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WATER AND SANITATION IN UNICEF 1946-1986

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IN UNICEF 1946-1986**

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FOREWORD

Water supply and sanitation are two of the most basic services for humanity. They are so basic that in many of the wealthier areas of the world they are taken for granted by everyone but the administrators, engineers and plumbers who manage the treatment plants, the water distribution networks, and the accounting.

Not so in those parts of the world where water has to be fetched from distant pools, green with algae and containing an assortment of harmful organisms and pollutants; where sanitation for women and children may be no more than a corner of the courtyard; and for men a clump of bushes in a field just outside.

Where infants and children are concerned, access to a sufficient quantity of water and a clean place to defecate, along with hygienic practices to keep body and surroundings clean, is a major step leading from illness and misery to health and well being. For their parents, especially their mothers, it signifies hours of labor and energy saved for better care of the children, better chances for education, and higher productivity.

This is why UNICEF has had these components of basic services on its agenda almost from its inception. It is why UNICEF is today one of the world's major agencies supporting water and sanitation programmes in the developing countries. UNICEF is involved in such programmes in almost 100 countries, stressing simple technologies and social strategies linked with other UNICEF activities in the fields of health, nutrition, and education.

A number of coincident factors have been involved in the path leading to UNICEF's present substantial commitment to water and sanitation. A sharp upturn in its involvement was initially prompted by emergencies. It was maintained by urgent government requests and great interest and generosity on the part of donors, great and small. The present monograph tries in a nutshell to trace this development, part planned, part spontaneous. All that can be said without fear of disagreement about UNICEF's involvement in this field is that there was never a dull moment.

The present monograph was evolved from a considerably larger and more detailed account: "The WET History - Water Supply and Environmental Sanitation in UNICEF 1946-1986", UNICEF WET Monographs No. 2. It is a happy coincidence that as the editor of the present version, John Balcomb was chosen. His own background of many years with UNICEF in Africa and other parts of the world has given him a special understanding and enthusiasm, and thus greatly helped infuse our WET (Water and Environmental Sanitation Team) spirit into this volume along with keeping it more along linguistic lines preserving the dignity of the great language of Shakespeare and Milton.

The reader is thus welcomed to a world of handpumps and VIP latrines, a world populated by water well drillers, sanitarians, village-based workers, and children, children, children, whom we all wish to see clean, free from disease-bringing dirt, happily frolicking in splashes of clean, safe water.

Martin G. Beyer

As Martin Beyer has pointed out in his foreword, the present monograph is a much abridged version of his "WET History" produced in 1986 -- WET being the snappy acronym devised by him to signify the Water Supply and Environmental Sanitation Team at New York headquarters and, by extension, the whole globe-girdling UNICEF programme in that field. The "WET History" runs to about 80,000 words. To fit it into the regular UNICEF history monograph series I have rather brutally cut it to about 25,000 words, without, I hope, too greatly violating its spirited spirit and conversational flow. My longest cuts involved statements and discussions of present policies that can easily be sought elsewhere in UNICEF's documentation. I have also -- regretfully -- had to forego most of Martin's references to the very numerous individuals who played various roles in the "WET History". His index includes more than four hundred proper names -- a very full roll-call indeed. I hope I have not unduly hurt anyone's feelings by leaving out so many of these personal references.

I had the privilege of working in UNICEF's New Delhi Office from 1967 to 1973, the period when UNICEF's village water supply, operations "went to scale" in India, launching a chapter in UNICEF assistance that was to reach almost 100 countries around the world. It was, as Martin Beyer's account suggests, an exciting time indeed, and I hope some of this excitement comes through in the present edited text.

John Balcomb

PART I -- UNICEF'S ROLE IN WATER AND SANITATION

Looking back from a unique award

On June 15, 1985, UNICEF received a unique award: a huge clear drop of Belgian Val St. Lambert glass crystal, for its decades-long efforts to help put water resources to good use by communities in the poorest areas of about a hundred countries in the Americas, Africa, Asia and the Pacific. The occasion was the Fifth International Water Resources Congress in Brussels and the speaker who presented the "Crystal Drop Award" to UNICEF -- the first organization to receive it -- was Dr. Alexander King, president of the Club of Rome, the famous association of scientists from 45 countries concerned with the future of humanity.

UNICEF's involvement in community water supply and sanitation had by that time become one of its largest and most visible activities. But it was just part of its efforts to help ensure the survival, health and well-being of children and -- by implication -- their mothers and the rest of their communities. And whatever it was achieving in water and sanitation in cooperation with assisted governments would not have been possible without interaction and linking among various child-related sectors, including health, education, food and nutrition, and social welfare.

UNICEF has now (1987) been involved in water and sanitation for more than 30 years. Its really large-scale involvement in programmes tending toward nation-wide coverage goes back almost twenty years. In some countries, notably in south and south-east Asia, there is a good chance that most inhabitants will have access to a satisfactory if not luxurious supply of fresh water for drinking, personal hygiene, and other domestic purposes. Sanitation is lagging far behind for a number of behavioral and other reasons, but it has at least become an issue, with some countries trying to tackle it on a large scale.

The environmental and other problems of our globe appear quite overwhelming, particularly in view of the present, still-continuing increase in the world's population. UNICEF's inputs, as compared to those of governments, communities, and other agencies, are very modest. But actions to overcome negative situations do stand a chance of a breakthrough when improvements begin to be continuous and when countries and communities begin to manage on their own. This is clearly visible in the field of water and sanitation. Within months of its launching, a community water supply scheme can show rapid progress not only in the provision of safe water itself but in terms of people's awareness of its importance and usefulness. In terms of a more lasting effect on communities and governments, including proper organization and upkeep of the installations on a nation-wide basis, things may take a good deal longer -- ten to fifteen years or more.

UNICEF's expenditure for water supply and sanitation in 1985 reached \$58 million. This was spent in some 95 countries. The amount of UNICEF funds spent in water supply and sanitation programmes from 1947 through 1985 adds up to approximately 500 million dollars. Total funding for the same UNICEF-assisted country programmes, including government and community inputs

as well as other external contributions, are on an order of magnitude of several billion dollars.

In recent years 15-20 million people per year have benefitted directly from the UNICEF inputs in water-supply schemes, as against 2-4 million people benefitting from similar inputs in sanitation. The total number of beneficiaries from all the water and sanitation programmes with which UNICEF has been involved in some way is estimated on the order of 150 million. How much still remains to be done is suggested by the fact that an estimated 1.3 billion people still lack adequate household water supplies and 1.9 billion people lack adequate sanitation.

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UNICEF's role is two-fold

First, water and sanitation are seen as basic needs. Without water people cannot survive. Without sanitation people and especially children are left much more vulnerable to the risk of infections through a number of communicable diseases, including many forms of diarrhoeas and skin and eye diseases. UNICEF inputs in these fields supplement other actions for the survival and development of children and help demonstrate the effects and importance of using simple, low-cost means.

Second, UNICEF in close coordination and cooperation with other internationally active organizations -- given the limited funding and technical expertise available to the group as a whole -- helps meet a major need. This pertains especially to many of the poorest areas in developing countries, where few other external organizations venture or would be allowed to work. Beginning in the 1970s, UNICEF played a distinctive role in pushing low-cost technologies, whereas most of the others were concentrating on higher technologies suitable primarily for urban systems.

In keeping with its general goal of improving the well-being of children and women, UNICEF therefore supports the development of drinking-water supply and improved environmental sanitation in rural areas, urban slums, and shanty-towns of developing countries. It seeks to build national capacities through the provision of technical, financial and material support to national planning and programming for water and sanitation, including community mobilization and health education, as part of primary health care.

Water and sanitation projects tend to be capital intensive. This posed special problems for UNICEF with the spectacular increase in activities that took place in the 1970s. Thus, in 1969 UNICEF expenditure on water and sanitation came to \$2 million. By 1982-1984 yearly expenditure was topping out at around \$70 million. With such a demand for funds, UNICEF could not rely on its regular budget alone. This led to the necessity of meeting an increasing part of the water and sanitation requirements through supplementary funding, principally through "noted" projects which could be adopted by one or more donors. In 1985 such special contributions accounted for 55 per cent of all funding for water supply and sanitation. Fortunately, there is an inherent drama about water supply projects, and the efforts of UNICEF's

Programme Funding Office, at first under the leadership of a flamboyant Dutch historian named Victor Beerman, were notably successful in "selling" the projects to donors. (It was said of Beerman, that his powers of persuasion could make stones weep.)

