Rural Water Supply in Developing Countries

Proceedings of a workshop on held in Zomba, Malawi, August 1980
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Rural Water Supply in Developing Countries

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Mankind cannot live without water. To survive, the equivalent of at least three pints of water per day must be taken into the body in the form of foods or liquids. This is only a small portion of our water needs, however, because water is needed for cooking, cleaning, and washing; water is also essential for agriculture and livestock; for practically all industrial processes; for use in hospitals; as a source of power; for cooling and for numerous other uses.

It is for this reason that nations are concerned with the exploitation and utilization of their water resources. It is for the same reasons that colossal amounts of money are being spent to implement water projects and programs in developing countries to meet the needs of the rural populace. Unfortunately, in a number of cases the expected returns from these projects are not fully realized. Most of the water projects that are commissioned become partially or fully inoperative. Where do things go wrong, or, more precisely, what is the reason for such a state of affairs? Could it be due to finances, equipment, systems, or the people themselves? Whatever other reasons are advanced, the operation and maintenance personnel seem to be the main cause of the problem. It is their inability, due to a lack of proper training, to carry out their various responsibilities effectively that is the root of the problem. There is, therefore, a strong relationship between the performance of water projects and training in the field of operation and maintenance. In the water sector, one cannot talk of training without including operation and maintenance needs. In this paper, an attempt is made to discuss training requirements for proper operation and maintenance of community water supply projects run by public institutions.

**Operational and Maintenance Management Requirements**

In the management of community rural water supplies, it is generally accepted that operation and maintenance functions are better managed if they are decentralized. However, in doing so the chain of technical communication in terms of information flow, instructions, data and records must be streamlined, coordinated, and maintained from top to bottom. For instance, it should be possible for the village mechanic or operator to pass on information regarding an abnormal breakdown to his local district or regional (provincial) branch and finally to the headquarters of his institution, which in turn should either seek further technical advice elsewhere or provide appropriate assistance in the shortest possible time. Because maintenance problems are highly technical and unpredictable, no one isolated functional unit can solve all the problems. For a water project to continue to give the
expected performance, timely maintenance is essential.

The success of a rural water supply program or project is hinged on how effective the program is operated and maintained. Operation and maintenance is a permanent feature of the program and its continuity depends on the existence of systematic and comprehensive working principles built on past history and experiences. Normally, such principles are developed when maintenance service is based on specified sequences of operation that can be chosen to suit a particular condition and circumstance. In general terms, the sequences consist of the standard activities given in Fig. 1.

To develop such a program, sound knowledge of the duties and responsibilities of the operation and maintenance unit is required. However, such a system should be supported by the availability of balanced resources in terms of finances, manpower, materials, facilities, and transportation on the one hand, and on the other, be under the proper supervision of maintenance and cost conscious technically disciplined personnel capable of working in accordance with professional ethics and with a sense of commitment to public service. To keep the morale of such personnel high there must be attractive service schemes and fair methods of providing rewards and incentives. Finally, because the efficiency of operation and maintenance is based on fast decision making and quick action, an operation and maintenance setup must at all costs avoid cumbersome formalities and unnecessary administrative bureaucracy.

**How Training Should be Carried Out**

Every water project that is completed requires competent personnel for its continued operation and maintenance. A shortage of such people suggests the need for

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![Fig. 1. Maintenance service for water supply programs.](image-url)
training at all levels and in all fields of water supply maintenance. The training of additional personnel must be commensurate with the number and type of water projects under consideration. In preparing training programs for operation and maintenance personnel it is important to know and define the objective of the training, be it at the village, craftsman, technician, or engineering level. Is it for meeting additional needs, improving the quality of the personnel, upgrading already competent personnel, or introducing new techniques? It should aim at training people who can do the work and provide the required services. It should by no means be intended to create knowledgeable people who cannot be put to use as soon as it is practically possible. For this reason, training programs for operation and maintenance are more meaningful if classified in terms of formal, in-service, and informal training.

Formal training equips the candidate with the basic academic qualifications necessary for working in a given discipline. This is acquired as general education, mass education, or workers' education. It does not possess special requirements as far as operation and maintenance are concerned. The individual abilities of the trainees, however, determine the speed at which they can translate theory into practice. Experience shows that it is better to start by assuming that all trainees are of equal ability when preparing for the in-service training.

