

Without community participation, the installation of piped delivery systems would rarely be possible in the rural areas of developing countries. Such involvement can also be a springboard for community education programs.

## Manpower development for water and sanitation programs in Africa

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Safe water supplies and adequate sanitation facilities for the world population by 1990—the aims of the international Drinking Water and Sanitation Decade (1981–1990)—are impossibly high goals. The World Health Organization estimates that only 22 percent of the 70 percent rural population in developing countries have “reasonably safe” drinking water and that 15 percent have sanitary human waste disposal facilities. Even if the funds and adequate institutional capacity were available, objectives for the decade still could not be met. The greatest constraint is the lack of competent manpower: professional, technical, and semiskilled.

In Africa, the ratio of rural to urban population is at least 5:1, and the problems resulting from scattered settlements are immense. Communities are located within easy access to water, and villages often have several sources. During the wet season, wells and streams near the villages are full, and water is easily acquired. After the rains cease, these supplies dry up, and women and children collect water from more distant sources. In some regions of Mozambique and Ethiopia, water must be carried 10 km or more. The water supply is barely adequate for drinking, and sanitation—as known in developed countries—is nonexistent. Thus, the primary objective of national water supply programs is to make water more accessible and to reduce the hardships of everyday life.

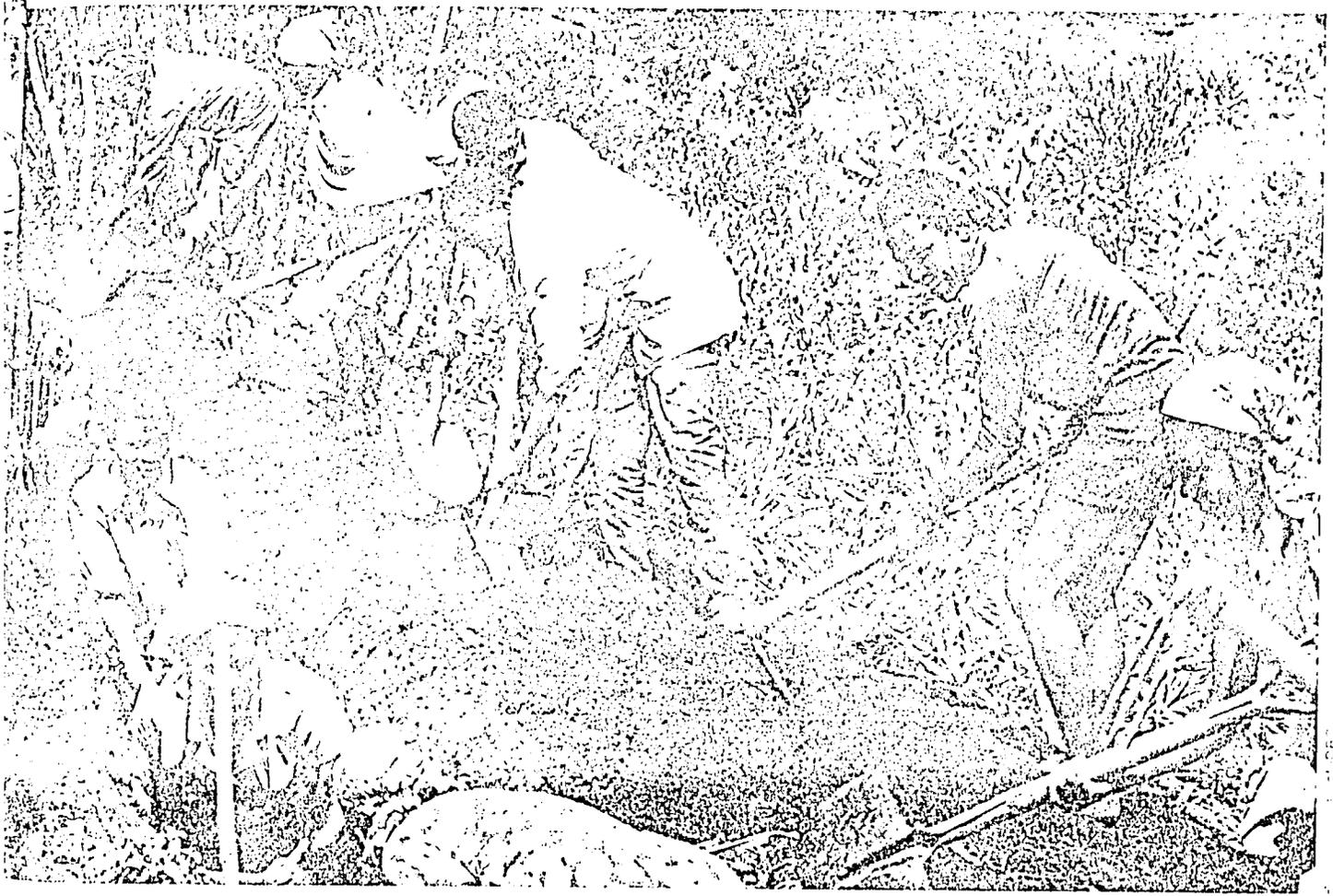
Because water is requisite to improving hygiene and