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Technological and social strategies

Part II of this history, "Development Through the Decades", traces the growth of UNICEF's increasing involvement in water and sanitation and the evolution of its policies from 1946 to 1986, a period of 40 years. Here will be found accounts of the technological, social, and other challenges that were encountered and, to a certain degree, overcome on a region by region and country by country basis. The relative independence of UNICEF's field offices and the flexibility allowed to country, area, and regional representatives encouraged the design of programmes and projects taking into account a wide range of local needs, conditions, and resources. At the same time certain common, overall strategic principles emerged which it may be well to stress here at the very beginning.

:The technological background

The many hundreds of millions of people living under conditions of extreme poverty in physically difficult terrains who have need of water and sanitation presented a seemingly insoluble problem. The first step taken was to identify and develop technologies which would allow for low-cost approaches and make it possible for the communities themselves to undertake a part of the construction work and take responsibility for the use and upkeep of the installations, including their operation, maintenance and repairs.

Fresh water, a renewable resource in theory, is not readily available everywhere. Surface waters, with few exceptions, are contaminated with disease-carriers and are often available only during the rainy season. Consequently, the solution had to be sought in using groundwater occurrences, through digging or drilling wells, or, in hilly and mountainous regions by harnessing natural springs. Groundwater furthermore has the advantage of being filtered by its passage through soil beds and rock formations.

During the 1960s a technical revolution took place in water well drilling with the development of rapid compressed air drilling methods and other improvements, e.g. the application of hydraulic drive heads in rotary drilling and the use of new additives to the drilling media, such as polymers, for stabilizing borehole walls. With the rapid spread of water well drilling, handpumps had to be improved for continuous heavy use by hundreds of villagers for each pump. For piped schemes, new plastic products provided longer life and easier handling. Old "appropriate" technologies for water treatment were revived, like slow sand filtration. New insights in the epidemiology of water-, excreta- and other dirt-related diseases, combined with developments in East Asia, Southern Africa and Europe, prompted new designs of excreta disposal facilities.

All these changes were incorporated in the technological approaches followed in UNICEF-assisted programme projects. They were made prominent parts of the

new programme strategies towards the end of 1960s. Also, they made it possible to attack the problem on a much larger scale than was possible before.

:Social approaches

The technological revolution that would make it possible for the benefits of water and sanitation to reach unserved populations called for a new approach to potential users and their communities. The recognition of this need coincided with what was developing in the other fields of UNICEF-related work.

At first the introduction of new "hardware"-oriented technologies to rural areas had tended to overlook the human dimension. Government drilling teams rushed in with mighty machines, drilled holes in the ground in a jiffy, plunked in their handpumps, and then left, leaving the villagers to fend for themselves. The results were often disastrous. Thousands of pumps would soon fall into disuse, broken or idle for want of maintenance and repair.

The communities had to be stimulated into turning external assistance into self-help. Age-old social structures, habits, attitudes and beliefs had to be redesigned for a two-way traffic of ideas and inputs. A number of major issues had to be tackled jointly, including the need to integrate the water supply and sanitation components with those of the other fields: health services, education, family food production, and nutrition.

With the need recognised for promoting community motivation and participation (now known as "social mobilisation"), new elements such as Project Support Communication were incorporated in UNICEF's work. Another favorable factor was the development and application of Primary Health Care (PHC). Elements of health and sanitation education and women's advancement were added. Part of UNICEF's basic services approach from the outset, they were not easy to put into practice in country programmes. One major reason for this was that rural water supply was usually dealt with separately from other aspects of community and agricultural development. UNICEF advocacy for integrated services foreshadowed practices now accepted by most governments.

These developments coincided with the beginning of the International Drinking Water Supply and Sanitation Decade (1980-1990), and in the country conferences and seminars that followed, the elements of social mobilization were strongly emphasized.

An important development was the introduction of stronger health education components in country programmes. Though the need had been perfectly obvious to anyone visiting field projects, health education, until a beginning was made around 1979, had been rarely linked to water and sanitation programmes. A kind of breakthrough was achieved when a senior specialist in health education was dispatched to a difficult project area in Pakistan. The officer, a female health educator, started a completely new trend by successfully promoting sanitation teams consisting of men and women for villages in rural Pakistan. Health education efforts have subsequently crept into other country programmes, though not as universally as would be desirable. The trend is now to combine the health education elements of water and sanitation programmes with the promotion of other health elements, notably child survival actions.

Water and sanitation are basic concerns of women. They are the traditional carriers of water, devoting a large part of their time and energy to this arduous task. For hygiene and privacy, both for themselves and for their families, they are dependent on adequate sanitation. Women's participation in planning, implementation, and maintenance of water and sanitation facilities can become a major factor in improving their status in the community.

Women's involvement is closely linked to human resources development, which includes the training of a wide range of people in planning, management and implementation of water and sanitation-related work. The skills and capacities being developed in different countries include those of villagers as well as government officials. Curricula include not only technical matters but anything that helps bring water and sanitation to the people.

:Management and support

A good part of UNICEF's achievements across the board are related to its effective management and support structure. The magnitude and strong technological orientation of the organization's work in water and sanitation placed particular demands on backup along these lines. From 1980 on, UNICEF developed a strong staff support structure for planning and implementation of water, sanitation, and later, health education. By 1985 this consisted of 130 specialists in 30 field offices. Backstopping and coordination is provided by the small WET section (Water and Environmental Sanitation Team) in the Programme Development and Planning Division in New York.

The work of the field specialists has been critical to the success of UNICEF's assistance. Experience has shown that once UNICEF's inputs exceed a certain threshold (as a rule of thumb, around \$500,000 per year) a specialist's work pays for itself in better planning and programming and in increasing efficiency in the use of equipment and supplies. For all practical purposes, these colleagues are an integral part of the field offices where they serve.

Over the last twelve years, WET has gradually become a focal point for the exchange of information between UNICEF, the Field Offices, other organizations, suppliers of equipment and materials and interested individuals. There has been an unending stream of documentation and messages, especially useful in the '70s, when there were only a few organizations dealing with low-cost approaches.

PART II -- DEVELOPMENT THROUGH THE DECADES: LEARNING FROM EXPERIENCE

THREE PHASES

UNICEF's involvement in water and sanitation over the organization's first 40 years, 1946-1986, evolved through a process of trial and error and reflected the major trends and shifts in UNICEF's overall activities and policies. There were three distinct phases:

<u>PHASE</u> (US\$ dollars)	<u>PERIOD</u>	<u>ANNUAL UNICEF FUNDING CHARACTERISTICS</u>
I. 1946-1967	<u>Demonstration projects</u>	Less than \$2 million
II. 1968-1980	<u>Development of technologies, targets and policies</u>	\$2-\$50 million
III. 1981 through 1986	<u>Clarification of objectives and links with PHC and CSDR</u>	Over \$50 million

DEMONSTRATION PROJECTS

Phase I (1946-1967) began with scattered efforts in the rural areas of a few countries, as it was increasingly realized that child health was dependent on safe water supply and adequate sanitation. There was a close collaboration with WHO at the country level for technical backstopping. The volume of work and the number of beneficiaries was small. The outcome probably led more towards gaining technical experience for the UNICEF field offices than to providing a lead in the development of national policies and programmes for water supply and sanitation. It was during this period that the first two WHO/UNICEF Joint Committee on Health Policy (JCHP) studies on water and sanitation were prepared. These laid the groundwork for the joint policies which govern UNICEF's action on a much larger scale today.

In this "demonstration project" phase, UNICEF aid was at first restricted to water supply and sanitation in health care facilities and in schools. Some of the earliest programmes were in Central America. The first project to be assisted through pumps and stipends for the training of sanitarians was in Panama (1954). Within five years assistance in the form of supplies and training stipends had been extended, with WHO technical approval, to 33 projects, 18 of which were in Latin American, the others scattered over Africa, the Middle East, Europe, South-East Asia and the Western Pacific.

During this period perceptions about water and sanitation were still conditioned by the notion of large public works, into which UNICEF resources would have vanished liked a drop in a bucket. The idea, therefore, was that UNICEF assistance should act as a "catalyst", establishing a model for much larger projects funded from national budgets and supported by better-endowed bilateral or multilateral resources. In some instances, this strategy worked. In Peru, for example, a WHO/UNICEF-supported demonstration project in a small area led directly to government adoption of a national scheme to bring gravity-fed piped water to every village, with the help of external loans.

But the results were not uniformly encouraging, as was revealed in a survey undertaken at the request of the 1965 Executive Board -- a survey which included on-site evaluations in eight of the 80 countries with whose water authorities UNICEF was cooperating. In West Pakistan an ambitious programme to provide water to a thousand rural communities had overextended the resources of the public health engineering department, and much of the equipment brought in by UNICEF was lying around unused. This was embarrassing since this was the largest water programme UNICEF had supported up to that time.