In-service training is perhaps the most important part of training insofar as operation and maintenance are concerned. It is during this stage that maintenance consciousness is instilled. After in-service training, one is able to assess the potential of the would-be operation and maintenance personnel. Apart from the trainees themselves, the prerequisites for good in-service training include availability of work, facilities, experienced personnel to work with (preferably with equivalent academic qualifications as the trainee), and a comprehensive training schedule. Insofar as operation and maintenance are concerned, it does not mean much to assign a trainee to a counterpart. The nature of in-service training in operation and maintenance is such that one has to actually do the work in order to learn. Furthermore, there are no tailored solutions to operation and maintenance problems.

The in-service training should start with a short orientation course, during which time the trainees should be introduced to the various functions of the organization, the duties of the position, rules and regulations, current practices, communication and information systems, etc. It is useful at this time for the trainees to discuss the in-service training schedule that they will follow. This schedule will include topics such as general maintenance; design, installation, and performance of water supply systems; safety; records management; and materials and manpower management.

At the end of in-service training, the trainees should undergo practical objective testing. For instance, the training could lead to the professional registration of an engineer or an upgrading trade test in the case of a craftsman. In-service training without a time limit, goal, and benefit is likely to be frustrating, vague, and lax. As mentioned earlier, in-service training is the responsibility of the Operation and Maintenance Department. However, to ensure that a homogeneous level of training is maintained it must be checked, inspected, and coordinated by formally trained instructors. Such instructors should be capable of evaluating the operation and maintenance needs relevant to the formal training in the academic institutions. The schedule should be prepared by operation and maintenance personnel who should also be responsible for its execution on a rotational basis. The schedule covers those areas of operation and maintenance relevant to the trainees that have immediate application or are already in use. At the end of the in-service training, efforts should be made to measure its success. An important indicator is the ability of the trainee to apply the theory in a practical work situation. In reality, the productivity of operation and maintenance personnel begins with the end of in-service training. It is at this time that reliable independent work can be expected.
The novice operation and maintenance worker has much to learn before becoming competent in the work. During this time, and after, the operation and maintenance worker must constantly update his knowledge by attending informal training sessions at a water supply demonstration training centre. The demonstration centre, if properly utilized, is of particular assistance for the administration of upgrading tests and the introduction of new work methods to the craftsmen and operation and maintenance personnel. Here trainees can easily comprehend the working principles of water schemes and see how a water supply project should ideally be run. The centre should be designed to meet engineering standards and be supervised by experienced field officers.

Choosing the Correct Level of Technology

As mentioned earlier, effective maintenance service is based on specific sequences of operation selected to suit particular conditions and circumstances. It is worth mentioning here that such a selection, as a rule, is governed by the level of technology available and the type of technology mix used in the development of the water supply. Because it is not always feasible to use a particular level of technology, and because the level of technology available is of fundamental importance in facilitating operation and maintenance activities, the selection of various water supply technologies to be used must take these facts into consideration. It is clear, however, that the presence or absence of other resources and the desire to meet demands completely overshadow the need to use appropriate technology to facilitate operation and maintenance. Any attempt to satisfy all of these conditions is likely to complicate matters and cause undue delays. The logical compromise is systematic training. Those who advocate intensive use of hand pumps, windmills, and the like as appropriate technology to facilitate operation and maintenance have yet to provide workable alternatives where such technologies are not feasible. Without political bias or inner motives the people should be required to adapt to the technology used in the development of water resources and not vice versa. With technology developing, cultural and traditional bonds must be broken to accommodate the newly developed innovations. This is where training instructors face the challenge of technological development of the country as a whole.

Understandably, community rural water supplies are better managed if the beneficiaries are involved in the supervision of the project. Their participation can either be in kind or monetarily. Villagers can be expected to protect, operate, and even supervise the projects. Such involvement can have detrimental effects if not considered in the technology, design, and equipment selection. Simpler and less sophisticated projects and equipment should be used at the expense of obvious advantages, and appropriate training should be given to the beneficiaries. In practice, however, the technology used is normally of such a level that operation and maintenance requires a formally qualified and trained employee who expects to be inspected, supervised, advised, and rewarded. The training programs for beneficiaries must, therefore, be selective and distinct.

Conclusions

When preparing a training program for operation and maintenance of a community water supply, consideration must be given to the prerequisites of a good operation and maintenance system. The training objectives should be clear and practical. The training should be carried out under conditions which permit monitoring and control of the end results and it should take into consideration the technologies in use and type of people being trained. Lastly, the training should be recognized, appreciated, and rewarded.