does management look in making decisions concerning O&M?
- Is there a clear planning cycle within the organization or department?
- Are there restrictions due to the budget cycle which are outside the control of the organization or department?

Integration level

- Are decisions concerning O&M taken with sufficient insight and knowledge of the broader context of what is happening in other related sectors, e.g. rural development, city-wide structure planning?
- Are planning decisions about capital works programmes taken in conjunction with the organization or department responsible for O&M?
- Is the O&M function perceived to be an important component of the overall infrastructure cycle (identification–preparation–implementation–O&M–renewal)?

Step 3. Assessing “levels of perfection”

The following qualitative description of the different levels of perfection can be assigned:

Level of perfection	Management process structure	Feedback	Forecast horizon	Integration
Very low	No rules	Never	None	None
Low	Rules of thumb	Sometimes	Short	A little
Medium	Rules	Regularly	Reasonable	Reasonable
High	Procedures	Often	Considerable	Far-going
Very high	Systems	Always	Large	Total

Note that while this assessment may appear to apply more directly to formally structured organizations such as utilities or government departments, the criteria can equally well be applied to a community-managed system or a partnership approach between a government department, NGO and community-based organization (CBO). The important difference is that we should look for informal mechanisms that may be in place, e.g. verbal transactions and communications with few written records. The existence of such mechanisms at the community level are best explored through participatory methods (see Tool 9, page 42).

Step 4. Actions and further guidance

Actions

1. Carry out a qualitative assessment of the effectiveness of O&M management according to these criteria.
2. Develop *action plans* in the different areas of performance in order to move up to a higher “level of perfection”.

Further guidance

1. See Tool 2 (Guidelines for an audit of O&M, page 14) as the first stage in this process.
2. See *Operation and maintenance of urban water supply and sanitation systems* (WHO 1994) for important additional guidance on management systems.

References

Marcelis WJ. *Onderhoudsbesturing in Ontwikkeling*. Deventer (in Netherlands), Kluwer, 1984. (No English translation; inputs provided by Belgian contributors)

World Health Organization. *Operation and maintenance of urban water supply and sanitation systems*. Geneva, WHO, 1994.

Tool 2: Guidelines for an audit of O&M

What is an O&M audit?

An O&M audit is a valuable management tool for assessing the way O&M is working. It is a systematic procedure for obtaining and evaluating objective evidence on O&M organization and practice. The information from the audit feeds directly into the development of action plans to improve both the function and structure of the management processes for O&M (see Tool 1).

Why carry out an audit?

Audits are carried out to establish the status and effectiveness of O&M management. They provide important information in the following situations:

- prior to making organizational or policy changes;
- when an independent opinion is needed in addition to internal views;
- for comparative purposes, when setting performance targets for new facilities.

What is the value of auditing?

Audits are important in several situations, such as:

- to highlight system deficiencies and a lack of crucial management functions in O&M;
- to provide basic information about the O&M function, against which more detailed information from performance indicators can be interpreted;
- to help make the O&M function transparent to salaried or voluntary staff;
- to make international comparisons, develop guidelines for O&M practices, and plan for future investments.

What does an audit involve?

An audit presents an independent view of O&M functions, objectives, organization and practices, against which questions and answers can be evaluated. The framework of a structured audit procedure is supported by performance reporting tools and performance indicators (see Theme 2, page 9).

How is the audit carried out?

The purpose of an audit is to gather objective information and, as such, is normally carried out externally, in the same way as financial accounts are audited independently. However, a lot can still be learned from an internal audit in a first attempt to improve performance.

A structured audit procedure for O&M management

The procedure involves investigations, often by posing questions, in eight steps (see below) in order to elicit information about the management of O&M in an institutional setting.

Step 1. Background information

Objective: to obtain basic background and general information on the organization and systems being audited.

Issues

- How old are the systems? If they are very old, rehabilitation may be urgent.
- How well is the capacity utilized? Low utilization may indicate design over-capacity.
- What scope is there for expanding the capacity in the short term, so that the existing systems can serve a rapidly growing population?
- Are the materials, plant and equipment standardized? This is especially important if the system is not installed by local or national firms or the materials are not procured locally.

Step 2. The culture of the organization

Objective: to understand the culture and fundamental operating principles within the organization responsible for O&M.

Issues

- An understanding of the O&M environment depends on the attitudes of managerial staff, and whether this 'cultural environment' gives priority to O&M management.
- If O&M is seen as an area of major concern, it may be easier to invest in maintenance resources, or to adopt and implement more advanced maintenance management approaches.

Step 3. Responsibilities within the organization

Objective: to develop a clear understanding of all O&M responsibilities, including the way O&M is organized and how it relates to the overall management of the water supply and sanitation systems.

Issues

- While an organigram chart will show the theoretical structure, it is also important to interview staff to find out whether the actual functioning of the department works along the lines of the chart; and if not, how the lines of responsibility actually work in practice.
- Does O&M form a substantial or only a minor part of the overall management of the utility or department? This will be reflected in the decision-making powers of O&M management in such matters as purchasing of spare parts and hiring of personnel.
- The extent of these decision-making powers is an important part of O&M organization and practices.

Step 4. Setting O&M objectives

Objective: to find out whether there are clear management objectives set for O&M.

Issues

- Clear objectives form the basis for determining O&M policy and for supporting O&M decisions. Although this may seem an obvious requirement, in practice they are often lacking from the O&M function.
- The objectives may be vague, e.g. "to keep the system working", instead of being clear and measurable, e.g. "the O&M budget is \$X" or "interruptions to supply are kept below Y hours in any month".

Step 5. Planning structures for O&M

Objective: to find out if there is a clear planning structure for O&M covering the three categories described below.

Issues

- *Strategic planning* is concerned with the provision of resources to ensure continuous and satisfactory performance of the systems. It includes decisions concerning construction of new systems, capacity enlargement projects and major rehabilitation projects.
- *Tactical planning* is designed to ensure effective and efficient operation by adopting the right policy. This means, for example, finding the right mix of preventive and corrective maintenance.
- *Operational planning* occurs after aggregate allocation of resources has been made. Daily operational planning assumes that there is a rational work order and job documentation system.

Step 6. Resource management

Objective: to find out the procedures that are in place for managing different resources.

Issues

- Important resources are finance, personnel, repair facilities, materials availability, information and documentation.
- Utilizing the potential of local materials and labour markets, compared with the need to import skills and materials. Long delays in replacement of spare parts mean the system's performance is very poor.

Step 7. Personnel management

Objective: to find out the extent to which personnel management skills exist and are utilized.

Issues

- Are appropriate staff hired and trained, ensuring a broad mix of skills throughout the organization?
- Are there incentives to motivate staff to perform competently?
- Are there operational skills that allow systems and equipment to function within their designed capabilities?
- Do the staff have skills for repairing and restoring the systems and equipment to their original operating condition?
- Do documentation skills exist so that all events can be adequately recorded?

Step 8. Actions and further guidance

Actions

1. Carry out the structured audit procedure for O&M management following the seven steps outlined above.
2. Prepare a report from this audit procedure which feeds back into Tool 1, in order to assess the effectiveness of the O&M management system and to develop action plans for improving the system.

Further guidance

1. See *Operation and maintenance of urban water supply and sanitation systems* (WHO, 1994) for important additional guidance on management systems.
2. Theme 2 tools provide some specific guidance on performance evaluation for O&M (see page 9).

Reference

World Health Organization. *Operation and maintenance of urban water supply and sanitation systems*. Geneva, WHO, 1994.

Tool 3: A framework for assessing the status of O&M

Guiding principle of Theme 2

The guiding principle of Theme 2 is *measuring and evaluating the effectiveness of O&M* in water supply and sanitation. A process for developing this principle is described in six steps below (see WHO 1994, Brikké 1995). The concepts apply to centralized systems and also to community- and household-managed systems which may involve intermediaries such as NGOs. However, the means of accessing information at each step may be radically different. Formal centralized systems can be investigated in a relatively objective manner, while community- and household-managed systems are likely to require participatory information gathering. These issues are considered in Tools 8 and 9. It is important to emphasize again that while the terminology used in this tool may appear to relate to centralized management, many of the principles can be applied to community- and household-managed systems through the adoption of participatory mechanisms and approaches.