In most cases it proved unrealistic to expect that a demonstration project on a small scale would blossom into a national rural water grid: by and large the governments concerned simply did not have the resources, nor did they attach a high priority to rural water supply and its essential concomitant, rural excreta disposal. Meanwhile, however, the "customers" for pipes and water -- the villagers of the developing countries -- were keen for water, and they usually co-operated in "self-help" and "community participation" schemes to cut the costs of water projects through voluntary labor for digging wells or trenches for pipelines or carting stones for catchment dams. But usually the village people valued these new sources of

water as a convenience, not a health aid. This dichotomy between water as an engineering achievement and as a bringer of health haunted water supply and sanitation schemes then and has continued to do so down through the years.

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1968-1980: GOING TO SCALE -- NEW TECHNOLOGIES, AMBITIOUS TARGETS

Phase II (1968 - 1980) saw UNICEF entering the village water supply field on a large scale as new technologies came on the scene, as national targets were set, and as new policies were elaborated. This was the period during which UNICEF took off to become one of the major, if not the major, external agency in promoting the new technologies and strategies to help the poorest areas in the world to obtain safe water and sanitation.

A number of major trends could be noted:

- * Most of the large government programmes with UNICEF input began with relief operations in emergency situations. These were rapidly turned into rehabilitation of the affected areas. Finally, installations were carried out so as to serve longer term goals. The ground was laid for achieving nation-wide coverage, eventually codified under the targets of the Water Decade.
- * During the latter part of the period, environmental sanitation, notably excreta disposal, began to win greater acceptance among people and politicians in some major countries. Limited country experiences in health education linked with water and sanitation began to spread to other countries.
- * The feasibility and acceptability of low-cost technologies for both water and sanitation was established. A technical revolution in water well drilling methods was accompanied by new concepts for handpumps and new materials and standards. Likewise, waste and notably excreta disposal were influenced by new ideas and new understanding of disease transmittal. All of this made possible a more rapid spread of water and sanitation among the millions, nay, billions of people, who urgently needed such services.
- * After a number of haphazard and improvised starts, valuable technical, social, planning and programming experience accumulated through various national programmes. This body of experience was reflected in joint UNICEF/WHO policies which could be applied to further programmes.
- * National governments, along with international agencies -- intergovernmental, bilateral, and voluntary -- began to coordinate their efforts in an organized manner.

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UNICEF involvement through emergencies

The year 1968, which marked the beginning of large-scale involvement of UNICEF in water supply, was the year when the government of India came with its first request for large-scale assistance to the then newly-conceived India village water programme. It was prompted by the drought in the East-Central India States of Bihar and Orissa in 1966-67. This catastrophe which was accompanied by widespread famine threatened the lives of millions of people. As in other droughts, the effects were caused by an unholy combination of the absence of rainfall for consecutive years, a deterioration of the soils and the vegetation through overworking by a steadily increasing population, and the absence of technical means and know-how to tap the underground water resources.

The Bihar and Orissa drought was only the first of a series of emergencies that, during an eight to ten-year period, would draw UNICEF willy-nilly, to a much greater extent than had been originally foreseen, into assisting water supply and later sanitation programmes. The drought in India was followed by the horrors of the liberation war in Bangladesh, which resulted in the widespread destruction of whatever infrastructure had existed in the earlier East Pakistan -- a catastrophe further compounded by enormous floods which followed shortly thereafter. Other emergencies which accelerated UNICEF's involvement in water and sanitation included the Indus River floods in Pakistan's Sind province in 1972, the great Sahel drought emergency of 1972-73 in Africa, and subsequent civil strife and warfare in several African countries, including Sudan, Mozambique, and Angola. The emphasis to begin with was on water supply, for in these emergency situations the first concern was survival. It was only toward the end of this period, when programmes were growing to national scale, that in some important projects sanitation and health education began to receive their due consideration.

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The big push in Asia, 1968-1980

:Village water supply in India - A model programme

Since India was the country where UNICEF's large-scale cooperation in village water supply began, early developments in that country merit a somewhat detailed description. UNICEF's input in India was the first to be carried out in cooperation with a government that, from the outset, was aiming to provide its poorest populations with reasonable access to safe water on a nationwide scale within a scheduled time frame. It was also in India that the first coherently planned programme for water well drilling along with handpump installation took shape. The India village water programme since then has served as a model, both technically and from a programming and strategic point of view, for developments in other countries with similar conditions.

Among the many problems besetting rural water supply in India are the hydrology and hydrogeology of that country. Year-around sources of surface water are limited to few and far-between rivers, the same rivers being used both for water supply and as deposits for all sorts of waste. Over large parts of the country there are small and large dams ("tanks") which serve

for irrigation, cattle-watering and household purposes. These are normally filled during the monsoon period, but most of them are empty after a few months of use, with easily another six months to go to the next rains. For year-around use, most of the rural people have traditionally dug open wells. Many of those are so-called step wells, some of them very large, which could be likened to inverted pyramids. Many are very old, some probably pre-historic. They were excavated when the population of the sub-continent was far less numerous, when there was much more protective vegetation and soil cover, and when the groundwater was not being tapped at the rate it is today. Thus, the water table lay much higher and could reasonably be relied upon for an all-year-round supply.

With the tremendous population increase, especially during the last forty to fifty years, the forests were largely felled to yield room for increased acreage and for construction and fuel wood. Modern industries, large and small, were introduced, many of them also in the countryside. Farmers who could afford it had deep wells drilled and power pumps installed in order to increase their crops. All of this contributed to drawing down the water table catastrophically for the open wells and the communities using them.

With the lowering of the water table, the open wells could not be deepened with the few hand-tools available to the villagers. During the early 1960s, attempts were made to develop methods with light-weight rigs ("bench drills") to drill horizontally through the rocks at the bottom of the open wells to open new channels for groundwater ("revitalization"). This was a temporary success but did not really improve the overall situation. In addition there was the problem of pollution of the water in the open wells -- especially the step-wells, where every day hundreds of villagers climbed down to fill their jugs and jars.

The boundary between the hard rock formations that underlie the largest part of India and their very irregular cover of softer, weathered and alluvial soils roughly marks the old water table which was running dry. When the drought in Bihar and Orissa hit these unfortunate states, it exacerbated a situation which already caused problems all over the country. People would have to try to get to deeper occurrences of ground water. Short of blasting shafts into the underlying hard rock, an exceedingly expensive and difficult process, the only possibility was to drill water wells.

Up until about 1960, only slow drilling methods were available. One was the so-called "calyx" method, in which slowly rotating steel pipes were worked into the ground with steel shot added to wear down the rock. It could take a year or more in one hole to reach the required depth. The other method was cable-tool drilling, which with the old-fashioned equipment available in India could take three to four months to drill a "tubewell" to a depth of 50 metres (150 feet).

:The arrival of new drilling methods

Just in the nick of time, it proved possible to alleviate some of the worst effects of the drought in eastern India through new drilling methods. In the early 1960s, rigs driven by compressed air that could cut through hard-rock with percussion hammers were used for the first time, in a few cases, to drill water wells. Such machines had been used since the

beginning of the century to drill blast holes for mining and engineering construction. But only with new advances in metallurgy (especially for the drill bits and drill steels) and in pneumatic and hydraulic machine engineering was it possible to drill holes to the depth required for effective well drilling. The new technology had only recently proved to be a feasible one in a few industrial countries, such as Sweden, the United States, and Canada.

In India, several non-governmental organizations which dealt with agricultural development such as War-on-Want, AFPRO (Action for Food Production), the Betul Movement and others had imported a few of these rigs from different manufacturers. The first use of down-the-hole hammer equipment was introduced by the Reverend John McLeod, a Church of Scotland missionary, in the early 1960s. The new rigs successfully drilled wells to a depth of 50-metres in hard rock, such as gneiss or granite, within a shift of eight hours. At the same time, some of these non-governmental organizations pioneered new types of handpumps that would stand up better to the wear and tear of the hundreds of villagers using them at each water point.

During the drought in Bihar and Orissa, some of these NGOs rushed their drill rigs to those unfortunate States and began water well drilling. Even though they represented only the literal drop in the bucket, these drilled wells were an instant success. Among those who brought in drill rigs was Malcolm Kennedy, a New Zealander who worked for one of the NGOs, AFPRO, and who was shortly to head UNICEF's water section for India. In Bombay, a young Indian mechanical engineer had just set up his own contracting firm with two very small drill rigs, intending to drill relatively shallow wells in the backyards of Bombay households. He had hardly established his business when he was engaged by UNICEF to bring his small rigs to Bihar - along with their compressors - and to begin punching holes in the ground and installing handpumps in some of the worst affected areas. This was Kumar Jagtiani, who thus became one of the two pioneers, along with Kennedy, in UNICEF's involvement in low-cost water supply for villages in hard rock areas.

