



AFRICAN PUBLIC HEALTH ENGINEERING DURING THE DECADE

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1. THE DECADE PROBLEM

In 1976 the World Health Organization reported^(1,2,3) that 62% of developing countries, some 1250 million people in all (excluding China) did not have reasonable access to safe water supply while a greater percentage 68% had very inadequate facilities for the sanitary disposal of human excreta. The current situation in the Africa region has been reviewed elsewhere^(4,5) and it is currently estimated that about 84% of the total African population, some 280 million people, does not have access to safe water supply while 91% has very inadequate facilities for excreta disposal. Over 80% of the African population lives in the rural areas and well over 90% of the rural population does not have access to safe water supply and any form of excreta disposal facilities.

This gloomy situation in the developing countries prompted the United Nations Conference on Human Settlements (HABITAT),⁽⁶⁾ in 1976 and the United Nations Water Conference⁽⁷⁾ in 1977 to recommend that the decade 1981-1990 be designated *THE INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE (IDWSSD)*. Briefly state, the objective of the Decade is to provide about two billion (2 x 10⁹) people with *basic water supply and excreta disposal facilities* at an estimated cost of about three hundred billion (3 x 10¹¹) U.S. dollars in the decade 1981-1990⁽⁸⁾. Considering this level of investment and the per capita cost estimates^(4,5,8) for the various water supply and sanitation facilities, it is apparent that a substantial mix of both standard wester⁽¹⁰⁾ and low-cost⁽¹¹⁾ water supply and sanitation technologies is essential even in the urban areas for the accomplishment of the objective of the Decade. In fact, the low-cost technologies would have to predominate if any substantial level of coverage (above 60%) is to be provided in Africa.

Apart from financial constraint, the next major constraint to be overcome for the successful implementation of the Decade is the provision of the *appropriate type* of technical manpower needed for the planning, designing, implementation, operation and operation of water supply and sanitation facilities. This paper reviews the existing manpower availability, current academic training programmes; and

then proposes potential training programmes for the various cadres of manpower in the water and sanitation sector in Africa.

2. MANPOWER AVAILABILITY AND EXISTING TRAINING PROGRAMMES

The lack of trained manpower has been highlighted⁽⁷⁾ as one of the major constraints to the effective and efficient development of the water and sanitation sector in the developing countries. Unfortunately, little or no quantitative information exists to be able to define the problem adequately, particularly in Africa^(12,13,14). The seriousness of the situation is perhaps best illustrated by comparing the targets for the first United Nations Development Decade (1960-1970) with the situation as at 31st December, 1971 as presented in Table 1⁽¹⁵⁾. The targets of the first decade have now been carried over to the 1970-1980 decade. The achievements over this period will be of considerable interest.

Table 1

Comparison of targets for the first United Nations Development Decade with the situation as at 31st December 1971 in Africa⁽¹⁵⁾

Objectives of 1st Development Decade (1960-1970) carried into the Second (1970-1980)	Situation as at December 1971
1 Physician for 10,000 pop	1 phys. for 17,500 pop.
1 Nurse for 5,000 "	1 Nurse for 6,000 "
1 Midwife for 5,000 "	1 Midwife for 17,000 "
1 Lab. Tech. for 5,000 "	1 Lab. Tech. for 62,000 pop.
1 Health Insp. for 15,000 "	1 Health Insp. for 37,000 pop.
1 San. Eng. for 250,000 "	1 San. Eng. for 2,370,000 "
1 Health Aux. for 1,000 "	1 Health Aux. for 3,250,000 pop

The cadres of manpower that have the principal role to play in the water and sanitation sector during the Decade are:

- (i) the environmental (public health/sanitary) engineers and scientists,
- (ii) the professional sanitarians (health superintendents/inspectors) and water technicians; and
- (iii) the health assistants (community aides) and water artisans (borehole and pump maintenance mechanics).

2.1 Environmental Engineers and Scientists

The cadre of manpower termed environmental engineers and scientists in this paper are those graduate engineers and scientists who are actively engaged in water supply and wastes disposal technology in the governmental agencies, parastatal organizations and the private sectors of the economy. The functions of such persons may involve the planning, designing, construction, operation and maintenance of water supply and wastes disposal schemes.

Available data (^{5, 12, 15, 16, 17}) suggest that there is acute shortage of this cadre of manpower. This shortage may persist during the present decade because graduating engineers and scientists show very little desire to either specialize in environmental engineering or take up appointment in the water and sanitation sector. The attitude of the graduating engineer and scientist to a career in the water supply and wastes disposal industry is partially attributable to the undergraduate curricula in the established or traditional science and engineering disciplines. For instance, civil engineering departments emphasize the teaching of environmental engineering/science much more than any other science and engineering departments. However, environmental engineering/science is generally allocated much less time than the other civil engineering subjects. The relatively short period of exposure to the fundamentals of environmental engineering is usually insufficient to motivate the undergraduate to a postgraduate specialization in environmental engineering or to a career in the water supply and wastes disposal industry.