Step 1. Performance evaluation

Commentary

Action plans to improve O&M must be based on a sound evaluation of the performance of different O&M functions. Performance evaluation has to answer specific questions so that those in a senior position can take action relating to O&M, whether centralized or managed by the community or householder.

Performance evaluation needs to take place against a number of clearly defined criteria or targets which have been set for the particular reporting period. The approach adopted is to define performance indicators with quantitative or qualitative values, which cover the field of O&M activity. Associated with each performance indicator is a performance target; the status, or 'performance', of O&M is then assessed by comparing each performance indicator with its respective target. This enables performance comparisons to be made, such as:

- between different time periods for a programme or organization;
- between different programmes or organizations.

These tools do not attempt to prescribe arbitrary performance targets; these must be set within the local context.

Key points / Questions

- Are action plans to improve O&M based on an evaluation of the actual performance?
- Is the evaluation based on the use of indicators and targets?

Actions

See Tool 4 for guidelines on developing a system for performance evaluation

Step 2. Performance reporting

Commentary

Performance reporting provides the essential input to performance evaluation. It not only reveals whether planned actions have achieved their objectives, but identifies common problems and allows improvements to be built into the system for the future. The development of a sound performance reporting system, along with the choice of appropriate performance indicators, are important elements in O&M management.

Key points / Questions

Investigate the existing performance reporting systems, what they are and whether they are sufficiently well developed to permit a thorough evaluation of O&M activities to be carried out.

Actions

See Tool 5 for guidance on performance reporting and the selection of different reporting tools.

Step 3. Selecting performance indicators

Commentary

Performance indicators can be defined as *variables whose purpose is to measure change in a process or function*. They provide the information from which performance reports are compiled, in order to assist in answering the questions posed by performance evaluation for O&M. Characteristics of a good performance indicator are:

- A valid link between the indicator and the question being addressed;
- The information required to define the indicator is readily available.

Information relevant to O&M can usefully be grouped as follows:

- User opinions and satisfaction
- Community management issues
- Levels of service
- Financial
- Materials
- Personnel
- Equipment
- Work order control.

Key points/Questions

When setting up performance indicators, make sure that they display the appropriate characteristic; use the above groupings as a starting-point to focus attention on the key areas.

Actions

See Tool 6 for further details on how to develop performance indicators and descriptions of the different groupings of indicators.

Step 4. Performance indicators for water supply and sanitation

Commentary

There is no fixed set of questions which can be applied to all situations; the indicators selected will be different for centralized, community- and household-managed systems. These will vary from place to place according to the local context. Once the indicators have been selected, check that they will assist in answering the important questions about O&M.

Key points / Questions

- It is essential to think about what a particular indicator is telling you; can the information be used as the basis for actions.
- Avoid collecting large amounts of data (either through objective means or using participatory techniques), which cannot subsequently be put to the intended purpose.

Actions

Select appropriate performance indicators from Tool 7.

Step 5. Defining and selecting information

Commentary

The nature and form of the information systems is crucially important for determining performance indicators and developing performance reports. We must know:

- what information needs to be collected in relation to each indicator; and
- where that information can be found.

This requires a careful review of the different performance indicators in order to see whether or not information will be readily available, and if necessary to plan for the collection of the information required.

Key points / Questions

- For centrally managed schemes, information about O&M should be available through a management information system; in many cases this will be poorly developed or non-existent.
- For community-based schemes, the key knowledge lies with the community of users and may not be recorded in a formal sense.

Actions

- Tool 8 suggests likely sources of information for the centralized institutional setting.
- Tool 9 describes the use of participatory methods for gathering information.

Step 6. Collecting the information

Commentary

This is more complex than appears at first sight as there are two distinct methods which can be employed.

- Performance indicators which can be assessed in an objective manner by collection of performance data; this could be done internally using the staff of the institution or by using external consultants.
- Data on community- and household-managed schemes and consumer perceptions of O&M; this is qualitative as well as quantitative and requires participatory assessments of performance.

In particular, information related to service levels must involve consumer satisfaction surveys as well as more objectively obtainable data on physical performance.

Key points / Questions

Distinguish clearly between indicators which require different data collection methodologies. Make sure that the overall assessment of performance includes user satisfaction surveys covering the full range of consumers (high to low income groups).

Actions

- Tool 8 suggests likely sources of information for the centralized institutional setting.
- See Tool 9 for further information on user satisfaction and participatory methods of data collection.

References

Brikké F. Personal communication, 1995, of material from *Design of a project monitoring system*, unpublished Training Notes from the Management for Development Foundation (MDF), Ede, Netherlands, 1993.

World Health Organization. *Operation and maintenance of urban water supply and sanitation systems*. Geneva, WHO, 1994.

Tool 4: Guidelines on O&M performance evaluation

This is related to Tool 3, Step 1 (*Performance evaluation*, see page 18) and involves four steps, as described below.

Step 1. Performance measurement

The most important point about measuring and evaluating performance is that the whole exercise needs to answer specific questions which are relevant to those people responsible for O&M. The outcome has to be helpful in improving performance, whether it be centralized, or community- or household-managed.

Effective evaluation of the status of O&M depends primarily on the ability to measure current performance. This can be achieved using indicators and targets for the performance of different functions.

Issues

- Define **performance indicators** having quantitative or qualitative values which cover the field of O&M activity.
- A **performance target** is associated with each performance indicator.
- The status, or 'performance', of O&M is then assessed by comparing each performance indicator with its respective target. This enables performance comparisons to be made:
 - between different time periods for a programme or organization, whether centralized or community-based;
 - between different programmes or organizations.

Step 2. Interpreting performance indicators

While this approach has the apparent advantage of simplicity, the characterization of performance in this way is obviously dependent on the number of indicators used and the quality of the data upon which they are assessed. Difficulties can arise when interpreting performance indicators; for example, it may be difficult to determine exactly which are the decisive factors in a particular situation, *and the information gathered may not offer any real guidelines for improvement.*

Performance evaluation is the outcome of interpreting a range of performance indicators in relation to their respective targets. Skill and experience are needed in this process of interpretation in order to draw appropriate conclusions. This becomes particularly crucial when dealing with qualitative information obtained through participatory information-gathering. The data tend to be very rich in detail, and it is important not to neglect findings that cannot be expressed numerically; beware of an over-obsession with numbers alone.

Issues

If the indicators do not achieve target levels it does not necessarily mean that the O&M function is below standard. Instead, this may indicate that O&M works in a difficult environment (for example, with inappropriate technology, or excessive delays for delivery of spare parts). Awareness of this point may prevent the wrong conclusions being drawn and help motivate institutionally based staff and community groups. Thus, it is crucial with formal performance-reporting systems that:

- the roles and responsibilities for O&M are clearly understood by all parties;
- the expectations of all concerned about O&M performance are realistic and that a commitment to carry out corrective action is present.

Step 3. Performance targets

The setting of appropriate performance targets is by no means straightforward. No attempt is made to prescribe arbitrary performance targets as this must be done within the local context.

Issues

- Involvement of customer/community representatives in the target-setting process for service levels.
- Acknowledgement of the time and support required to complete this process.
- Relationship of local consumer perceptions to standards which may have been arbitrarily set at regional, national or international level.

Step 4. Actions and further guidance**Actions**

1. Establish a baseline of performance using performance indicators
2. Prepare action plans which contain proposals to improve the level of performance.
3. These action plans can also feedback information into the Theme 1 'Audit of the O&M functions' (Tool 2).

Further guidance

1. See Tool 5 for guidance on performance reporting.
2. See Tools 6 and 7 for guidance on appropriate performance indicators.

Tool 5: Guidelines on O&M performance reporting

This tool is related to Tool 3, Step 2 (*Performance reporting*, see page 19) and provides additional guidance for the action points of Tool 4. Six steps are described below.

Step 1. Understanding why performance reporting is important

Performance reporting is an indispensable part of all management functions and provides the key input to performance evaluation outlined in Tool 4; this subsequently determines the nature of the action plans for improvement. Detailed performance reporting for water supply and sanitation in developing countries is comparatively rare. The following points need to be recognized.