The instant success of the new rigs was impressive, and the UNICEF regional office saw and grasped the opportunity for a much greater breakthrough. Consultations with the responsible authorities in India led to an official request by the Government that UNICEF provide 70 or 80 air-hammer drill rigs for the beginning of a nation-wide village water programme. It aimed, in the first instance, to fill the water supply needs of the approximately 125,000 villages that formed the absolutely poorest and most under-served, or totally unserved, communities in India, out of a total of 650,000 villages in the entire country.

Feeling it needed a "second opinion" for what was for it a new field of action, UNICEF first approached WHO which was asked to set up a fact-finding mission of specialists to visit India to assess the situation and make recommendations on the drilling programme. Because of the new technologies involved, it was evident, however, that it would take WHO a long time to find the necessary specialists. With India's urgent request on the table - which foresaw UNICEF assistance of some US \$5 or \$6 million over three years beginning in 1970 -- UNICEF felt it could not wait so long. It turned to a

Swedish firm, Terratest AB, consultants and contractors for minerals and groundwater prospecting, to carry out the assessment. The report of the Terratest mission was to serve as background information to the 1970 session of the Executive Board for its decision approving the project - a project that would constitute UNICEF's largest single programme input anywhere up to that time. The objectives were quite clear, although the targets in those days seemed formidable. No one had ever been confronted with a situation that already for the first two or three years of the programme foresaw the drilling of over 8,000 wells in the State of Andhra Pradesh alone, not to speak of some vague plans for 25,000 more wells in Orissa. Nobody then could foresee that something like 100,000 wells for handpump installation would be drilled annually in India. The risk that UNICEF took by supporting this first really major part of the programme, was considerable. But, as Gordon Carter, then UNICEF's Regional Director, recalls, "The first lot of rigs were literally nursed onto the job by our people, and even as numbers grew, programme and project staff kept a pretty close eye on them." The drilling programme as it rapidly expanded was an outstanding success.

:The handpump problem: the India mark-II handpump

With the exception of a handful of master drillers to be brought in by UNICEF for several years to train national drillers, it was foreseen that the Government of India would handle the rest of the programme, including installation of handpumps, sanitation and sanitary education, on its own. It soon developed, however, that the handpumps which were to be fitted to the new village wells presented a considerable problem in their own right. No one in the world had had much experience in the use of deep-well handpumps by larger village populations on such a scale. There were a few water well drillers and handpump manufacturers in the world that had come up with relatively good solutions at a much earlier stage. Among them was the Craelius East African Drilling Company with its so-called "Uganda" handpump. It was made of standard hardware and had a giant mahogany handle and could be repaired and maintained locally. Most of the handpumps available in India and manufactured there in those days, were cast iron pumps of the traditional type as developed in Europe and North America for single-farm households. They were fine for families of a few persons and a total use of a few minutes per day. No provision to speak of had been made for any organized maintenance and repair of such pumps. Everyone just went optimistically into this whole programme.

Martin Beyer, who along with Alge Messing, had made up the Terratest survey team, later joined UNICEF and in 1973 established the nucleus of the Water and Environmental Sanitation Team (WET for short) at Headquarters in New York. One of his first visitors was the director of Rädde Barnen, the Swedish Save the Children Fund, who had just returned from India with an alarming report of the very high proportion of village handpumps which were out of order in the UNICEF-aided water projects he had visited. This was disconcerting intelligence indeed. But in the meantime, UNICEF in India had been monitoring the whole situation and were working hard on solving the problem.

Two convergent approaches were chosen. One was to improve the materials and design of the handpump. The other was to secure proper operation, maintenance and repairs of the pumps, which was a matter requiring major

improvements in the social approaches to the villages and the villagers. The persons who mainly contributed to the development of the India Mark-II handpump, which was eventually adopted as a national standard, were Rupert Talbot, a young British engineer, who was to become one of UNICEF's most experienced specialists in water well drilling cum handpump programmes, and an Australian rural water supply specialist, Ken McLeod (now a consultant to UNDP/World Bank). They started with a handpump that different NGOs had helped develop and which had a number of innovative technical design features (steel handle, ball bearings for the fulcrum, circle quadrant and chain to link the handle with the pump rods, angled spout etc.). From the latest version of this pump, Talbot and McLeod went on to develop the present standard Mark-II design. In its later phases their work was carried on jointly with the Mechanical Research and Development Organization of the Government of India, MERADO, and the engineers and management of the government-owned steel manufacturing company, Richardson and Cruddas, both in Madras. From 1976 onwards, the India Mark-II Handpump went into production on a large scale, which by 1986, amounted to 150,000 pumps per year. The manufacture was carried out by some 40 officially recognized manufacturers who agreed to submit to the very crucial quality control.

That much of this development took place in the State of Tamil Nadu was not a coincidence. Tamil Nadu has one of the best state organizations for water supply, the Tamil Nadu Water and Drainage Board, with ramifications to rural and agricultural development. The state of Tamil Nadu was also to pioneer in innovative social approaches to the villagers to create a viable maintenance system. This was the responsibility of Mr. Francis, the state's Assistant Director of Agricultural Development. In the environs of his home town, Tirunelveli, Francis developed the so-called "three-tier system". It is based on village handpump caretakers in the "tier" at village level. They are responsible for the regular maintenance and supervision of the pumps. The handpump caretakers are selected by the Block Development Officers and given a crash course of two or three days in handpump operation and maintenance. The caretakers are reinforced by a second "tier" of roving mechanics, each having 100 village pumps to inspect, who help the caretakers with minor repairs. Finally, the third "tier" consists of a district-based maintenance team with a truck and a tripod for pulling out the rather heavy rising main.

Even though the organized maintenance of the handpumps still only reaches a minor part of all the pumps installed, it is remarkable how high a percentage of the pumps are functioning. A recent evaluation shows that the average number of pumps functioning at any given time in four sampled areas throughout India amounts to about 85%. Most of the maintenance carried out seems one way or the other to be spontaneous. This is a sign that the local populations give a high priority to the pumps and try to keep them up, as they would do with their trucks or bicycles.

:Sanitation in India: The Gandhi legacy

The need for proper environmental sanitation, notably excreta disposal, was known all the time, but there seemed to be no viable way to really get people in the communities, as well as in the government agencies and at political levels, to accept the idea. Not that India was completely unfamiliar with the concept of sanitation. It had been strongly promoted by

Mahatma Gandhi. Somewhere in his memoirs he gives a vivid description of how impressed he was as a small child, when one day his father, who was the vizier, or Prime Minister, of the Maharaja of Porbandar in Gujarat, got fed up with the filth of his own rambling house and forced the family members to all participate in a total scrubbing and cleaning up of the household. Gandhi's own promotional work may not have gone far towards national coverage, but to many it did constitute a valid argument for more large-scale promotion of such activities.

When the UNICEF WET advisers met to discuss what could be done with their colleagues in the WHO Regional Office for Southeast Asia in New Delhi, someone said, "Oh, we tried to introduce latrines in Uttar Pradesh 25 years ago and it failed utterly. Forget about it." Nevertheless, the discussion resulted in the secondment from WHO's Regional Office of an energetic sanitary engineer from the Philippines, Alberto (Bert) Besa, who moved over to the UNICEF Regional Office. Bert Besa, with his good knowledge of the country and with his close links country-wide with professional engineering and public health colleagues, was able through his insistent campaigning to encourage positive trends that were latent and to get the ball rolling.

In 1978 the Ministry of Works and Housing, along with the Ministry of Health, called a major conference on environmental sanitation in Patna, the capital of Bihar. There the chief engineers and their assistants and representatives of health authorities from all the states of India gathered in order to work out a national plan for sanitation. Discussions revealed a few encouraging experiences such as those of communal latrines in Patna itself and from Ahmedabad in Gujarat. Local NGOs had installed these latrines, which gained rapid popularity through being equipped with shower facilities. For a few paise anyone could go in there, relieve themselves, and then have a good shower with a small piece of soap provided by a paid attendant who would keep the place clean.

Apart from Besa's campaigning, a major factor prompting the meeting in Patna and the resulting national plan was the defection of the Harijan "scavengers" -- the caste-less people who until the end of the 1970s constituted India's corps of night soil collectors. As they gained political influence (again one of the Mahatma Gandhi's major achievements), the night soil carriers got better job opportunities and defected en masse from the defecating. The results were both inconvenient and dangerous, as their former clients, the city and town dwellers were left almost literally up to their necks in the muck.