health, water supply is a politically important issue. In some countries, the funds allocated for water supplies exceed the entire amount allotted to health ministry budgets. Rural water supply programs are afforded a high priority in countries such as Ethiopia, Tanzania, and Mozambique, and international financial assistance for such programs has increased dramatically over the past decade. But adequate financing and high-priority ratings are not enough. The institutional capacity required for effective programs is closely linked to manpower, the lack of which severely limits the capacity to make use of funds.

It is common to find at least 50 percent of the installations in developing countries lying idle in disrepair soon after construction. The technologies may be appropriate and low in cost, but the manpower needed for maintenance and operation is usually allocated to ambitious construction projects elsewhere.

The paucity of manpower is obvious at professional, technical, and semiskilled levels. International aid offers technical assistance in the form of advisers or cooperants, but because too few local people qualify as effective counterparts, these advisers quickly become part of the bureaucracy. First brought in as an interim stop-gap measure, the expatriate too often becomes a permanent fixture. The system becomes self-perpetuating as expatriate contracts are renewed. This form of aid is welcomed by donors who want to keep funds “in-house” and highly visible and by the expatriate who finds it increasingly difficult to find comparable



employment at home. But imported expertise can become an excuse not to solve the fundamental problem.

#### **Water and sanitation developments in east Africa**

During the 1950s and 1960s, east Africa relied heavily on imported technology, which was usually more relevant to the urban centers. Although some 70 percent of the international assistance capital in the water supply sector is still allocated to urban areas, this situation is rapidly changing. Recognition is now being given to the real source of national income and the real needs of the majority of the population, not located in the cities.

**Technology.** Urban water technologies are not applicable to rural areas. Developing countries need new and adapted technologies more suited to the low income levels and harsh conditions in rural areas. Several research projects aimed at testing water supply and waste disposal technologies have been established in the field. In particular, these relate to the development of robust hand pumps, such as the Kangaroo pump under test in Tanzania, as well as simpler hand pumps that can be maintained by villagers. The simpler pumps are being field-tested in Malawi and Ethiopia. In Ethiopia, Botswana, and Kenya, research is under way on the potential for using locally made windmills for pumping water. In Kenya, research into defluoridation through low-cost technology is progressing, along with field-testing of water treatment by slow sand filtration. The social aspects and local management of tubewells are being investigated in Sudan.

**Sewerage.** Several outbreaks of cholera and the continuing migration of rural people into urban centers have given rise to a search for socially acceptable, low-cost alternatives to sewerage. Field trials of on-site human waste disposal technologies are under way in Ghana, Tanzania, Mozambique, and Botswana. Zambia's national housing authority has recently completed an evaluation of the aqua-privy systems built some 20 years ago in Lusaka.

These applied research projects are often undertaken by government agencies, which are also responsible for implementing the findings. It appears, however, that the research results are not being widely disseminated. Sometimes dissemination is confined to limited local distribution of thick reports, which are subsequently shelved. Although this practice may be commonplace in developed countries, it must not occur in countries in which competent professional manpower and financial resources are scarce and in high demand. A major constraint to the direct application of research results is the shortage of technicians and skilled laborers with training in the newer, more relevant technologies.