- Evaluation of O&M performance depends on the perspective applied: accountants may perceive O&M in terms of costs, while engineers will focus on performance in terms of reliability, availability, and maintainability of equipment. User-satisfaction surveys are crucial in finding out users' perspectives on the quality of the service delivered.
- It is often difficult to distinguish clearly between operations and maintenance functions. For example, more extensive maintenance may be required because of operator faults.
- Community-based reporting will be much less formal than some of the steps outlined below; nevertheless, the principle of finding out and reporting on what is going on is an important factor in the eventual improvement of the services. (See Tool 7, Table 7.2, page 32, on *Community and household management indicators* and Tool 9, page 49, on *Participatory information-gathering*).

Step 2. What needs to be reported?

The relevant information can be classified as either an input to, or an output from, an activity or process. Clarity and transparency are equally important for centrally managed and community-managed systems.

Input reporting

- Financial reporting of expenditure against budget (this may be allocated to separate heads for staff/labour costs and materials).
- Use of materials including spares in relation to storekeeping.
- Contract monitoring of the performance of external contractors.

Output reporting

- The reporting of output is much less frequent; all too often, it is assumed that because the input has taken place, then the output must have been achieved. This is not so.
- Performance reporting of **output**, i.e. verifying what has actually happened, is therefore central to the whole concept of improving O&M.
- The performance indicators proposed in Tool 7 are primarily focused on output reporting. There are aspects of this which are necessarily subjective; in particular, it is important to realize that as a service sector we must obtain the perceptions of the users. This is addressed further in Tool 9.

Step 3. Selecting performance reporting tools

There are a number of different tools which can be used to measure performance. The focus of this work is on *performance indicators*; see Step 1 of Tool 4, and Tools 6–8.

Other techniques include:

- *Benchmarking*, in which specific measures of performance are compared with those in a different organization; the objective is to equal or improve on the benchmark. This technique is based on performance measurement through the use of performance indicators.
- *Graphics*, which can be used to convey simple messages such as the breakdown of costs between labour and materials, or can be developed into sophisticated multi-dimensional forms.
- *Elaborated methods* which are complex, and aggregate different parameters.

Step 4. A structure for performance reporting

The key element of performance reporting relates to the flow of information with respect to both *inputs* and *outputs*, described in Step 2. The relevant information needs to travel throughout the managerial structure and we need to recognize the requirements for different levels of information. The following applies to a typical centralized management structure.

Levels of management

1. *Senior management* are responsible for overall supervision and are concerned with the achievement of the objectives which the organization or scheme has set.
2. *Middle management* are responsible for operational management and are concerned with the overall performance of activities.
3. *Day-to-day administration* is concerned with the smooth running of the work being carried out and its associated information.

At this stage we are concerned with the first two levels in the structure; these are considered below. The day-to-day information provides the core data to assemble measures of performance and is considered separately in Tool 8.

Step 5. Preparing performance reports

The following system of reports for centralized management can be adopted in relation to the structure outlined in Step 4 (Brikké, 1995).

Senior supervisory	Feature: <i>Consolidated reports summarizing key performance indicators for senior management</i>
1. Periodic reports 2. Technical reports 3. Financial reports	May be quarterly, six-monthly or annual; summarize key indicators over the period in comparison with targets Qualitative reports giving overview of activities Statements of expenditure and revenue and the use of financial resources
Middle operational	Feature: <i>Develops performance indicators from day-to-day sources for middle-level management</i>
1. Periodic reports 2. Technical reports 3. Financial reports	Usually quarterly or monthly, quoting key performance indicators, comparing with previous periods (trends), and highlighting problem areas for attention Specific reports on key activities, or items of equipment (see below) Summaries of expenditure and revenue in relation to the projected budget and O&M workplans for the period

The content of these reports has to be decided locally and in the context of the management of O&M. Again, this approach is not necessarily restricted to formal institutions. For small rural schemes the whole thing is simplified and may be based on verbal reporting and communication. However, if performance is to be measured and improved, a system does need to be in place.

Where there are specific items of plant and equipment which are essential to the operation of a system, it is worth considering much closer monitoring using a few very specific performance indicators. These are linked to the production of regular *detailed reports* on the plant or equipment, and give a clear picture of the different aspects of O&M performance and their inter-relationships.

Step 6. Actions and further guidance

Actions

1. Investigate the need to develop output (as well as input) reporting within the organization.
2. Decide on an appropriate reporting structure.
3. Use performance indicators as the basis for the output performance reports.

Further guidance

- See Tools 6 and 7 for guidelines on selecting performance indicators for use in point 3 above.

References

Brikké F. Personal communication, 1995, of material from *Design of a project monitoring system*, unpublished Training Notes from the Management for Development Foundation (MDF), Ede, Netherlands, 1993.

Tool 6: Guidelines for the selection of performance indicators

This is related to Tool 3, Step 3 (*Selecting performance indicators*, see page 19) and provides additional guidance for the points under Action in Tool 5. Four steps are described below.

Step 1. General features of performance indicators

Performance indicators (PI) can be defined as *variables whose purpose is to measure change in a process or function*. They provide the information which assists in answering the questions posed by performance evaluation for O&M. The following points are important.

Features of performance indicators

- *Purpose*. PIs should be matched to the objectives of O&M and their role in achieving those objectives needs to be clear.
- *Visibility*. Each PI should be relevant and transparent in order to provide the required insight.
- *Definition*. Defining a performance indicator is a time-consuming process in which PIs are suggested, critically analysed and redefined until a consensus is reached on their value. All persons involved in the use, analysis and targeting of O&M should contribute to this process.
- *Control power*. PIs should be used to report on the performance of O&M which is under the control of the user, i.e. on the process that he or she, either alone or collectively, can influence.
- *Computation*. The method of computation and data collection must be carefully defined for each PI. The method must allow for validation of input data.
- *Consistency*. PIs must remain consistent over time and in the face of other variations, e.g. in exchange rates, inflation or interest rates.
- *Comparability*. Careful consideration must be given to comparison of PIs between organizations because of differences in circumstances and/or targets.
- *Aggregation*. The use of a single aggregated PI to evaluate overall efficiency should be avoided, since the ratios used in aggregation may obscure valuable information.
- *Data integrity*. The integrity of the data and their timeliness are essential, as PIs aggregate large quantities of information. Cross-checks should be built in, where possible.

Step 2. Check what the performance indicator will tell you

When choosing performance indicators for O&M, the following factors need to be taken into account for a performance indicator PI(x) which is intended to measure the performance of X.

Evaluating Pis

- Is X an area which falls under the control of O&M management?
- Will the PI(x) measure what is needed?
- Will problems in area X be detected by the use of PI(x)?
- Does PI(x) give an idea of the magnitude of the problem?
- Are data available to compute PI(x)?
- Is PI(x) accepted by the people involved?
- Are there any other indicators that can help identify the cause of the problem?
- Who, besides O&M staff, will use PI(x)?

Step 3. Suggested grouping of performance indicators

Developing performance indicators can consume a lot of resources; the following broad classification can assist in focusing attention on the key areas.

1. User opinion and satisfaction

- The opinions of the users of services and their level of satisfaction provide essential information about the operation of that service. This is central to the whole concept of evaluating the performance of a service, whether it be managed centrally or by the local community or the household.
- It is important to include the views of the urban poor and rural people, as well as those in middle- and high-income areas of cities.

2. Community management

- Community-managed schemes exhibit significantly different characteristics from those that are centrally managed. Willingness and the capacity to undertake O&M works are very important, in addition to more standard indicators which reflect the actual performance of different functions and activities.
- Participatory information-gathering is central to evaluating performance.

3. Financial

- Knowledge of the direct and indirect costs incurred in carrying out O&M is essential; this includes revenues received both directly from consumers and from transfer payments by government.
- Poor households may have to pay more in order to access operational water and sanitation services than better-off consumers with formal connections.
- Poor revenue collection from customers may contribute to poor performance.

4. Level of service

- Levels of service reflect the consumers' access to services in respect of reliability, availability, quality, quantity, cost and value for money.
- O&M practices contribute significantly to the satisfactory performance of the service.

5. Materials

- The proper functioning of O&M depends to a large extent on the availability of the appropriate materials and parts in the right place at the right time.

6. Personnel

- Human resource development is crucial to both centralized and community-managed systems.
- While training is an important measure, it may be difficult to assess relevance and quality as opposed to quantity.
- If different skill groups are represented within the personnel structure, it may be preferable to calculate performance for the whole staff complement and the different skill groupings.