Beginning with the Patna meeting's examination of the means and modalities to change and improve the sanitation conditions in India, a better atmosphere began to develop for UNICEF/WHO cooperation with the government in this field. It took some time for this process to take place. Nevertheless, awareness of the importance of sanitation started to spread to the rural countryside as well as to urban areas and could later, in the 1980s, be combined with other means of combatting diarrheal diseases among children.

The water and sanitation components in UNICEF's programme inputs in India grew almost from scratch in 1970 to the present roughly \$15 million (1986). Yet this is a small amount compared with the Government of India's present

budget of \$650 million for these purposes. In 1985 there were in India 3,000 rapid-action drilling rigs, and thousands of engineers, water well drillers, administrative staff and others were involved. A corresponding build-up of the water and environmental sanitation support staff in the UNICEF offices had also taken place. Although the work is now being done entirely by Indian nationals in the different states, the international and national UNICEF specialists in India still make up one of the largest project support sections in UNICEF anywhere. The reason for this is the continued need to assist in planning and training in a technical field that is under constant development, in regard to drill rigs, water well construction methods and handpump designs. There is a continuing need for support to the very intricate commercial and industrial aspects of the handpump manufacture. This also pertains to the efforts to introduce and develop sanitation methods and approaches, which has led to the build-up of a UNICEF staff group of sanitation and health education specialists.

:Bangladesh - sludging tubewells by hand

If the advent of high-speed hard-rock drilling rigs paved the way for WET developments in India in the early 1970s, it was the refinement of existing local technologies that led the way in neighboring Bangladesh, the scene of the second largest UNICEF/Government water and sanitation scheme in Asia. UNICEF had already begun to support community water supply with handpumps in that country when it was still East Pakistan, before the liberation war of 1971. But it was only in the aftermath of that terrible war and the flood soon after that UNICEF's inputs accelerated in earnest.

Almost all of Bangladesh is underlain by the soft and relatively permeable sediments of the great Ganges and Brahmaputra rivers that come silt-laden from the North India plain and the Himalayas to form the Padma River flowing to the Bay of Bengal. In the early years of the 1970s, the water table in large parts of the country was still only a few feet below its flat surface. Here tubewells could be sunk through an incredibly simple method, the so-called "sludging" method. This was carried out by local contractors with nothing more than a few bamboo poles for a derrick, a string of standard 1-1/2 inch galvanized pipes, and a chain to link the pipes to a bamboo lever laid across a rung in the derrick. One man from the drilling crew perched on top of the derrick and acted as a human valve, while the other members of the crew pumped up the sludge of water and sand and silt in the drilling process. Once the drilling reached the necessary depth, normally 90 feet (30 metres), the hole remained open for the twenty minutes or half hour that is sufficient to install a string of plastic pipes with a screen (slotted pipe) at the bottom end and a handpump attached at the top.

In coastal areas, conditions were somewhat different. Here, the groundwater close to the surface tended to be saline. But fortunately fresh water could usually be found by drilling through clay strata to reach sand aquifers down to depths of 900 feet (300 meters). So soft were the sediments that even at these depths the fresh water could be reached through simple methods of jet drilling, and once a casing was installed the fresh water would rise to a few feet below the surface.

In those days, for the largest part of the country, it was sufficient to install so-called suction pumps with the entire pump mechanism above the

ground surface. Such pumps were manufactured throughout the country by local small foundries. With the need for much larger quantities of pumps, UNICEF's water specialists had to look for possibilities to increase production and improve the pump design.

Despite the seeming simplicity of a suction pump, pump design was fairly complicated, but after several years of development a good model was chosen as the standard one: the "Bangladesh New No. 6 Handpump". Cast iron could be kept as the basic material, since in general each pump only served a small hamlet and wear and tear was not as great as it was in India. Foundry technology was well established. There are very competent metallurgical engineers in Bangladesh, and incredibly skilled foundry workers working with simple cupola ovens in an ambience recalling iron foundries of 18th-century Europe. There were no modern safety precautions, but it was impressive to see these barefoot workers nimbly skipping over the sand floor of the foundries, two of them each time with a stretcher load of white-hot glowing molten iron in a heavy crucible between them, then carefully pouring the melt into the molds laid out on the sand floor. The government agency responsible for this handpump programme, which rapidly entailed the installation of some 90,000 suction pumps per year, is the Public Health Engineering Department. Their local offices throughout the country became the focal points for a nation-wide action, with UNICEF seconding national project officers to assist with the planning and logistics of this unusual effort. The result was a phenomenal network, supervising and directing the work of hundreds of contractor teams who now for years have "sludged" their way down into the ground and installed the handpumps and plastic pipes and screens provided by UNICEF.

The main UNICEF thrust in Bangladesh is the provision of household water, including drinking water supply. With the spread of both private and village handpumps in Bangladesh, however, a number of farmers with very small holdings above the high water mark were in need of means to increase their rice harvests. The availability of relatively low-cost (about US\$ 45 each) handpumps on a large scale now enabled them to irrigate their lands all year around, thus getting one or two additional rice harvests during the year. UNICEF supported a pilot project for the spread of such handpumps by financing a total of 30,000 handpumps on a loan basis through the local Grameen Bank, a rural credit institute. The back-breaking task of actuating a handpump for hours on end was in many cases made easier by the farmers themselves attaching treadles to operate them by foot.

:Pakistan -- follow-up to a flood

After an initial handpump programme in the 1960s which never reached fruition - probably too early an attempt - the first major effort to assist Pakistan with village water supply came about as a consequence of the floods of the Indus River in 1973, which inundated large parts of adjoining agricultural areas in the Province of Sind, all the way down to the delta east of Karachi. Thousands of villages had their wells and pumps destroyed and the old pumps had to be replaced with new ones. Thus a project for rehabilitation of the wells and the installation of some 8,000 handpumps was launched, financed partly by UNICEF, partly by USAID. A local handpump manufactured in Sukkur was to be used. It was built of standard galvanized iron pipe components, and might be termed moderately successful, since it was relatively easy to repair and replace. But somehow this first programme, relatively large as it was, never made a big splash.

More successful, eventually, were projects in the rugged north and northwest, where both government officials and the local people eagerly grasped the opportunities for UNICEF assistance in bringing water from newly-protected springs or newly-drilled wells down to the relatively isolated valley villages.

:Burma's dry zone

In Burma the Government solicited UNICEF's assistance in providing clean water for villages in its dry zone, extending north beyond Mandalay for about 500 km., an area with about ten million inhabitants. Here water was fetched by women carrying jars on their heads or in wooden vats on oxcarts from sources up to 25 km. distant.

The government's programme to alleviate the water needs of the most affected villages was ambitious, targeted to reach a population of 2.5 million over a five-year period. It was therefore necessary to provide up-to-date water well drilling equipment and adequate pumps. Since so many people were to be served by each system, sometimes over 1,000 users per pump, it was necessary to supply engine pumps. For each pump, a cistern with a number of taps was constructed. The villagers would then take care of the operation and maintenance. A payment system was instituted with payment of a few copper coins per jar filled.

Fortunately enough, the government agency responsible for the programme, the Rural Water Supply Division of the Agricultural Mechanization Department, was eagerly prepared to take on this huge task. UNICEF after helping secure the completion of the 3,000 water wells in the Dry Zone, went on to support low-cost, community self-help schemes for protected, dug water wells and latrines in the geologically easier regions closer to the coast.

:Gravity feed in Nepal and Afghanistan

New developments in low-cost, easily workable plastic pipes constituted the "technical breakthrough" that enabled UNICEF to provide cost-effective assistance to a variety of gravity-feed systems in mountainous areas. Among other things, PVC (polyvinyl chloride) was in many cases superseded by HDP (high density polyethylene), which was more resistant to wear and tear on rocky surfaces.

In Nepal UNICEF assistance to water supply began with the protection of springs and the installation of gravity-feed pipelines to villages down the mountain slopes. The distances, the very high mountains (the great Himalayas), and the very thin roadnet -- or complete absence of roads -- necessitated a special set-up. During the 1970s a whole network of field offices was established by UNICEF to house its young engineers, both expatriates and Nepali nationals, who would locally plan and supervise the implementation of the individual projects. Water supply also gradually, more so in the 1980s, would be accompanied by pilot projects for sanitation, i.e. latrine construction.

For many years, from 1973 on, this operation from UNICEF's side was headed by Leo Goulet, a Canadian geologist. Leo's job was to direct assistance to villages which in extreme cases, as in Western Nepal, might be two-weeks'

journey by foot from the nearest road-head. During the first two or three years, this implied helicopter transport of the heavy coils of HDP pipes and other materials. Many villages had such difficult access that even the Sherpas, who helped conquer Mount Everest and other mountain giants, simply refused to lend a hand in carrying these pipes.