#### **The IDRC-CIDA manpower development program**

Early in 1979 the International Development Research Center (IDRC) and the Canadian International Development Agency (CIDA) undertook a feasibility study on how appropriate technology dissemination and manpower development might be accomplished through a cooperative effort. It was felt that important

Photo courtesy of IDRC



A primary benefit of piped delivery systems is the availability of water for personal hygiene and sanitation practices.

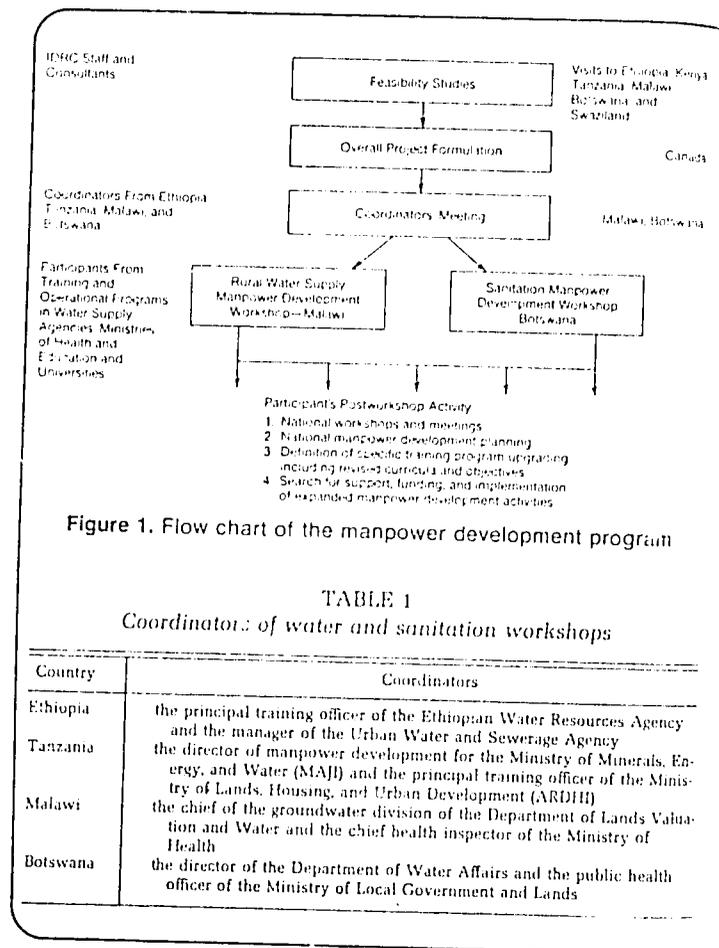


Figure 1. Flow chart of the manpower development program

TABLE 1  
Coordinators of water and sanitation workshops

Country	Coordinators
Ethiopia	the principal training officer of the Ethiopian Water Resources Agency and the manager of the Urban Water and Sewerage Agency
Tanzania	the director of manpower development for the Ministry of Minerals, Energy, and Water (MAJE) and the principal training officer of the Ministry of Lands, Housing, and Urban Development (ARDH)
Malawi	the chief of the groundwater division of the Department of Lands Valuation and Water and the chief health inspector of the Ministry of Health
Botswana	the director of the Department of Water Affairs and the public health officer of the Ministry of Local Government and Lands

gains could be made on the manpower deficit by introducing the technologies into curriculums and by upgrading training resources at all levels.

Because several rural water and sanitation projects in east and southern Africa were being supported by CIDA and IDRC, that region was selected for preliminary visits by IDRC staff and consultants who tested the idea with local agencies and institutions. It became apparent that those responsible for technology dissemination and manpower development in Ethiopia, Kenya, Tanzania, Malawi, and Botswana agreed on several critical points.