7. Equipment

- The availability and reliability of equipment is an integral part of the O&M management function. This includes treatment plants, pumping systems, distribution networks and maintenance vehicles.

8. Work control

- Work control allows the use of O&M resources to be effectively planned and applied.
- Good use of operating cost indicators measures the effort spent on specific categories of maintenance work. This enables a large portion of O&M work to be planned in advance.

Step 4. Actions and further guidance**Actions**

Carefully review the suggested performance indicator groupings and think about what are the particular areas which require focus in any given situation before selecting specific indicators.

Further guidance

- See Tool 7 for suggested performance indicators in each grouping.

Tool 7: Performance indicators for water supply and sanitation

This tool presents a list of performance indicators which can be applied to the operation and maintenance of water supply and sanitation systems using the broad groupings described in Tool 6, Step 3 (see page 27). The purpose of this listing is to give the user a set of indicators from which those most appropriate to the local situation can be selected. It is not intended to be comprehensive, nor will it be appropriate for the user to try to calculate the value of all the indicators. Guided by the ideas and concepts from some of the indicators, the user should be able to develop alternative new indicators to suit the local circumstances.

Eight groups of indicators are presented in separate Tables, each one followed by explanatory notes. They present the following information:

- title of the indicator;
- data/information required to calculate the indicator's value;
- simple formula for calculating the value of the indicator (where appropriate, some indicators make use of qualitative rather than quantitative information); and
- suggestions on situations for applying the indicator.

Potential applications of the indicators for both rural and urban water supply and sanitation have been classified according to the three basic management systems, as described in the Introduction and repeated below.

Management system	Examples
<p>Centrally managed</p> <ul style="list-style-type: none"> • Private service connections to individual plots which require supporting external infrastructure 	<ul style="list-style-type: none"> • Piped water supply • Sewerage
<p>Community-managed</p> <ul style="list-style-type: none"> • Non-private facilities which are shared by members of a community or user groups; depending on the technology adopted, these may or may not require supporting external infrastructure 	<p><i>With external support infrastructure:</i></p> <ul style="list-style-type: none"> • Piped water to public standposts • Sewered communal or shared latrines <p><i>Without external support infrastructure:</i></p> <ul style="list-style-type: none"> • Communal handpumps or wells • Communal latrines linked to pits or septic tanks
<p>Household-managed</p> <ul style="list-style-type: none"> • Private on-plot services which do not require supporting external infrastructure 	<ul style="list-style-type: none"> • On-plot wells, handpumps • Latrines linked to on-plot pits or septic tanks

TABLE 7.1 INDICATORS FOR ASSESSING USERS' OPINIONS AND SATISFACTION

Indicator	Components or data	Formula	Application
1 User satisfaction	<ul style="list-style-type: none"> • User satisfaction surveys for water and sanitation 	% of interviewees satisfied with service operation, classified by degree of satisfaction	All
2 Five main O&M problems	<ul style="list-style-type: none"> • User satisfaction surveys for water and sanitation 	% of interviewees identifying each of the five most frequently listed problems for both water supply and sanitation	All
3 Roles and responsibilities	<ul style="list-style-type: none"> • Who is perceived by the users to be responsible for O&M of water and sanitation services? • Who actually carries out O&M work? 	See note 3 and note 1	All
4 Care and use of facilities	<ul style="list-style-type: none"> • Evidence of facilities being used and looked after 	See note 4	All
5 Approaching formal institutions and outcome	<ul style="list-style-type: none"> • Number of times formal institutions are approached for assistance in a given period • Number of successful outcomes 	Number of successful outcomes divided by the number of approaches during the period	Centralized
6 Complaints dealt with	<ul style="list-style-type: none"> • Number of actions dealing with complaints in a given period • Number of complaints logged in a given period 	Number of actions dealing with complaints in a given period divided by the number of complaints logged in that period	Centralized

Notes on Table 7.1 (Users' opinions and satisfaction indicators)

The opinions of the users of services and their level of satisfaction provide essential information about the operation of that service. These indicators are central to the whole concept of evaluating the performance of a service, whether it be managed centrally or by the local community; nevertheless, there has been surprising reluctance to find out and act on users' perceptions. It is important to include the views of the urban poor and rural people, as well as those in middle- and high-income areas of cities. There are a number of important indicators in several of the following Tables which make use of the user satisfaction survey.

1. User satisfaction surveys are fundamental (see Tool 9 on participatory information-gathering). In addition to qualitative classification, for example into "very satisfied", "satisfied"... "poor", etc., it is possible to explore in detail particular aspects of the service which the users find to be lacking. This approach is essential in rural and peri-urban areas, where there is much less access to any formal complaints system. In addition, valuable information can be gathered from middle- and high-income consumers.
2. It is important to maximize the information obtained from user satisfaction surveys through a problem analysis which identifies key areas for action. Tool 9 suggests some lines of enquiry to establish key O&M problems as perceived by the users. See Cotton & Saywell (1998) for details of users' perceptions in urban sanitation.
3. This is an important issue for both centrally managed and community-managed systems.
 - Institutional responsibilities are often very complex, which contributes to making the complaints procedures long and frustrating. It is therefore very informative to elicit views about where responsibility lies in the eyes of the users. For example, a common response in many cases is that 'the government' is responsible, with no clear picture of the different institutions of 'government'.

- In systems which have tried to establish user involvement in O&M, it is important to establish whether such approaches are understood and are operational in the eyes of the users, or whether they remain theoretical ideas which have not been effectively implemented.
 - For example, in a VLOM system, a functioning water committee should exist for each community water supply. Use participatory approaches to explore whether caretakers have been identified and how effective they are in the view of the users. This gives a primary indication of whether or not the system is working according to its original concept. Similar indicators can be applied to the different levels of the VLOM system; for example, there might be an 'area mechanic' responsible for a number of water supplies. Other performance indicators, e.g. *Functioning supply points* and *Reliability* can be used to point to the effectiveness of the personnel involved.
4. One of the key user-related issues for O&M is to engender a sense of care and ownership, regardless of whether management is by the household, the community or a central institution. It is common to look for evidence of misuse, e.g. broken standposts. However, it is important to complement assessments of the physical facilities by exploring why this is the case (see Tool 9 on participatory information-gathering). There may be evidence of latrines not being used, such as excreta in open drains or on the ground, or being used for other purposes such as storage sheds. This raises fundamental issues about the use and appropriateness of sanitation systems whose implications are much wider than O&M. This is where participatory methods which explore the underlying reasons are particularly useful and powerful.
 5. This indicates how responsive the institutions are from the point of view of the user. Note that it is common for representations to be made by intermediaries such as NGOs and local action groups, and also through the local elected political representatives.
 6. A system of receiving and acting upon complaints is an essential part of consumer services; utilities, line agencies and municipalities all require a system for receiving and logging complaints. These systems may exist without being well publicized, and are hence little known to the consumers. For example, whether to complain in writing, or by telephone, or by paying a personal visit to an office. If so, where is the office and what are its opening times? Complaints may be received by locally elected representatives, who keep a formal complaints register. Local community-based management also requires mechanisms for reporting problems; these are much more likely to be verbal and informal. Having received and logged a complaint, the key point is that remedial action is taken. This can be checked by having a simple book-keeping system which allows the action to be recorded against the complaint. The register needs to be subject to external audit on a regular basis.

Note: Indicators 5 and 6 apply to both water supply and sanitation.

TABLE 7.2 COMMUNITY AND HOUSEHOLD MANAGEMENT INDICATORS

Indicator	Components or data	Formula	Application
1 Direct work	• Number and description of O&M activities carried out over a given period by community members	Number of activities divided by the duration of the period	Community Household
2 Managed work	• Number and description of O&M activities carried out over a given period by engaging third parties	Number of activities divided by the duration of the period	Community Household
3 Financial expenditure	• Total amount spent on operation and repairs carried out both by direct working and by engaging a third party over a given period	Total amount divided by the duration of the period	Community Household
4 Labour expenditure	• Total unpaid skilled and unskilled labour days committed to operation and repairs over a given period	Number of days in each category divided by the duration of the period	Community Household
5 Problems resolved by internal actions	• Number and description of problems resolved by the people themselves over a given period	Number of problems resolved divided by the duration of the period	Community Household

Notes on Table 7.2 (Community and household management indicators)

Issues relating to household- and community-managed systems for water supply and sanitation are, in general, explored using participatory information-gathering; while important quantitative data can be used to calculate performance indicators, it is important to remember that there are likely to be qualitative data which give a great deal of insight into what is happening and why. This is very important in developing action plans with user groups and households.