If any project illustrates how water supply close to home can relieve women's drudgery, it is the one in Nepal. Women in Nepal are hardly better than donkeys in terms of the loads that they are required to carry. These ladies of small stature, under-nourished and worn out, are seen carrying cement bags of 30 kilograms or backpacking loads of firewood or water containers with similar weights for miles and miles on end over trails rising and falling thousands of metres. The advent of piped water supply in any village saves each woman hours of backbreaking work and an energy expenditure of over a thousand calories per day.

In Afghanistan similar topography suggested widespread use of spring-fed gravity-flow systems, replacing the trek of often several miles for the women up and down mountain sides. But in traditional Afghan society all decisions were made by the men, and the question of women's drudgery was almost completely disregarded at first in community deliberations. (In some villages, the entire population would run into the hills when the first survey teams arrived. The villagers thought that these were tax collectors.)

Once, however, the first few installations had been made, the convenience and advantages of it were not only clear to the people who benefitted immediately, but caused villagers in a wide periphery around the first project areas to come in with their petitions to the Government and UNICEF to obtain installations of their own. These documents were rather remarkable in themselves, written in Dari, the local language, and signed with scores of thumb prints.

:Moving away from conventional schemes elsewhere in Asia

In those instances in Asia where UNICEF's assistance went to more conventional schemes the results were not encouraging in terms of meeting needs on a large scale at an affordable cost. In Sri Lanka (then Ceylon), for example, a programme launched in 1972 to bring piped chlorinated water to public standposts in 100 villages was phased out before it was more than half completed. It was a system better suited to house connections and a recovery of costs through normal water fees and would have been better financed through a loan, from the World Bank, for instance. The Philippines had already developed a sturdy handpump built of standard fittings, named the Magsaysay pump in honor of one of the country's first presidents, but at the Government's request UNICEF assistance throughout most of the 1970s went to occasional piped systems for large villages. Community participation was lively, but toward to end of the decade it was realized that the only way to provide water on a larger scale basis to a considerable population would be through handpumps.

For some years in Thailand UNICEF provided assistance to the rehabilitation of small water treatment plants in the northeastern part of the country. These small waterworks, originally constructed with U.S. bilateral aid, had quickly fallen into disuse. As time went on, UNICEF assistance increasingly

was directed to well drilling and handpump installation in this part of the country. Eventually the greatest efforts were directed towards rainwater harvesting from roofs. Some three million people were provided with huge ferrocement jars to store rainwater at their households.

The only conventional urban water project UNICEF was to assist in Asia was the rehabilitation of the city water systems in Haiphong and Hanoi in Vietnam following the end of the Vietnam war. This was considered an emergency situation and prompted a more intensive input from UNICEF's side than would otherwise have been the case. The Hanoi system had been designed in 1910 for 200,000 people. In 1977 the same system had to serve 1.2 million people through its 70-year old corroding cast-iron pipes. In 1979 and 1980 UNICEF delivered large tonnages of equipment and materials for this extensive rehabilitation job, but never received an evaluation of the outcome, which seemed to be somewhat doubtful. Later developments would direct UNICEF's assistance to the type of low-cost solutions it was becoming engaged in elsewhere, adequately supported by UNICEF project staff on the spot.

At village level in Vietnam UNICEF cooperation featured assistance to the improvement of open wells, dug by the villagers themselves, and aid to the construction of safe latrines, the famous Vietnam double vault compost latrines, allowing anaerobic fermentation of excreta into harmless, odorless, but extremely valuable fertilizer. A major UNICEF contribution to Vietnam's reconstruction in these years was construction materials, especially cement in the case of latrines. In Laos as well there was considerable emphasis on safe latrines. Here, for the first time, on a large scale, water-seal latrines were constructed with light-weight, inexpensive plastic latrine pans. The pans were imported from Malaysia where they were manufactured and built into platforms constructed from local materials.

:Indonesia - an integrated approach

In Indonesia neither a particular emergency nor a single technological breakthrough sparked UNICEF's large-scale involvement in water and sanitation. Rather, water and sanitation were brought in as a component of integrated basic services from the very beginning. Part of the work consisted of the installation of handpumps in already existing or newly dug wells, which would be adequately protected. In other cases there would be spring protection and piped water supply, especially for the villages on the slopes of the volcanoes.

It was in Indonesia, where also in a few cases - as in Nepal - use was made of hydraulic rams, a kind of self-operating water pump which lifts water through its own pressure, an ingenious invention by the brothers Montgolfier (who also invented the hot air balloon) in France 200 years ago. In two poor areas, one along the southern coast of Java and on the island of Madura, northeast of Java, the water problem had to be tackled in a different way.

Both are limestone areas with a very thin soil cover. They have the kind of topography and hydrogeological conditions that limestones show in moderate to warm humid climates: a rocky terrain ("karst") pitted with caves,

sinkholes and enlarged fissures in which water disappears for miles underground and is very hard to locate through drilling. Furthermore, being close to the coast there is a great deal of infiltration of salt sea water rendering a large part of the groundwater undrinkable. Over much of these areas as well as in some outlying small coral islands south of Java, rainwater harvesting was the only possibility. For a cost of about \$300, rainwater cisterns of ferrocement for the collection of water from the often large roofs of communal or family buildings could be installed to serve a small group of families over the worst part of the dry season. This type of project proved so successful that a major loan was later approved by the World Bank for the same purpose.

UNICEF support spread to projects in other parts of Indonesia, notably the islands of Bali, Lombok and Sulawesi. A share went also to the resettlement areas on southern Sumatra for the grandiosely planned scheme for the migration of populations from overcrowded Java. A modest component of sanitation promotion was included, but got an added push only in the 1980s.

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Africa: the challenge of drought and famine

The great drought catastrophe of 1972 - 1973, affecting first the Sahel and then Ethiopia and other parts of Africa, entrained the first major UNICEF inputs for water supply in that continent. In most countries UNICEF efforts were carried out jointly or were closely co-ordinated with those of other members of the United Nations system, bilateral aid programmes and NGOs.

The 1972 Lome Conference, arranged by UNICEF to promote planning for children and mothers in West Africa, put water high on its list of priorities. This was the beginning of awareness of the drought, which had, so to speak sneaked up on everyone. In those days the means for drought monitoring were much less developed than they are now. This is one of the reasons the more recent emergency in 1984-85 was detected earlier and was somewhat better contained, along with increased overall alertness to the problem and the use of such technical innovations as satellite imagery.

In the years 1972-1973 the Sahel countries presented a bleak picture. Fine sand and dust, eroded by the winds from the Sahara in the north and from the overgrazed Sahelian plains, covered the ground over hundreds of thousands of square kilometres which once had been cultivated fields and reasonably green pastures. Overpopulation and overgrazing together with the long absence of rain contributed to the catastrophe.

The ensuing sudden migration by large numbers of nomads and semi-nomads from the north - starving, emaciated and dying people by the hundreds of thousands -- was a terrifying phenomenon. In many areas it increased the pressure on the sedentary populations further south, who under normal conditions eked out a marginal existence and now also felt the effects of the drought.

:Reinforcing joint ventures in West Africa

In West Africa, fortunately, there already existed an infrastructure in the form of specialists from UNCTCD (the United Nations Department of Technical Cooperation for Development) whose work was funded by UNDP. For many years they had assisted a number of countries with water resources studies in the Sahelian drought belt and in the regions to the east and south of it. A number of hydrological studies had been made of the highly seasonal river flows in the great rivers, such as the Senegal and the Niger. Rather extensive groundwater studies also had been carried out. With the onset of the drought these specialists directed their efforts to water well drilling and the immediate installation of handpumps for the drought-stricken communities.

The first countries slated for immediate assistance were Senegal, Mali, Upper Volta (in 1984 renamed Burkina Faso) and Niger. There had not previously been any major UNICEF-supported water projects in any of these countries. It was therefore logical for UNICEF to provide additional equipment and materials, reinforcing the DTCD-managed projects. (Only much later, in the 1980s did UNICEF begin to set up its own posts for water and sanitation project staff in the Sahel countries, when the work had developed into a long-term concern.)

Major support went into reinforcing the national well drilling organizations such as HER (Hydraulique Equipement Rural) in Upper Volta or OFEDES (Office pour L'Exploitation des Eaux Souterraines) in Niger. The selection of well sites to be equipped with handpumps aimed at maintaining fresh water supply in areas where people were still staying - often women, children and the elderly - who had been left behind while the men went further south with their cattle in search of greener pastures. These most vulnerable remaining groups had to be helped to survive and then to create a base for better and more secure living conditions.