- The lack of manpower was a primary constraint.
- Information about relevant technologies being developed within the region were not being disseminated.
- The lack of manpower at the professional level fostered continued reliance on imported expertise in the form of consultants, advisers, or cooperants. Most undergraduate and postgraduate environmental engineering programs have been modeled along the lines of western universities and are not applicable to the needs of developing countries.
- Polytechnic schools are largely responsible for training technicians, but their curriculums are insufficiently focused. As a result, additional specialized technician training programs must be established within the ministries responsible for water supply and sanitation.
- Inadequate field capacity and the lack of trained manpower at the village level have created a need for

costly, centralized water supply maintenance programs, with little or no development of latrine facilities or education in sanitation in the rural areas.

• However interconnected and interdependent water and sanitation activities are, they remain separate responsibilities of diverse agencies, even within individual countries.

• Enormous benefit could be gained from sharing the experience and expertise that exist in the region.

It was decided that the IDRC-CIDA manpower development program would comprise two workshops. The first, on water supplies, was held by the National Research Council in Malawi in collaboration with the Department of Lands Valuation and Water. Malawi's initiative was welcomed in light of its interest and commitment to the activity. Its piped-water plan in the Mulange area is an excellent example of water delivery accomplished through community participation.

The Ministry of Local Government and Lands of Botswana held the sanitation workshop. This agency is responsible for Botswana's urban sanitation program, which is under considerable stress from a continued influx of rural migrants into Botswana's cities (seven percent annual growth rates are not uncommon). A research project supported by IDRC is enabling the ministry to investigate low-cost alternative technologies for sanitation. Initially, owing to financial limitations and the desirability of keeping the workshops small in size, participants were to include only delegations from Ethiopia, Tanzania, Malawi, and Botswana. However, because Kenya and Mozambique responded

TABLE 2  
Training institutions related to environmental engineering and sanitation

Country	Institution	Program
Ethiopia	University of Addis Ababa Gondar College	BSCE health inspectors
Kenya	University of Nairobi, Department of Engineering	MSEE, BSCE, diploma in environmental engineering
Tanzania	University of Dar es Salaam	BSCE, environmental engineering courses health inspectors
Malawi	Mohumbili Medical Center Ministry of Health Training Center University of Malawi Polytechnic, Zomba College	primary health worker training health inspectors health assistants

TABLE 3  
Training institutions related to water supply engineering

Country	Institution	Program
Ethiopia	University of Addis Ababa, Department of Civil Engineering Ethiopian Water Resources Agency (located in the University of Addis Ababa)	BE, undergraduate environmental courses technician diploma for engineering aides, mechanics
Kenya	University of Nairobi, Department of Civil Engineering	MSEE, BSCE, diploma in environmental engineering
Tanzania	University of Dar es Salaam Ministry of Mines Energy and Water (MAJ) Water Resources Institute MAJ Water Resources Institute Trades Training Institute	BSCE with courses in environmental engineering water technicians mechanics, O&M training crafts, skills
Malawi	University of Malawi Polytechnic Ministry of Works and Supplies Department of Lands Valuation and Water	general technicians field assistants field assistants, water technicians
Botswana	Botswana Polytechnic Department of Water Affairs	general technicians in-field technicians



Water hauling is a major responsibility of women and prevents them from contributing more to the economic welfare of the family.

with strong interest, the workshops were enlarged to include some participants from Kenya, Zambia, Mozambique, Swaziland, and Lesotho.

The workshops were designed primarily according to the directives of the participating countries. Expertise was drawn from within the region rather than from Europe or the United States. Each country appointed workshop coordinators who were responsible for organizing that country's delegations, for preparing papers to be given at the workshops, and for administrative tasks. Coordinators met to finalize the workshops' format, agenda, and content, and to select delegates and persons to present papers. The coordinators are listed in Table 1.

#### Institutional responsibility and training curriculums

Patterns of institutional responsibility for both water supply and sanitation vary widely from country to country. Urban and rural water supplies are normally within the jurisdiction of centralized water supply departments of ministries, such as the Ethiopian Water Resources Agency (EWRA), the Tanzanian Water Ministry (MAJ), the Malawian Department of Lands Valuation and Water, and Botswana's Department of Water Affairs.