1. This indicates the willingness and capacity of the community to undertake the work and, conversely, the extent to which formal institutions are absent.
2. The distinction here relates to the capacity of the community to manage the service rather than just do the work itself. The key point about indicators 1 and 2 is not just that the people are actually doing or managing matters related to O&M, but that the awareness of the need to care for facilities exists among the users.
3. The financial expenditure indicates the extent and commitment of the users. Note that if this indicator increases regularly, it may also point to major operating deficiencies in the system which need to be rectified.
4. This is interpreted in a similar way to indicator 3, but only with contributions made through provision of labour rather than cash. A mixture of these approaches may be adopted; for example, skilled artisans may be contracted in, with the user groups providing unskilled labour.
5. It is essential to explore with the users and user groups what problems they have resolved; this uncovers deeper explanations of why the facilities are functioning satisfactorily and leads to a greater understanding of awareness of O&M issues, care of facilities, and local capacity for action.

TABLE 7.3 FINANCIAL INDICATORS

Indicator	Components or data	Formula	Application
1 Revenue collection efficiency	<ul style="list-style-type: none"> • Total amount billed for water or sewerage • Total collected (= total tariff revenue) 	Total collected divided by total billed	Centralized Community-managed
2 Billing efficiency	<ul style="list-style-type: none"> • Total number billed for water or sewerage • Total number of known water and sewerage connections required to pay charges 	Total billed divided by the number of connections required to pay	Centralized Community-managed
3 Informal water cost	<ul style="list-style-type: none"> • Amount paid to water vendors (including other households) for a standard volume of water in a locality 	Average amount paid to vendors divided by the local household tariff rate for an equal volume	Household
4 Informal sanitation cost	<ul style="list-style-type: none"> • Amount paid for use of a public or private latrine 	Average amount paid annually per household	Household
5 Operating costs per connection	<ul style="list-style-type: none"> • Total O&M cost for water or sewerage • Number of connections (includes individual and communal) 	O&M cost divided by the number of connections	Centralized Community-managed
6 Revenue per connection	<ul style="list-style-type: none"> • Total tariff revenue for water or sewerage • Number of connections (includes individual and communal) 	Tariff revenue divided by the number of connections	Centralized Community-managed
7 Cost-recovery ratio	<ul style="list-style-type: none"> • Total O&M costs for water or sewerage • Total tariff revenue • Total miscellaneous and subsidy income 	Total tariff revenue plus subsidies and miscellaneous income divided by the total O&M cost	Centralized Community-managed

Notes on Table 7.3 (Financial indicators)

There are many different financial indicators available, and it has been necessary to restrict the listing to those which are likely to be measurable in the context of government bodies whose accounting systems are not geared up to management accounting. In general, financial balance sheets are not available for most rural water supplies, and accessing the necessary information can be difficult. In both urban and rural water supply and sanitation, lack of finance and poor cost recovery are major problems. It is important to realize that in addition to financial costs, there are wider economic implications for the poor, e.g. relating to the amount of time required to access basic services.

1. In urban water and sewerage systems, the efficiency of revenue collection is one of the most important indicators; many organizations simply do not collect the user charges from those to whom they send bills. Improving this indicator is one of the highest priorities for increasing revenue.
2. There are usually many unregistered connections for water and sewerage; the revenue net can be widened by checking up on properties which are identified under the land registration system but are not registered with the water/sewerage agency.
3. Users in peri-urban areas which are poorly served by the trunk supply may obtain drinking-water from informal water vendors (they include households with their own connection); the rates may be much higher than the prevailing tariff charged by the utility.
4. Where there are no household latrines, family members may pay to use either a pub-

lic toilet or, in some cases, the toilet of a neighbour. Both indicators 3 and 4 are extremely important as they concern operational payments by poor households; this, in turn, indicates willingness to pay for the service and identifies opportunities for formal services to be extended to the poor.

5. A major problem in defining an operating cost indicator is that the recorded O&M expenditure does not necessarily reflect the expenditure required to operate and maintain the system; the result is a spiralling deterioration of the assets. The problem with the centralized approach is that a budgetary allocation may be made for each household or each community based on the expected income from user charges and subsidies; in other words, while 'the books balance', the actual demand for O&M is not met. Asset registers and infrastructure condition surveys are required to determine O&M requirements; until this is done, it may not be appropriate to plan for this indicator to reduce in value.
6. In centralized urban and possibly some rural schemes, there are two common ways of collecting revenue. First, through a direct water tariff; secondly, through an indirect form of municipal taxation, e.g. where property tax payments may contain an item of charges for water supply and sewerage. A community-managed system may or may not pay the village caretakers, but a maintenance fund will normally be required in order to purchase spare parts, and the contributions in cash or in kind can be explored with the users.
7. Comments on the difficulties of extracting information on levels of subsidy in order to calculate meaningful financial indicators for O&M performance have been made by WASH (1992).

TABLE 7.4 LEVELS OF SERVICE INDICATORS

Indicator	Components or data	Formula	Application
1 Access to functioning water supply points/latrines/septic tanks	<ul style="list-style-type: none"> • Number that are functioning • Total number in a defined locality 	Number functioning divided by the total number in the locality	All
2 Cleanliness of public/shared facilities	<ul style="list-style-type: none"> • User satisfaction survey for communal water supply and sanitation facilities 	% interviewees satisfied with the operation, classified by the degree of satisfaction	Centralized Community-managed
3 Reliability	<ul style="list-style-type: none"> • Functioning time: the number of days in a month or year when the water supply and sanitation service is functioning 	Functioning time during a particular period divided by the duration of that period	All
4 Piped water supply continuity	<ul style="list-style-type: none"> • Average number of hours per day of supply to a locality over a given period (e.g. number of days) 	Average number of hours of supply per day divided by 24	Centralized Community-managed
5 Water quality	<ul style="list-style-type: none"> • Bacteriological water quality survey for <i>E. coli</i> at the supply points in a defined locality. • Number of supply points at which the <i>E. coli</i> count is greater than the target value set for the locality 	Number of supply points at which <i>E. coli</i> samples are greater than the target value divided by the total number of supply points for which samples are taken	All
6 Flow rating	<ul style="list-style-type: none"> • Discharge as measured from the tap/pump • Design discharge: either discharge as measured after commissioning the scheme, or theoretical discharge used in the scheme design 	Actual discharge from tap or hand-pump divided by the design discharge	All

Notes on Table 7.4 (Levels of service indicators)

Levels of service are of great importance to users; they relate the perceived benefits of the level of service they receive to the cost they have to pay. An overall picture needs to be built up both from objective assessments of performance and from the opinions of users.

1. Access to an adequate service is a key objective of water and sanitation provision. Participatory information-gathering can identify communal services such as standposts, handpumps and communal latrines which are not working. Household interviews can explore the functioning of individual septic tanks and latrines and service connections. As well as being direct indicators of the O&M status, these also point to the actual benefits which the service provides because they relate to the proportion of the population utilizing the systems.
2. One of the major problems with communal facilities is that they tend not to be clean. This is particularly important for sanitation, as nobody wants to use dirty latrines. Cleaning is probably the single most important aspect of operation.
3. Unreliability is the most serious concern for users, e.g. breakdowns leading to lack of water or sanitation. For handpump water supplies or on-plot latrines, this is a relatively straightforward indicator as the problem causing malfunction can usually be readily identified. However, for piped systems there are many different components within the system which may cause failure of water to come out of a tap. Different components will have different reliability; the indicator can be applied to individual components of more complex systems. This enables 'weak points' to be highlighted (see Table 7.7, indicators 1 and 2). The reliability indicator may also point to problems with the system of reporting, diagnosing and repairing faults.
4. A characteristic of many water supplies is that they are discontinuous, with water being delivered to the taps for only a few hours each day. This affects both urban and rural supplies and is particularly acute in the dry season. Information needs to be gathered from users and from bulk supply records which may be available centrally. The problem which arises is how to compute the average number of hours per day of water supplied; ideally, it should be an annual average using data from each day of the year in the different supply zones to account for weekly, monthly and seasonal variations in supply and consumption. Efforts should be made to obtain a value for at least each month of the year. A high value of the indicator implies good continuity of supply.
5. While water quality surveillance can indicate O&M problems, the diagnosis of cause and effect within treatment and distribution systems is difficult. WHO (1983) suggests that "it is not unusual that a protected spring without chlorination contains 5–10 *E.coli* per 100 ml, and in an unprotected spring the number might exceed 100." The target number of *E.coli* per 100 ml has to be set locally, taking account of local water quality standards and objectives. Note that this does not indicate the quality of water consumed within the home, which is really what is important.
6. The discharge from a sample of handpumps and/or taps can be measured by counting how many strokes of the pump it takes to fill a bucket of known volume. This can then be compared with the recommended handpump ratings (Arlosoroff et al., 1987). For piped systems, the values obtained should be compared with measurements taken immediately after the system has been commissioned, if available. Otherwise design flow could be used. However, errors in hydraulic design do occur and a standpost may never be capable of delivering its anticipated design flow. Low discharges may indicate leaks or breakages in the pipelines, and incorrect valve settings. Pressure measurements at taps using a simple Bourdon pressure gauge can also be used to identify a problem.