In the same years of the drought, during the first half of the 1970s, other joint UNCTCD/UNICEF ventures were begun in some of the countries south of the Sahel. They are in the wooded savanna and rainforest belts, with a higher rainfall but with equally difficult water resource problems. Most water resources traditionally available in the villages, were surface water courses or shallow unprotected dug wells. Therefore, again, drilled water wells and spring protection would be the only ways to provide reasonably safe water the year round. Elsewhere in West Africa in those days, and until the early 1980s, UNICEF had only small inputs.

:East Africa

The 1972-73 drought was not confined to the west but had the most severe repercussions clear across Africa to the Red Sea and the Indian Ocean. In two large countries of East Africa, Ethiopia and Sudan, UNICEF was to help carry out very large-scale water supply projects in the 1970s which would be expanded and continued into the next decade as well.

:Ethiopia - dealing with a catastrophe

In Ethiopia, the combination of drought, malnutrition, internal strife

(Eritrea, Wollo, Tigrai, etc.) and complete neglect from the side of the Imperial Government had catastrophic effects. In the words of a senior UNICEF colleague, "The government would not disclose the conditions that would spell famine, misery and death to millions of its people, to the outer world. The international organizations dared not speak up for fear of prejudicing the Ethiopian government against them and thus make any action impossible. Thus, when the first disclosure to the exterior was made of the real state of affairs by a young UNICEF Programme Officer, Stephen Green, the drought and its effects were already in an advanced stage. Stephen Green's courageous stance cost him his post for raison d'etat but triggered a massive international relief campaign." The rest is history now. Emperor Haile Selassie was deposed and replaced by a military government, the "Derg" under Colonel Haile Mariam Mengistu.

Among the direct relief actions, water supply was a prime one. Relief in terms of water supply at the same time became a first step towards rehabilitation and strengthening of the national infrastructure on a longer term basis. In spite of the miserable condition of Ethiopia and its people, two government-linked organizations stood out as effectively managed. One was Ethiopian Airlines whose good services greatly facilitated transport of people, equipment and other supplies from UNICEF. The other one was the Ethiopian Water Resources Authority (EWRA), now called the National Water Resources Commission, responsible for water supply and water resources management throughout the country. It was staffed by competent and motivated nationals such as Ato Birru Itissa, one of the Directors, and strongly assisted by a United Nations team (TAB/DTCD) headed by a Dutch hydraulic engineer, Gerry Dekker.

This provided a stable base for the UNICEF-assisted activities, which were developed successively during the years 1973-1975 and which have been maintained since. For many years, UNICEF remained highly operational, with direct inputs in the most difficult areas of drought, strife and warfare. Only by early 1984 was UNICEF's role somewhat toned down to advisory services and supplies, although a direct training component continued.

Beginning in 1973-1974, UNICEF's assistance concentrated on some of the worst hit drought areas in Wollo and Tigrai to the north and northeast of the central, rainier highlands. Later on it spread to Hararge and to the Ogaden, the hotly disputed border areas with Somalia. To this were then added a series of provinces in the southern part of the country bordering Kenya and Sudan: Bale, Sidamo and Gemmu-Goffa.

For Wollo and Tigrai with their extension into that geologically interesting but climatic hell-hole of the Danakil Depression, inhabited by the tribes of the Afar and the Issas, drilling of water wells was the only solution. Engine-driven pumps were installed to serve people, cattle and camels inasmuch as they had survived. A high priority was given to camps for the refugees from the drought and - later, especially in the Ogaden - from the border war with Somalia.

For larger camps and communities, and wherever conditions so allowed, perennial natural springs were harnessed and pipelines laid to camps, villages, even small towns. Where the technologies could be kept simple enough, the self-help element was encouraged. This was the case

particularly with the digging (manual excavation) of water wells in the south. One of the most important features of the UNICEF assistance was the training of water well drillers and engineers.

The work was never easy. Adverse geological conditions with tough basalt rocks, with an overburden boulders and loose gravel, and with highly mineralized, hot groundwater proved to be problems for drilling crews and water consumers. Add to this the long distances, few and bumpy roads, a formidable terrain and all sorts of logistics and supply difficulties. In the ports of Djibouti and Assab, imported equipment would be delayed, vying for clearance with hundreds of thousands of tons of grain and other relief items.

Political pressure, the severity of transport and outright danger to life and limb made the work difficult for the Ethiopian drillers and the few UNICEF watermen who were their instructors. UNICEF's Vlado Zakula one Sunday afternoon in Wollo literally came under crossfire between government troops and rebel forces. He had to dive for shelter from his car into a ditch, spending some very uncomfortable hours there. Normally, however, UNICEF-assisted water supply construction would never be hampered by either side in the conflict. The sanctity of water transcended any short-term considerations and UNICEF, with its staff, was too well-known and popular to warrant hostile action.

:Sudan and the "Donkey Pump"

When the drought struck across Africa south of the Sahara, the Sudan was just emerging from a state of protracted and bloody civil war, in which for seventeen years the partly Christian population of the south -- the provinces of Bahr-el-Ghazal, Upper Nile, and Equatoria -- had been fighting the Arab-speaking Sudanese of the North, including the central government in Khartoum.

When the war ended, the South was left with hundreds of thousands dead, villages that had been burned and wells that had been destroyed. Some of the wells were choked with corpses. In the centres of Juba, Wau, and Malakal, a new regional semi-autonomous government strove to introduce a semblance of order.

Such was the situation when the Norwegian Government agreed to channel \$2 million in special assistance to UNICEF for water supply in southern Sudan. Initial discussions led to the assignment of the Norwegian consultant, Per-Fredrik Tröften to the project. (Tröften, among other things, had invented a method of horizontal drilling for the "revitalization" of wells in India.) Tröften's recommendations led to the drafting of a programme for Upper Nile province, centred on Juba, which was to be carried out in cooperation with Norwegian Church Aid, long active in rural development work in Upper Nile.

Just before the beginning of implementation, however, the Sudanese government requested UNICEF to leave Juba aside and concentrate on Bahr-el-Ghazal, working out of its capital, Wau. Here the first UNICEF project manager, the Norwegian drilling engineer Per Engebak and his team, faced an unusual challenge. The nearest port was Port Sudan, connected to

Wau via Khartoum and El Obeid through a rickety railroad. It could take a month or more to get the goods through - a distance of over 2,500 kilometres. The other port was Mombasa in Kenya - which meant truck transport over about the same distance and running through Uganda, then under the unpredictable rule of Idi Amin.

Undaunted, Engebak and his companions from UNICEF, set to their task in 1976. While waiting for the trucks to arrive, they had maintenance workshops, offices, and laboratories constructed on the outskirts of Wau. The drilling equipment eventually arrived and so did the handpumps. The priority was given to the hardrock areas in the southern part of Bahr-el-Ghazal. Later these activities spread to adjoining parts of Equatoria. Drilling methods and equipment were the same as those used in India - compressed air rigs with down-the-hole hammers. The handpumps were standard India Mark II, which the workshop at Wau assembled.

For the local population, predominantly members of the Dinka tribe, the handpumps were completely new and rapidly gained popularity, being referred to as the "donkey pump". The Dinkas are stately, tall people. The men - very appropriately in the hot climate - walk about practically naked. All men at any given moment carry three or four short iron-tipped spears for hunting and for fighting. A visit to the government hospital in Gogriol, 100 kms. north of Wau in 1976 revealed that 90 out of the 100 hospital beds were occupied by men with bad cuts and gashes from fights, mainly over water. With the introduction of handpumps village by village, this epidemic of spear wounds diminished and the hospital beds could be used for the treatment of more "legitimate" sick cases.

An even greater innovation was the function of handpump caretakers selected from every village with a new pump. The caretakers-elect were assembled at central locations in their own districts and given a crash course in handpump mechanics and repairs along with a considerable amount of health education. All this was bestowed by the WHO sanitary engineer - for many years Mr. Singh - from Juba. The ambiance of the training courses was congenial and they often culminated in meals of dik-dik (a small antelope) and baboon, washed down by home-brewed beer.

A major feature of the entire programme was the development of human resources at all levels. On the managerial and technical side, one difficulty was in getting the trainees to stay on once they had learned their jobs. Either they were siphoned off by the government for high positions elsewhere or, if they were drillers or mechanics, they would succumb to the lure of the Arab Gulf States, hungry for skilled labour. Those who did stay on, however, did a fine job. They included the Sudanese manager of the project, Joseph Maker (pronounced Makkair) and the hydrogeologist Mohammed El Fatih.