In the area of sanitation, the pattern is more complex, and in some cases jurisdictions overlap. Problems arise from conflicting definitions of what is rural and what is urban. Frequently, jurisdictional boundaries are defined according to the technologies used. For example, the choice between sewerage or low-cost toilets is

closely linked to the user's financial capacity. A municipality may be responsible for sewerage but not sanitation. In Ethiopia, both urban sewerage and suburban sanitation are the responsibility of the Urban Water and Sewerage Authority of the EWRA, although responsibility for Addis Ababa itself is held by the Addis Ababa Water and Sewerage Authority. Rural sanitation, including health education, is under the Environmental Health Division of the Ministry of Health. The Tanzanian Ministry of Lands, Housing, and Urban Development (ARDH) acts largely in a planning, policy-making, and advisory role to urban councils. In both Tanzania and Malawi, the Ministries of Health are responsible for rural sanitation, as well as education on sanitation. Malawian urban sewerage is the responsibility of urban sewerage authorities, who are under the general purview of the newly formed Department of Lands Valuation and Water.

**Polytechnics and health ministry courses.** This mixture of jurisdictions concerning water and sanitation confuses the issue for training programs. At the professional level, sanitary engineers are prepared through postgraduate engineering courses, which follow undergraduate studies in civil engineering. Since sanitary engineering curriculums are often theory-oriented, water ministries have been forced to establish in-house training programs to provide practical information to recent graduates. Technicians are prepared by polytechnics in subjects that are not specific to water supplies. Here, too, water ministries have found it necessary to set up specialized training courses for



Water collection, although a social activity, is a time consuming chore that hinders healthy sanitation practices.

water technicians. Health inspectors are trained as technicians in sanitation through specialized courses within the Ministry of Health or through the University of Polytechnic under the guidance of the health ministry. At less skilled levels are the assistant health inspectors, who are also trained through specialized health ministry courses. There are few examples of water technicians or less skilled technicians who are initially responsible for assisting supervision of construction and later are responsible for maintaining rural water installations. One such course, which was successfully developed in Malawi, is a three-week on-the-job training program for trainees selected from the area in which water delivery systems are being installed.

Training courses have generally sprung up individually, corresponding to divisions in institutional responsibilities, with each responding to its own confined market. For sanitation-oriented personnel, this has led to dead-end careers and frustration. Water supply and sanitation are interdependent. The fact that responsibility for their implementation is held by separate ministries does not obviate the need for training curriculums to include training in both water and sanitation. Lack of knowledge in both areas results in errors in the field. In the simplest form, this lack of coordination can result in the water supply authority installing shallow wells topographically below latrines that have been located under advice of the health ministry. Water supplies are frequently installed without related education on how water can be used to improve health. Without improvement in hygiene, water can hardly be expected to have any impact on health.

The existing training courses in water and sanitation in east and southern Africa present opportunities for

upgrading and expansion to meet the rising demand for manpower. Some of the most relevant programs are listed according to sector and level in Tables 2 and 3.

**On-the-job training.** There are two other important forms of training. The first is on-the-job training. This, when coupled with appropriate personnel policies, can be a powerful tool for manpower development. Formal course training can provide only a foundation for later personnel development. In many countries on-the-job training is not recognized, resulting in frustration and eventual manpower drain from the sector. Although leaders of the IDRC-CIDA training program recognized the potential of this form of training, it was decided at the outset that it would not be the focus of this program. Formal course training as it currently exists in east Africa offers the best foundation on which manpower development can be based at the present time.

**User education.** Training in water supply and sanitation must include user education. Education on the proper use of water and water facilities, as well as sanitation education concerning proper waste disposal and personal and household hygiene, are essential if investments in this sector are to result in significant health benefits. There are three forms of health education, which, though diffuse, offer broad coverage of the population.

Health education, which in this context is better termed sanitation education, is the responsibility of village-level Ministry of Health personnel.