TABLE 7.5 MATERIALS INDICATORS

Indicator	Components or data	Formula	Application
1 Outstanding repairs	<ul style="list-style-type: none"> Number of outstanding repairs due to lack of spare parts 	Number of repairs not carried out due to lack of spare parts at any given point in time	All
2 Location of spares	<ul style="list-style-type: none"> Survey of users' satisfaction and opinions 	Travel time and/or distance to the nearest place to buy supplies for latrines, taps, sand, cement, etc.	Community-managed Household-managed
3 Accessibility	<ul style="list-style-type: none"> Date on which the need for a spare part is identified Date of arrival of the spare part at the place where it is required 	Time elapsed between identifying the need for the spare and the arrival of the spare where it is required	Centralized Community-managed
4 Spare parts use	<ul style="list-style-type: none"> Number of spare parts requisitioned for a particular scheme over a particular period 	Number of spare parts requisitioned for a particular scheme divided by the duration of the period	Centralized Community-managed
5 Delivery time	<ul style="list-style-type: none"> Date on which an order is placed with a supplier Date of receipt of the order 	Time elapsed between placing an order with a supplier and receipt of the order	Centralized

Notes on Table 7.5 (Materials indicators)

The purchase, delivery and storage of materials are an integral part of the O&M management system, whether community-managed or centralized, and should be subject to performance checks.

1. The number of repairs outstanding reflects overall problems with obtaining spare parts. Further analysis using delivery time indicators (see note 5, below) may help identify possible causes of the problems in centralized systems; user opinions and satisfaction surveys are important tools in identifying problems for household- and community-managed systems.
2. When establishing community-managed systems, or programmes which focus on household-level facilities such as on-plot sanitation, it is important to identify the suppliers of the most commonly used materials and parts (see note 3).
3. The accessibility indicator reflects the time taken for spares to arrive on site in the right place. In a VLOM system the process might involve the trained caretaker diagnosing the need for a spare, travelling to the nearest supplier and returning with the required part; this may require more than one journey if the parts are out of stock. Problems in supplying centrally managed systems may need to be explored with the suppliers as well as the institution concerned; for example, a supplier may have had problems in getting paid.
4. If very few spare parts are used, this suggests that O&M is not being carried out to the required extent. For example, Arlosoroff et al. (1987) report that, for handpump systems, the average period between actions necessary to repair breakdowns or correct poor performance is six months. If, for example, a handpump scheme had requisitioned no spare parts in five years, it might reasonably be assumed that it was not fully functional.
5. The delivery time for spare parts is a distinctly different indicator from the number of outstanding orders in that it measures the effectiveness of the materials supply chain to the stores, including the ordering procedure.

TABLE 7.6 PERSONNEL INDICATORS

Indicator	Components or data	Formula	Application
1 Maintenance team indicator	<ul style="list-style-type: none"> • Number of maintenance team vehicles on the road in a particular week • Total number of vehicles in the fleet 	Number of vehicles on the road divided by the total number of vehicles in the fleet	Centralized
2 Training (community-based)	<ul style="list-style-type: none"> • Number of people trained in a particular community disaggregated by skill and gender • Number of water supply points/latrines in that community 	Number of people trained in a particular community divided by the number of supply points/latrines	Community-managed Household-managed
3 Training (centralized)	<ul style="list-style-type: none"> • Number of days spent on training per year 	Number of days spent on training divided by 365	Centralized
4 Idle time	<ul style="list-style-type: none"> • Number of days of idle time per month • Number of days worked in a particular month 	Number of days of idle time divided by the number of days worked in a particular month	Centralized
5 Overtime	<ul style="list-style-type: none"> • Number of days overtime worked per month • Number of days worked in a particular month 	Number of days of overtime divided by the number of days worked in a particular month	Centralized

Notes on Table 7.6 (Personnel indicators)

It is relatively straightforward to develop quantitative indicators in relation to personnel and training; the problem is that they do not necessarily reflect either relevance or quality. As part of programme development, the issue of human resource development should be analysed in detail.

1. If there are centralized mobile maintenance teams, an obvious prerequisite is that they are mobile. The percentage of vehicles on the road gives an indication of the potential effectiveness of mobile maintenance teams and is particularly important for rural water supplies. This indicator can also reflect fundamental problems, such as lack of fuel. MTBF and MTBR (see Table 7.7, indicators 1 and 2) are also useful in measuring the performance of vehicle repairs and maintenance.
2. Training is an essential component of programmes which are developing community-based approaches. For example, in community-managed water supply systems in rural areas (VLOM), the different categories of people who require training include local caretakers, operators, and area mechanics. There is evidence that women make very effective caretakers (Arlosoroff et al., 1987) and it is suggested that the VLOM training indicator be evaluated by gender (PROWESS, 1990). In urban areas, there is more opportunity for community-managed systems to contract in skilled artisans, and the same level of skills training may not be necessary unless it is part of an overall skills-upgrading programme.
3. The effectiveness of staff within a centralized system depends upon the level of skill and training.
4. While 'shortage of staff' is often quoted anecdotally as a reason for poor O&M performance, it may be that the deployment of existing staff is inefficient. Ashford & Miller (1979) commented that pump operators in Botswana "would be underemployed, in that for long periods each day they would be doing nothing except watching an engine run."
5. If there are different skill groups employed by centralized systems, e.g. mechanics and electricians, it may be useful to compute indicators for the whole staff as well as for each of the skill groups. As an illustration, the workload may turn out to be acceptable when averaged over the whole staff; however, this may be the averaged result of, say, an understaffed crew of mechanics and an overstaffed crew of electricians.

TABLE 7.7 PARTS AND EQUIPMENT INDICATORS

Indicator	Components or data	Formula	Application
1 Mean time to repair (MTTR)	<ul style="list-style-type: none"> • Number of repairs undertaken in a given period • Total time spent on repairs in that period 	Total time spent on repairs divided by the number of repairs in the given period	All
2 Mean time before failure (MTBF)	<ul style="list-style-type: none"> • Number of equipment breakdowns in a system in a given period 	Duration of the period divided by the number of failures in that period	All
3 Leakage repair rate	<ul style="list-style-type: none"> • Number of leakages repaired in a given period 	Number of leakages repaired divided by the duration of the period	Centralized
4 Unaccounted-for water	<ul style="list-style-type: none"> • Total annual production of water • Total annual metered consumption • Non-metered water consumption 	Total annual production minus the total annual metered consumption minus the estimated annual non-metered consumption	Centralized

Notes on Table 7.7 (Parts and equipment indicators)

Implementing rapid and effective repairs to system components and equipment is an integral part of the O&M management system, whether community-managed or centralized.