Current environmental engineering syllabi (^{5, 12}) of undergraduate courses in civil engineering are of traditional nature in that they emphasize public water supply and sewerage and there are mentions of refuse disposal and air pollution. They also contain substantial amounts of materials on low-cost or "appropriate" water supply and sanitation technologies.

The syllabi would appear to be suitable for introducing prospective African civil engineers to public health engineering. However, some of the objectives of the syllabi are rarely achieved mainly because of the constraints imposed by the non-availability of suitably experienced academic teaching staff. In many Universities, departmental budget estimates rarely provide for more than one specialist public health engineering lecturer in a civil engineering department. Furthermore, most public health engineering lecturers have been trained in the industrialized countries and most regrettably have had little or no field experience in planning and executing water and sanitation projects in developing countries.

Two African Universities namely: The Ahmadu Bello University, Nigeria and University of Nairobi, Kenya run postgraduate courses lasting over 12-24 months and leading to higher degrees/diploma in public health engineering (¹²). This is a recent development and the first group of graduates from these courses are yet to justify the usefulness of their training.

The detailed syllabi of these postgraduate courses have been presented elsewhere (¹²). In general these postgraduate courses are of traditional nature emphasizing public water supply and sewerage, with related courses in sanitary chemistry, sanitary microbiology, epidemiology, hydrology and statistics. Low-cost water supply and waste disposal technologies, health education, rural sociology and anthropology which are all very important for the successful implementation of the Decade programmes are either barely or not covered at all in both syllabi. Like the existing undergraduate programmes, the syllabi emphasize the design aspects of public health engineering systems in preference to the operational and maintenance aspects.

2.2 Professional Sanitarians and Water Technicians

The cadre of manpower termed professional sanitarians and water technicians are respectively public health inspectors/superintendents who hold the Royal Society of Health (RSH) diploma or its equivalent and diploma holders in engineering and applied science who are engaged in water supply or waste disposal work in governmental agencies or associated organisations. In general their functions may involve assisting professional public health engineers in the design, construction, operation and maintenance of water and sanitary installations and also the general supervision of other operational staff.

There is a serious shortage of this cadre of manpower (^{5,13,14,18}). Added to the problem of shortage is the fact that the sanitarian sees his functions as being confined to epidemiology, malarial control, health education and general sanitation *inspection*. His employer is invariably a health department or ministry which normally does not consider the planning, designing, construction, operation and maintenance of water supply and wastes disposal facilities as its function. The ministries of works, housing, public utilities or water resources are more likely to have responsibility for the planning, installation and maintenance of water supply and wastes disposal facilities. These ministries employ the engineering/science diploma holder and subsequently "convert" him to a water engineering technician by on-the-job training.

The major training route for the public health sanitarians is via the Royal Society of Health (RSH) diploma and certificate (^{18,19}). The post-secondary school three years course leading to the RSH diploma not only provides a very broad training in environmental health but also has a high content of public health engineering topics (^{2,3,11,20,21,22}) which are very relevant to the successful implementation of the Decade. It is of interest that apart from subject matters which deal directly with water supply and sanitation technologies, other topics such as health education, rural and community organisation, public health administration, plumbing and management of sanitation programmes which are all very important for the successful implementation of the Decade programmes are also covered in the RSH diploma courses. These apparently ancilliary but very important subjects are not covered in any of the existing public health engineering syllabi of civil engineering undergraduate curricula of any African university.

There are very few post-secondary school diploma courses in environmental engineering/water resources in Africa (^{5,13,14}) and these emphasize hydrology and irrigation engineering and *not* water supply and waste disposal engineering technology. For most water technicians, water supply and wastes disposal technology have been taught as a component of major engineering or technology courses such as environmental services, town planning, building services, civil engineering, water resources, analytical and environmental chemistry, food technology and plumbing technology in the local technical colleges and polytechnics. The academic training programmes for prospective water technicians (water supply and sewerage scheme operators) are either non-existent or are grossly inadequate for the needs of the Decade.

2.3 Health Assistants (Aides) and Water Artisans

The health assistant or sanitary overseer is a junior sanitarian who generally works under the direction of a public health inspector/superintendent. He has had about 3 or 4 years of secondary school education before receiving an additional training of about 2 years in a School of Hygiene. He is usually attached to a ministry of health or a local authority where his work may involve the construction of wells, latrines, operation and maintenance of rural water supply and sanitation facilities, pest and malaria control and the promotion of health education particularly in the rural communities.

