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RESEARCH AND DEVELOPMENT DEMONSTRATION NEEDS IN WATER AND WASTE ENGINEERING IN ASIA

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Introduction

As of 1975, 128 million (69%) out of the total 185 million urban population of the South East Asia Region (SEAR) countries (Bangladesh, Burma, India, Indonesia, Nepal, Sri Lanka and Thailand) enjoyed water supply, 40% through house connections and 21% through public standposts. Only 26% (48.2 million) were connected to a sewer system, 47.8 million (26%) were served by pit privies and septic tank, and 26% by the bucket privy system (ref. 1). Only 145.1 million (19%) of the total 1975 rural population of 750 million in this region had reasonable access to safe water. Rural sanitation in general and excreta disposal in particular were receiving but marginal attention in Bangladesh, India, Indonesia and Nepal, but the 1980 target had been exceeded in the case of Burma, Sri Lanka and Thailand. The coverage for adequate excreta disposal in rural areas of SEAR countries in 1975 was only 6% (ref. 1). The colossal needs in funds, manpower and material on the SEAR countries for their current and future programmes in community water supply and sanitation are quite apparent. Severe limitations in their current resources make it imperative that alternative and simple economical and low energy technologies be given serious consideration for adoption. Research and development by each country supplemented by inter-country research on a regional basis is of paramount importance in this context (ref. 1).

This paper examines the trends in sanitary engineering research and development in Asia during the last decade with particular reference to SEAR countries which include India. Research philosophy, research management, coordination and technology transfer are analyzed with special reference to India.

RESEARCH PHILOSOPHY

Ideally there must be a balance between pure and applied research. Pure or fundamental research is time consuming, not always goal-orientated and often very costly requiring sophisticated instrumentation.

In the areas of water and waste engineering the developing countries of Asia and elsewhere pure research is of little practical or immediate value and it is quite evident that the majority of research and development needs should be orientated towards applied research - research applicable to national needs. Such research should take into account the appropriateness of the technology or the technology level feasible in the implementation of the final project; such a research and development effort of course does not rule out any sophisticated technique or instrumentation to evaluate the feasibility of a process for possible adoption in a developing country. Examples of this in water and waste engineering field include the use of isotopes as tracers in sedimentation, groundwater pollution and dispersion studies, satellite imagery and remote sensing techniques as well as advanced geophysical techniques in groundwater investigations, and sophisticated instrumentation in the estimation of organics and other elements in water, leachates and in air in trace concentrations. The General research philosophy applicable to a developing country in this area does not preclude any well established university department undertaking work of a fundamental nature within its known limits of expertise, instrumentation, and funds. The emphases for national and state research centres would definitely be applied research of immediate practical value. In this connection, the keynote address delivered in Kanpur by Prof. Nurul Hasan, Vice-President of Council of Scientific and Industrial Research (CSIR) of India at the National Seminar on the development of science and technology is of interest. He is reported to have said that India must go in for advanced science and develop sophisticated technology to eradicate poverty, achieve self-reliance and ensure national security. He mentioned "We cannot any longer remain satisfied with intermediate or appropriate technology" and added that the word 'appropriate' should not be a euphemism for inferior science or technology (ref. 2). Appropriate technology, or research orientated towards it, need not to be low-level or inferior technology.

The range of options for the development of appropriate technology is large and some of the options are: adapting or improving existing indigenous technology; adapting evolving modern technology; reviving old technology; developing new technology and transferring technology within or among developing regions and countries. Research to investigation, and any development needed to evaluate and adopt modular incineration concept with energy recovery for municipal solid waste disposal in a large Indian city with no landfill sites in our economical reach would be a case of adapting evolving modern technology. Research and development related to slow sand filtration of water would be a case of improving existing technology, possibly reviving an old technology as well. Research into the use of large scale composting for municipal solid wastes would be a case of improving existing indigenous technology.

RESEARCH OBJECTIVES AND PRIORITIES

Sundaresan outlines the following research and development objectives for environmental engineering in India (ref.3).

1. Determination of technical and economic feasibility of various options which are available for water supply and waste disposal.
2. Evaluation of economic and environmental system effects of technologies which provide for conservation of water, reclamation and re-use of wastewater.
3. Development of energy saving devices.
4. Technological innovations at intermediate technology levels to improve efficiency and enhance appropriateness.

Sundaresan has also presented an evaluation criteria based on benefits accruing from Research and Development project (ref.3). Guidelines for applied research, the organization of research and development, research priorities, project selection criteria, implementation and evaluation are outlined in a thought-provoking paper by Hindle and Berthouex (ref.4).

As a first step, research trends should be analysed and research priorities should be arrived at by a consensus process. This needs to be done in each developing country to establish a research agenda for its scarce scientific and engineering manpower. Sundaresan et al have presented information on research projects in progress between May 1977 and May 1978 and those which were continued beyond May 1978 in the field of environmental engineering and science in India (ref.5).

The breakdown of the projects totalling 462 into various subject areas is presented below.

Water - 169; Wastewater - 98; Solid Waste - 30; Air Pollution - 68; Noise Pollution - 7; Pesticidal Pollution - 20; Radioactive Material Pollution - 1; Industrial Hygiene - 7; Rural Sanitation - 8; Environmental Sanitation (general) - 10; Allied Subjects - 44.