The village-level cadre are widely known as the primary health care workers, or barefoot doctors, whose emphasis is on prevention but also includes curative care. There are, however, major variations among countries. Sanitation education is often given by

the primary health care worker in collaboration with the village health committee, and village-level health care is in its embryonic stage in most African countries. In Tanzania, the village health worker is most often a semitrained, sometimes illiterate leader working with the village health committee. In Malawi, cholera assistants trained during the 1973 cholera epidemic function as the sanitation educators. Both countries are planning major efforts in short-term courses for primary health care workers.

The second form of sanitation education falls under the Ministry of Education's adult education activities through which mass campaigns, correspondence courses, and health education extension services are conducted.

The third form is health education courses in primary and secondary schools. Health education in the primary schools offers the broadest, most consistent coverage of the youngest age group. It has tremendous potential for effecting permanent improvements in water-use practices and hygiene habits in the home, which are difficult to achieve through adult education. All three forms of education programs were covered at the IDRC-CIDA sanitation workshop, where consideration was given to how the education programs can be used in conjunction with the sanitation programs planned for the decade.

#### **IDRC-CIDA water and sanitation workshops**

The basic objective of these workshops was to enable those responsible for training to design upgraded curriculums for expanded training activities incorporating the newer, field-tested water and sanitation technologies. Both workshops were divided into four sections—technology, software, training programs, and working sessions.

At each workshop two days were devoted to presentations and discussions on technology under development in the region. This portion of the workshops also provided enough information to enable participants to discern which technologies are relevant to the various curriculums under later discussion. At the water workshops, these focused on shallow-well hand pumps, windpower pumping, gravity water schemes, and low-cost water treatment. The workshops included demonstrations and field trips near Zomba and the Mulanje mountain area.

Presentations on sanitation technology based on prototype field-testing programs were made by persons from the region. The technologies covered included conventional and improved versions of the pit latrine, the compost toilet, and the aqua-privy. Field visits were made to nearby Lobatse sites and services areas.

The software sections comprised presentations on institutional responsibilities, manpower planning, social aspects (including user acceptance), operation and maintenance, user education, organizational aspects, costs, and financing. The latter sessions of the workshops were devoted to training, the first part of which covered examples of training courses at all levels in both water and sanitation within the region. These presentations were made by participants who are themselves responsible for the training courses. The final two days of the workshop were spent on improving and

expanding existing training courses and establishing new training activities. Specific training courses and education programs were identified and detailed for eventual adaptation into proposals for funding as part of existing or future capital-assistance projects.

The training programs formulated during the working sessions reflect the specific interests and experiences of the participants. In response to the recognized manpower deficit, several countries are already defining training needs and determining how courses may be established—particularly at the technician level. The problem has been the lack of relevant curriculums. This is particularly true in cases where the technologies applied in the larger towns during the past decade are to be exchanged for technologies more appropriate to rural areas. The workshops are looked upon as timely sources of information for new and adapted technologies and curriculum development. Information gleaned from these workshops can be used as the basis for upgraded training programs in the near future.

Three newly instituted training programs will profit from the workshop. The Tanzanian Ministry of Lands, Housing, and Urban Development has identified the need for a new cadre of semiprofessionals who would be trained both in engineering and environmental health and who would rank at the top of the technician scale somewhere between the engineer and the health inspector. This semiprofessional would have a high school education with a college-preparatory background in biology, mathematics, and physics before undertaking two to three years of training. In Malawi, the Ministry of Health is developing qualifications for the village health care worker to meet in order to be responsible for development of latrine facilities and sanitation education in the village.

The Department of Lands Valuation and Water in Malawi and the Department of Water Affairs in Botswana are both planning to establish water technician training programs to meet demands over the coming decade.

Follow-up activity after the workshops included finalizing curriculums and plans for the specific courses outlined at the workshop. In addition, a broader look at the manpower situation in this sector could be achieved at the national level through meetings, with the workshops acting as prototypes. In this way, a larger number of responsible persons could contribute to more focused national requirements.

#### **Conclusion**

It is anticipated that funding for water and sanitation facilities in developing countries will come from both national sources and international aid. It is becoming increasingly apparent that the large investments from international loan organizations will be in jeopardy if the manpower situation is not alleviated. It is likely that assistance for long-term, in-country training programs will become standard components of large capital-assistance projects in the future.

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