The water artisan works under the direction of the water technician or operator. In general, he would have had some primary school education before undertaking local apprenticeship in plumbing, electrical or mechanical plant maintenance and repairing. Unlike his health assistant counterpart, he has had no form of training in environmental health. His duties involve general maintenance and repairs of water supply and waste disposal installations and in the rural areas these may also include the operation and maintenance of the installations.

This cadre of manpower whose role is very crucial for the successful implementation of the Decade would appear to be in short supply particularly in some of the West African countries. They are perhaps more available in some of the East and Central African countries where the basic institutional infrastructure helps in highlighting the importance of the role which they can play in the water and sanitation sector.

The number of trained personnel in this cadre of manpower is difficult to estimate since their training is not formalised in many cases; and secondly there is a continuous turn over as career advancement and prospects for this cadre would appear to be relatively slow. In any event, it is unlikely that the required 333,000 personnel required in Africa in this cadre has been attained.

3. RECOMMENDATIONS AND CONCLUDING REMARKS

The appropriate educational and training needs of the technical manpower in the water and sanitation sectors are not being provided in African universities, polytechnics and technical colleges. This situation is likely to persist in the foreseeable future mainly because environmental engineering,

in any of its ramifications, is not yet offered as a separate undergraduate degree or diploma programme in many higher institutions of learning (2³, 2⁴, 2⁵). Secondly, the "polyvalent" character of the environmental technology "discipline" is such that it cannot be adequately accommodated in a conventional university/college department at the present stage of the development of higher technical institutions in African countries. Thirdly, the high *practical* orientation required of all cadres of technical manpower in the water and sanitation sector, particularly during the Decade, is such it may be more beneficial for the graduate scientist/engineer to graduate after fulfilling the practical requirements of the technicians' undergraduate course than for him to follow a purely academic training as currently envisaged in some institutions (5). In other words, a very flexible approach (5) both in the intake and training of graduate scientist and engineer (managerial personnel) and the technician/sanitarian (operational personnel) is greatly needed. This flexible approach may be unacceptable in conventional African university faculties.

The Decade technical manpower educational and training needs are likely to be best catered for within Environmental Technology Training and Research Institutes. Such institutes which should be national or regional centres can be either constituent colleges of universities or they can be autonomous institutes with statutory powers to award degrees, diplomas and certificates in environmental science and technology.

An Environmental Technology Training and Research Institute can satisfy other needs:

- (i) Organise and run trade and craft courses which are orientated to the water and waste industries;
- (ii) Organise and run postgraduate courses in environmental health technology;
- (iii) Organise and run short refresher courses for subprofessionals and senior professionals in the water supply and waste disposal industries;
- (iv) Undertake *applied* research in appropriate water and sanitation technology; and
- (v) Serve as a focal point for research and training matters in the water and sanitation sector.

Potential training routes for the various cadres of manpower which can be implemented within the proposed Training and Research Institutes are summarized in Figure 1.

It is to be recognised that many African countries do not as yet have institutions or centres that serve as focal points on environmental technology matters. The establishment of this type of centres in India (National Environmental Engineering Research Institute, Nagpur), Pakistan (Institute of Engineering and Public Health Research, Lahore), Thailand (Asia Institute of Technology, Bangkok) and Brazil (School of Hygiene and Public Health, Sao Paulo) seem to have curtailed the fragmentation of scarce resources available for tackling environmental health engineering training and research problems in these countries. The World Health Organization (WHO), with its successful record in this sphere of activity in these countries, should extend its endeavours in Africa by initiating and encouraging the establishment of the fore-mentioned Training and Research Institutes.

Another area deserving international assistance in the development of public health engineering education is the *formulation of guidelines for appropriate course syllabi*. By and large, public health engineering problems in the developing countries are of very similar nature with the differences being in the degrees (1³, 1⁴). Because there are currently very few institutions that offer public health engineering as part of their curricula and also because of the severe shortage of funds, it has been very difficult to establish national or regional forums where public health engineering teachers can exchange ideas on curriculum development. The WHO Regional office for Africa (AFRO) has in the past organised and sponsored meetings for teachers of environmental health in Africa (12). This type of meetings should be encouraged during the Decade and in addition a Standing Committee on public health engineering education should be set up. This committee should have as its major terms of reference the formulation and revision of guidelines for the training of various cadres of manpower in the water and sanitation sector. National governments should also encourage the establishment of training committees (consisting of academics and practitioners in the water and sanitation sector) to formulate course syllabi based on the proposed WHO guidelines and tailored more appropriately to their national needs.