This categorization indicates very clearly that the rural sanitation is a neglected field of research contrary to what one would expect. The development of research priorities should take into account this imbalance. No attempt has been made in this paper to discuss the relevance of various projects included in the context of India's national needs.

Research findings are regularly issued by the Division of Environmental Engineering of the Asian Institute of Technology, Bangkok. The research projects generally reflect the needs of Thailand and the region. The procedure adopted in the selection of research projects by AIT and the benefits of these projects to the country or the region are not readily available for appraisal. A meeting of Directors of Institutions collaborating with the WHO International Reference Centre (WHO IRC) for community water supply held in 1973 had identified specific activities and projects for research and development with priority allocation in research centres in developing countries (ref.6). A global workshop on appropriate water and wastewater technology for developing countries convened by WHO IRC for community water supply in 1975 identified areas of study and research in water supply, waste disposal and socio-economic sectors in developing countries, (ref.7). Dave and Paramasivam presented research and development needs in community water supply in India at an international training seminar on community water supply in developing countries held in Amsterdam in 1976 (ref.8).

A workshop on research and development needs for water supply and sanitation decade in India conducted in 1979 had identified research priorities and recommended topics for research and development under the following groups: water, sanitation, manpower development and information system planning (ref.9). No attempt has been made in this paper to analyse the research priorities developed.

RESEARCH ORGANIZATION, CO-ORDINATION
AND INFORMATION TRANSFER

Two research centres in environmental engineering in the SEAR with a high level of international exposure are National Environmental Engineering Research Inst. (NEERI) of India and AIT at Bangkok, Thailand. These by virtue of their status and contacts have also become focal points in any transfer of technology from the west.

NEERI does not of course hold monopoly on environmental engineering research in India, there are other institutes, universities and state government research units engaged in environmental engineering research.

Central Public Health and Environmental Engineering Organization (CPHEEO) in the Ministry of Works and Housing is the organization directly involved in the National Water Supply and Sanitation programme, co-ordinating this activity with the various state governments, and advising them of design aspects. Design criteria and manuals are developed by CPHEEO for national use. NEERI is one of the many institutes/laboratories under the CSIR in the Ministry of science and Technology. An attempt by the user (user of research) ministry to bring NEERI (CPHEEO then) at its inception into its fold was not successful; subsequent attempts in recent years have not altered the status quo. Thus the research unit (NEERI) and prime user of research results remain in different ministries posing its normal share of co-ordination problems. Some measure of co-ordination was achieved in the sixties with the head of CPHEEO (Adviser) acting as the chairman of the technical sub-committee of NEERI which reviewed and approved research projects. Research co-ordination was at best patchy. CPHEEO did not attach much importance to this function in the sixties, in effect ignoring its primary role in research co-ordination and technology transfer. It is believed that CPHEEO had not taken aggressive leadership role in this area in recent times as well. Khare, a former adviser, had termed CPHEEO as a weak and an ineffective organization and had expressed doubts about its ever becoming a strong and effective organization; he attributes lack of feed-back and poor information transfer to the weak central organization (ref. 10).

It is very important that CPHEEO should play an active leadership role in this area of research co-ordination and technology transfer if the results of research are to find their way to the users (state governments). The organization must be strengthened either in the present set-up or as part

of the Ministry of the Environment; there should be a shift in emphasis of its functions as well as changes in attitude so that it can abandon its passive role as a marginally interested bystander and take on a productive role in the interest of a successful transfer of technology within the country leading to the success of water supply and sanitation decade targets in India. Technology transfer seminars would be a useful venture in this context.

Another matter of real concern relates to the mechanisms available within India for information on dissemination. There are only four primary journals on the subject namely: 1. Journal of the Institution of Engineers (India) Environmental Engineering Division; 2. Indian Journal of Environmental Health; 3. Journal of Indian Water Works Assoc; and 4. Journal of the Institution of Public Health Engineers (India). There are a few magazines issued by some state government departments such as Public Health Engineer (Kerala State) and Tamilnadu. A newsletter is issued by the Indian Association for water pollution control and a technical digest is issued periodically by NEERI; one would normally consider the number of publications available not adequate. In some of the journals publication delays of more than 18 months are not uncommon; in the case of some journals, publication dates are not kept up. A few of these journals response characteristics are very poor, chasing any prospective author miles away. In addition to this, many faculty members do not attempt to write papers based on research conducted by graduate students under their guidance; there is no incentive to publish, as publishing does not influence faculty promotion or standing. Thus very little of university research in this area is even published. There is a pressing need for a central organization such as CPHEEO as a part of its function to periodically issue a bulletin which contains in addition to other material, abstracts of theses accepted for graduate degrees in Indian Universities. CPHEEO should also consider issuing a publication consolidating all abstracts of theses.

AIT has been issuing a periodical publication once a year or so containing abstracts of theses approved in the environmental engineering area; it has also recently started issuing Environmental Sanitation Abstracts and Environmental Sanitation Reviews. There is also another magazine called Asian Environment published from Thailand.

CONCLUSIONS

Each developing country should develop a list of priority research projects. Information transfer should be strengthened in all the developing countries to benefit research locally done and in the region.

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