1. The mean time to repair (MTTR) gives an indication of how long it takes to carry out a maintenance job and reflects the reliability of the system. A low MTTR points to systems which are easy to maintain and to efficiently organized maintenance work. The MTTR measures the 'maintainability' of a system. It also reflects the efficiency of the work control system (see Table 7.8).
2. Another common measure of the reliability of a mechanical system is the mean time before failure (MTBF). This is the length of time the system can be expected to operate before some maintenance input is required, e.g. to rectify a problem which may cause the system to break down. The higher this MTBF, the less frequently will breakdowns occur and the better the performance. A low MTBF may point to bad maintenance or to poor equipment condition due to excessive wear. Both MTBF and MTTR can be most usefully applied to particular items of equipment such as vehicles and handpumps.
3. The leakage repair rate is relatively easy to measure compared with unaccounted-for water, and is an important indicator in the early stages of efforts to improve water distribution systems.
4. Unaccounted-for water is difficult to assess accurately, and will normally require a detailed survey of the distribution system. Estimating the unmetered demand is particularly difficult (see WHO, 1994).

TABLE 7.8 WORK CONTROL INDICATORS

Indicator	Components or data	Formula	Application
1 Work control indicator	• Number of outstanding or unfinished jobs (the backlog)	Number of outstanding or unfinished jobs at any point in time	Centralized
2 Workload	• Number of jobs carried out, classified by type, over a particular period	Number of jobs carried out in each classification divided by the duration of the period	Centralized

Notes on Table 7.8 (Work control indicators)

Effective control of work is essential to avoid unnecessary delays in responding to breakdowns.

1. As well as highlighting current difficulties, the backlog provides advance warning of problems with future workload; continual high levels of backlog indicate problems in the system, which needs to be reviewed and improved. This indicator could be refined by considering different categories of work. Poor performance in general may also point to factors which are more far-reaching. For example, in centralized systems, inadequate vehicle maintenance is often a serious problem; in VLOM systems, the key personnel have to be equipped with appropriate tools which are in working order. The number of visits to a site which are required to effect a repair is likely to be a function of the skill and competence of the workers. Incorrect problem diagnosis can waste a lot of time, particularly with centralized systems dealing with widely dispersed water supplies.
2. For the workload indicator it is best to classify the work by type, e.g. involving handpumps, standposts, latrines, pipelines, fittings, other equipment, vehicles, and buildings.

References

- Arlosoroff S, Tschannerl G, Grey D, Journey W, Karp A, Langeneffer O, Roche R. *Community water supply—the handpump option*. Washington DC, World Bank, 1987.
- Ashford R, Miller J. *Needs to improve District Councils' capacity to maintain and operate village water supplies*. SIDA Report for Ministry of Local Government and Lands, Botswana, 1979.
- Cotton AP, Saywell DL. *On plot sanitation in urban low-income communities*. Loughborough (UK), WEDC for DFID, 1998.
- PROWESS (Promotion of the Role of Women in Water and Environmental Sanitation). *Participatory evaluation*. Geneva, UNDP/WHO/World Bank/UNICEF, 1990.
- Water and Sanitation for Health (WASH). *Performance indicators for selected water supply and sanitation utilities in Ecuador*. Arlington (USA), WASH, 1992 (Field Report 376).
- World Health Organization. *Minimum evaluation procedure*. Geneva, 1983 (unpublished WHO document ETS/83.1 CDR/OPR/83.1).
- World Health Organization. *Leakage control: source material for a training package*. Geneva, WHO, 1994.

Tool 8: Potential information sources

This tool is related to Tool 3, Step 5 (*Defining and selecting information*, page 20) and Step 6 (*Collecting the information*, page 20); it also provides additional guidance for accessing the information required to calculate the performance indicators of Tool 7. The success of the whole process of performance evaluation depends fundamentally on the quality and quantity of basic information which is available. This information provides the building blocks from which performance indicators and performance reports are created.

Tool 8 is concerned with obtaining information for use with performance indicators which can be assessed in an objective manner by collection of performance data. This could be done internally using the staff of the institution or by using external consultants. It is mainly applicable to centrally managed schemes, but there is also likely to be some information relevant to community- and household-managed schemes which can be obtained in this way.

Step 1. Information systems

A crucial issue for institutions involved with centralized O&M is whether a formal management information system exists or not. This is an important asset to O&M management which can help to transform the management process. The relevant actions are as follows.

What to look for

- Explore the existing financial reporting and information systems.
- Explore the existing work order reporting and information systems.
- Look for technical information and documentation in relation to plant and equipment (e.g. equipment parts, interchangeability of spares, sequences of (dis)assembly, and history of equipment failure).

Computerized maintenance information systems may provide a good opportunity to improve the situation in the future.

As indicated previously, in the case of community managed O&M, much of the necessary information resides in the community (see Tool 9).

Step 2. Accessing information

Assuming, at least initially, that the required information is unlikely to exist conveniently in one place, one must now investigate where different sources of information are likely to be found. Given below are the essential information sources which should exist in most organizations. Nevertheless, the information may not be in a form which is easy to use; while it is the function of the management information system to abstract and process the basic data into a form which is more readily usable, in many situations there is no alternative but to go directly to the primary sources of information described below. The

problem is that summaries are not necessarily prepared as a routine matter, and it may be necessary to go through daily records and logs to assemble the information.

Day-to-day information sources	Feature: These are the key sources of information from which management information systems can be developed to provide aggregated and summarized data for calculating performance indicators and higher level reports.
1. Book-keeping system	Contains information on cash flow, revenue and expenditure. Reconciling information is made difficult because different books are used, and in the public sector the use of double-entry systems is limited. The auditing of accounts may be several years behind. Abstracting the relevant data is difficult and time-consuming.
2. Work logbooks	Details of manpower and materials used; these may be kept by individual supervisors/engineers and it may be necessary to cross-check different books to obtain all the information about a specific job.
3. Stock register	Contains inventory of current stock, purchases and amounts used (it may not be easy to relate this to specific jobs).
4. Contract files	These are key documents which relate to specific jobs and contain details of cost estimates, approvals, work authorised, work carried out, completion cost, and payments to external contractors.

Step 3. Actions and further guidance

Actions

1. Find out if the necessary information is available in summary form or through a management information system.
2. If not, there is no alternative but to search through the day-to-day records described in Step 2 in order to abstract and consolidate the necessary details.

Further guidance

See Tool 7 for specific information requirements associated with each performance indicator.

Tool 9: Participatory information-gathering

This tool is related to Tool 3, Step 5 (*Defining and selecting information*, page 20) and Step 6 (*Collecting the information*, page 20); it also provides additional guidance for accessing the information required to calculate the performance indicators of Tool 7, particularly in relation to indicators for *User perceptions* and *Community and household management* (Tables 7.1 and 7.2, pages 30 and 32).

Users can tell you about the service

In any performance measurement system for services such as water supply and sanitation provision, it is essential to obtain the views of the users of the service. The importance of consumer perceptions is clearly understood by both commercial and industrial sectors of the economy, but users' perceptions about water and sanitation services are frequently neglected.

So how do the users perceive the operating performance of the service? An important feature of this is the need to be *inclusive*, i.e. to include the views of the urban poor and rural people as well as those from the middle- and high-income areas of cities. This means that a review of customer complaints is unlikely to be sufficient, and we must look more deeply and use participatory techniques to elicit the views of the poor who rarely have access to the formal channels through which complaints are made. In the rural areas, this approach is essential in order to understand the roles and responsibilities for O&M.

Participatory approaches

The methodologies used for collecting information clearly depend upon the local setting. It is possible that participation has been developed by other programmes and that community groups have already been exposed to participatory information-gathering, in which case it should be relatively easy to adopt a similar approach to issues of O&M in the water and sanitation sector.

There is a place for both quantitative and qualitative data in assessing the status of O&M. Quantitative methods expose 'what' and 'how much', whereas qualitative methods have explanatory value and answer the question 'why'. This is one of the great strengths of participatory methods. Finding out whether something is working or not may be insufficient to plan effective remedial actions; we need to know and understand *why* there are problems to make sure that the root causes can be addressed, rather than just the effects.

Table 9.1 reviews some techniques which employ varying degrees of participation.