Finally, national, bilateral and multilateral donor agencies should involve African public health engineering teachers in the planning and execution of their projects during the Decade. Most public health engineering teachers have received their specialist training in the industrialised countries and there is a very urgent need to increase the perception of the different nature of African

public health engineering problems by adequate exposure to field projects. These field projects or fact-finding missions can be undertaken by many university staff during the long summer vacations. Ironically, the "experts" that are currently being hired from the other WHO regions to undertake these missions in Africa are neither older nor more academically qualified than their African counterparts. They may, however, have been offered more opportunity for field experience by the WHO regional office for their home country or other international agencies involved with the development of the water and sanitation sector. In "training" the highly qualified but "not-too-experienced" African public health engineering teacher. It is important to bear in mind the often quoted (or "misquoted") Chinese aphorism which says:

If I hear it I forget
If I see it I remember
If I do it I know.

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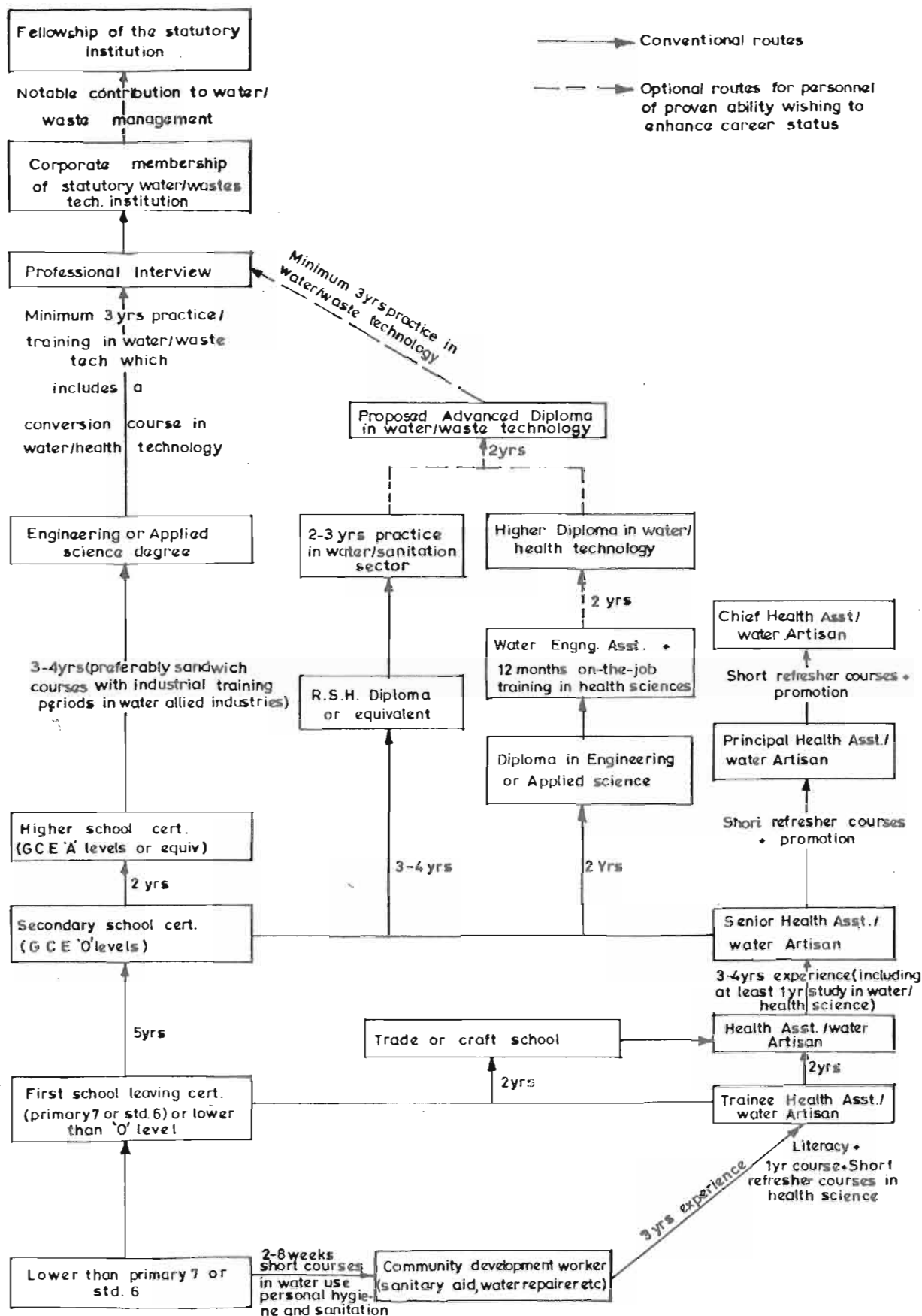


FIG.1 PROPOSED TRAINING ROUTES FOR CADRES OF MANPOWER IN THE WATER/SANITATION SECTOR IN THE AFRICAN REGION