TABLE 9.1 SOME PARTICIPATORY METHODS

Method	Advantages	Disadvantages	Alternatives/Keep in mind
Public meetings	<ul style="list-style-type: none"> The audience will contain many different interests, with different levels of understanding and sympathy 	<ul style="list-style-type: none"> It is difficult to keep to a fixed agenda Only a few people get a chance to have a say 	<ul style="list-style-type: none"> Identify and meet key interests informally Run workshop sessions for different interest groups Bring people together after the workshop sessions in a report-back seminar
Formal survey	<ul style="list-style-type: none"> Questionnaires, studies and in-depth discussion groups can be a good way to start the participation process 	<ul style="list-style-type: none"> Surveys are insufficient on their own 	<ul style="list-style-type: none"> Surveys require expert design and piloting Surveyors need training Survey design can be part of a process which leads to action
Consultative committee	<ul style="list-style-type: none"> Some focus for decision-making will be necessary in anything beyond a simple consultation process 	<ul style="list-style-type: none"> Even if a committee is elected or drawn from key interest groups, it may not be a channel for reaching most people People invited to join a committee may feel uncomfortable about being seen as representatives 	<ul style="list-style-type: none"> The committee can help to plan the participation process Surveys, workshops and informal meetings can identify other people who may become actively involved A range of groups working on different issues
Working through NGOs/CBOs	<ul style="list-style-type: none"> Voluntary bodies such as NGOs and CBOs are a major route to communities of interest and may have people and resources to contribute to the participation process They have a wealth of experience and are essential allies 	<ul style="list-style-type: none"> Voluntary bodies are not "the community" 	<ul style="list-style-type: none"> There will be many small community groups who are not part of the more formalized voluntary sector Voluntary groups have their own agendas; they are not neutral
Participatory rapid appraisal (PRA)	<ul style="list-style-type: none"> If done well, the work belongs to the local people 	<ul style="list-style-type: none"> Care needs to be exercised in choosing appropriate tools 	<ul style="list-style-type: none"> A range of tools are available (see the following section)

Participatory rapid appraisal (PRA)

Time and resource constraints often do not permit extensive social research to be carried out. Instead, the techniques of participatory rapid appraisal (PRA) can be used. An important feature of using participatory methods is that local people are directly involved in the processes of data-gathering and analysis. The findings belong to them rather than to the outsiders (always assuming that the PRA work is well done). This gives a wider context to PRA, in that it contributes to a shared learning agenda and local capacity-building as well as to the process of information exchange (WELL, 1999). The following summary of PRA sources and activities is taken from Section 2.2 of *Guidance manual on water and sanitation programmes* (WELL, 1999).

Some PRA techniques

- Secondary data sources, maps and reports
- Direct observation
- Case studies, work and incident histories from local experts
- Transect walks: systematically walking through an area with local guides, observing, asking, listening and learning about relevant issues
- Group discussions of different kinds (casual, focused, community)
- Mapping and modelling to show local world views
- Matrix scoring and ranking exercises to compare preferences and conditions
- Well-being grouping to establish local criteria for deprivation and disadvantage
- Time-lines and trend and change analysis to show chronologies of events and to analyse local trends and causes of change.
- Seasonal calendars and daily time-use analysis to show work patterns and activities.

For more details on these and other tools, see Narayan (1993).

Using participatory approaches

Participatory approaches are used to discover the users' perceptions on O&M. The whole process is quite different from strict question-and-answer methods, which are characteristic of objective external evaluation; these are commonly applied to many of the indicators described in Tool 7. Therefore in using participatory approaches, it is important to define key objectives and to keep them in mind when briefing the facilitators of, for example, the PRA approach.

Some important issues in relation to users' perceptions

1. What are the O&M activities currently undertaken in slums/rural communities, and by whom? They will include the activities carried out by statutory bodies, as well as through private arrangements made by the inhabitants who may either undertake the work themselves or contract a third party to do it for them.
2. What are the users' attitudes and perceptions concerning the roles and responsibilities for O&M, in particular:
 - What are the actual problems with O&M of services?
 - Whose responsibility are these problems perceived to be?
 - Is there evidence that the facilities are being cared for?
 - Is there evidence that the facilities are being misused?
 - Are there any mechanisms through which the users can approach city institutions; if so, what are they and how effectively do they work?
 - How have O&M problems been resolved, with particular reference to internal local initiatives?
 - What is the potential for promoting increased ownership and care of facilities through users becoming more proactive?
 - What are the possible routes and mechanisms that could help users to become more proactive?

A further benefit of using participatory approaches is that a lot of relevant background information about the community in question is revealed. While this may not be of immediate use in a narrowly focused status report on O&M, it can be crucially important when planning remedial measures and subsequent improvements. Although often qualitative in nature, such information is very important in building up a picture of the perception of services in a low-income community, as illustrated below (WELL, 1998).

Some detailed findings from PRA in urban slums

There are a number of general indicators pointing to the fact that local people in urban slums care for their facilities and are prepared to pay for their upkeep and improvement—as, for example, in:

- undertaking minor repairs to handpumps;
- collecting money for tubewell maintenance;
- paying for training to carry out standpost repairs;
- replacing standpost taps;
- tiling the standpost apron;
- contributing a total of 300 rupees per month to engage a sweeper for communal latrines;
- sweeping the road in front of houses;
- replacing some street light bulbs;
- cleaning and whitewashing the community hall, and contributing a maintenance fee;
- maintaining the plantation area and selling the produce;
- financing the construction of small temples and maintaining an existing temple.

Instances of community members approaching the different statutory authorities are quite widespread, although there is little evidence of a successful outcome. In general, there was no clear understanding of the division of institutional responsibilities. Approaches are made either directly, or to the local councillor, or through NGOs.

Misuse and lack of care of facilities is a problem in several areas studied; there are a number of common problems, such as:

- blocked drains, caused by indiscriminate dumping of solid waste;
- children defecating in open drains;
- illegal power connections;
- conflicts over water collection from a standpost (there was one case of appropriation of a handpump by an individual household);
- latrines that are used for a variety of purposes, e.g. storage lock-up, shelter for goats, and one case of an old lady in Khannagar (in Cuttack, India) who made an NGO-constructed latrine her place of residence.

Besides obtaining a general picture, it is important to ensure that PRA finds out from the users where the main problems lie, and looks at options for overcoming them. It can be difficult to disaggregate information as the following example illustrates (WELL, 1998).

Some lessons from application of PRA in urban slums

- User perception surveys showed variable levels of satisfaction, with a surprisingly wide range of responses and problems in areas that had been improved. In unimproved slums it is difficult to disaggregate inadequate provision of facilities from poor O&M of existing facilities.
- Consumers are concerned with the quality of the overall service; it either works or it does not, and they are not interested in which agency or programme was responsible for a specific intervention at different times. It is therefore important to address overall service provision, as opposed to the infrastructure construction of a particular programme. Furthermore, it indicates the potential dangers of a system of monitoring and evaluation which is narrowly focused on programme-related infrastructure provision, which does not include the users' perceptions on improving the *quality of service*.

Do's and don'ts in participatory rapid appraisal (PRA)

Although it is not possible to expand on any of these participatory approaches in detail, the following list indicates some of the key points which should be taken into consideration in the collection of information about O&M using participatory methods.

DO'S	DON'TS	ABOVE ALL
<ul style="list-style-type: none"> • Find out about taboos and norms • Stimulate people to talk • Provide facts and information • Build up a dialogue • Be neutral and objective • Assist people to evaluate • Be patient • Be creative, adaptable and innovative • Learn from 'errors' • Use analogy • Use a variety of PRA techniques • Cross-check information 	<ul style="list-style-type: none"> • Violate taboos and norms • Demand appreciation • Use abstract language • Interrupt, blame, suggest or promise • Side with opinion leaders or agitate • Manipulate or create needs 	<ul style="list-style-type: none"> • Listen and show interest • Respect the people, their perceptions and their knowledge

Actions and further guidance

Actions

1. Select those participatory methods which are most appropriate to the local situation.
2. Apply them to discover the users' perceptions and opinions, and to explore community- and household-managed systems for O&M.

Further guidance

See Tool 7 for specific information requirements associated with each performance indicator.

References

- Narayan, DP. *Participatory evaluation: tools for managing change in water and sanitation*. Washington DC, World Bank, 1993 (World Bank Technical Paper No. 207).
- WELL (Water and Environmental Health at London and Loughborough). *Guidance manual on water and sanitation programmes*. London, WELL (published for the UK Department for International Development), 1999.
- WELL (Water and Environmental Health at London and Loughborough). *Operation and maintenance: situation analysis and action plan. Cuttack Urban Services Improvement Project*, 1998. London, 1998 (WELL Task 34 Report).