Around 1978 UNICEF-assisted water supply activities spread to an area about halfway between Wau and Khartoum: Southern Kordofan, centered on the town of Kadugli. This is an extensive dry savannah, home to semi-nomadic herdsman who subsist on herds of cattle, goats, and occasional camels. The first task there was to rehabilitate the large rainwater collection basins, situated in shallow valleys, which during the brief rains would be filled with water. These basins or "hafirs" measure several hundred meters across

and serve the needs of humans and their animals. In order to desilt the "hafirs", UNICEF had to enter into the procurement of earthmoving machinery such as bulldozers and draglines - a far cry from the bedpans and baby scales of more conventional UNICEF supply lists. Somewhat later the first lightweight drill rigs arrived in Southern Kordofan. The "donkey pump" made its inroads there, too, and made it possible for the benefits of safe water supply to reach far-off villages in this desolate landscape.

As in Ethiopia, the national agency responsible for rural water supply, the National Water Board, provided a solid base for the work. It may not have been very strong in numbers, but was headed and staffed by purposeful national professionals. The drilling crews in the UNICEF-assisted projects in the South were reinforced by experienced engineers and drillers from the Water Board.

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The Middle East

:Lebanon - clearing the minefields for water pipes

UNICEF's largest water supply operation in the Middle East, like those in Asia and Africa, was occasioned by an emergency - the brutal civil war which continues to this day. In this beautiful and relatively developed country, once regarded as an oasis of peace in a troubled region, there were at various times in the hostilities as many as 40 different warring factions. Bombs, gunfights, mortar and artillery fire became an everyday fact of life. Amid the general destruction of homes, hospitals, schools and public utilities, water supply and sanitation facilities of all kinds were badly damaged and entire villages and towns were threatened by epidemics.

UNICEF's task was to assist the immense job of rehabilitation, concentrating in particular on institutions serving children, notably schools and hospitals. As the only major external aid agency with access to all parts of southern Lebanon, the part of the country most divided, UNICEF was saddled with responsibilities beyond its usual ones. Realizing this, funding sources such as the United States and Saudi Arabia provided major special contributions to enable UNICEF to go on with the work.

This involved water well drilling, carried out by local Lebanese contractors, the installation of entire pumping stations, repair of water treatment facilities and the laying of pipelines and connections to hospitals and schools. On occasion, help had to be relied upon from the UN peace-keeping forces in order to clear stretches of terrain of landmines for the laying of pipelines.

Somehow, UNICEF's work evoked a certain restraint on the part of different warring groups. Although violently opposed to one another, they would not interfere with the continued functioning of those water supply systems. A piped water supply system across southern-most Lebanon is one example. It originates at wells drilled close to the foot of Mt. Hermon and goes westward towards the coast, branching out to a number of villages along the way. The water would thus pass through and serve areas held by organizations as diverse as the PFLP, the PLO, the UN Forces and the

Christian militia that had been set up by the Lebanese army major Haddad. Any would have had opportunities to cut off the water supply of another. Yet the feeling of the sacredness of water, as enunciated in the Holy Koran, prevailed. Sometimes, repairs had to be made after heavy tanks passed over pipelines. By and large, though, there were no acts of hostility towards UNICEF and its water engineers.

One water engineer remained in his home city Beirut where he now has taken over the responsibility for all of UNICEF's activities. Raymond Naimy made an international name for himself when in early 1983, Israeli troops had cut off East Beirut from the rest of the country and from its normal water supply. In order to prevent a major water famine among the city dwellers and their large child population, Naimy launched "Operation Water Jug", providing at least minimum quantities of drinking water to the beleaguered citizens. He used water from private borewells and brought it by truck to hastily erected water tanks until after some precarious months conditions were more or less restored to normal.

:A transition to modern times in Yemen

Elsewhere in the Middle East and North Africa, including Algeria, Jordan and Morocco, UNICEF assisted a variety of water and sanitation schemes in the 1970's, but all on a fairly small scale. UNICEF's cooperation with the Yemen Arab Republic (North Yemen) was more considerable, however, and is an interesting example of water supply work being integrated into one country's hasty transition to modern times.

A five-year civil war had ended in 1967 with the ouster of the old ruler, the Imam, who had been both secular and religious head of this mountainous country in the southwestern part of the Arabian peninsula. The Imam had ruled in purely medieval fashion over his people, not allowing any modernities except for a DC-3 airplane for himself and one car operating over the only few miles of road existing in the whole country. The new government devoted itself to intensive efforts to develop the rudiments of a modern country, with considerable help from abroad in which the major world powers peacefully competed. Water supply was one of the immediate priorities, and in 1972 the Federal Republic of Germany allocated \$890,000 to UNICEF as a "noted project" for the express purpose of water supply in the Yemen Arab Republic.

Bilateral funding was taking care of assistance to water supplies in the cities and larger towns, but in the rural areas UNICEF was the first major international donor to be tapped for help. Some limited beginnings were made in the first year or two, including a simple piped water scheme with public standposts in the sleepy little town of Al Mukha, the ancient Mocha of coffee fame. But by 1974 the Government of the German Federal Republic began to get concerned over the fact that its special contribution was still unspent and threatened to ask for its money back -- plus interest! This prompted a rapid survey of the situation by Martin Beyer from HQ along with the local country representative, Toni Beruti. They found that the Government's Rural Water Supply Agency was more than willing to do its part in putting the proffered assistance to good use but was so badly understaffed it could hardly function.

UNICEF accordingly embarked on a crash programme to help train local craftsmen, and a burst of activity soon got underway. With seriousness and energy, the trenches were dug, pipes laid and pumps installed with their engines. Many of the systems installed were in the form of engine-powered pumps forcing water up from springs and other sources in the valleys to the villages, usually located on hill and mountain tops, a reminder of thousands of years of warfare against marauding neighbours. Consequently, in many places, water had to be lifted for many hundreds of meters. This entailed relatively high costs for the installation, operation and maintenance. It was a somewhat mitigating circumstance that Yemen at least was a neighbour of Saudi Arabia with access to the plentiful oil and gasoline produced there.

With the upswing of the economy of the oil-rich Arab countries in the mid-1970's, more funds, equipment and materials flowed in from different donors. This allowed for a widening of the scope of the government's work in the proud Yemeni tradition of water supply engineering, symbolized by the ancient Marib dam said to date from the reign of the Queen Sheba.

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The Americas region

UNICEF assistance to water supply and sanitation in the Americas Region focussed on relatively few countries and within these on the poorest areas. UNICEF's overall assistance ceilings in the Americas were lower than they were in Asia and Africa, and the countries of Latin America as a rule already had higher water and sanitation coverage.

The Punta del Este Conference of 1961 in Uruguay among American heads of state had set a target for water supply and sanitation coverage for all of Latin America and the Caribbean of 50 per cent by 1970. In the event, only 25 per cent coverage was attained by that date. Given the circumstances, this was not a bad result, though far from ideal, proving that regional plans could be established and at least partly carried through. The follow-up to the conference had brought international financing, private and public, into play on an unprecedented scale, one of the key lenders being the Inter-American Development Bank. The IDB loans benefitted not only the big cities but helped to finance water systems for small towns and villages, with active promotion of community participation. Major technical support came from the Pan-American Sanitary Bureau's strong network of representatives.

Under the circumstances, piped water schemes with household or patio connections for each family could be implemented on a wider scale in the Americas than in most other parts of the developing world. The need for low-cost approaches -- handpumps, simple gravity feed schemes, latrines etc -- definitely existed, but to a somewhat lesser degree than in the other UNICEF regions. The main target populations for UNICEF assistance in the Americas in the 1970's were found in the Caribbean, in southeastern Mexico, Central America, Peru, Bolivia and Paraguay. In these areas water and sanitation goals were pursued not as separate programs but within the framework of "integrated services for children."

:The Caribbean

In the Caribbean, UNICEF contributed materials to piped water schemes for communities of various sizes in Jamaica, St. Vincent, and the Dominican Republic, while in Surinam it supplied pumps and pipes to some more elaborate schemes based on large diameter deep wells. In Haiti, the poorest country in the Hemisphere, pipes and construction materials went to projects in some communities on the south coast. But with the then government paying scant attention to the needs of its citizens, the Rural Water Supply Agency in the later 1970's consisted of only of one engineer and one draftsman. Bilateral aid people, notably US AID, and a number of NGO's did their best to fill the worst gaps, but in an uncoordinated way. It was not until the 1980's that conditions were right for sizable UNICEF inputs to be appropriate.

:Central America

UNICEF provided materials and equipment to rural water supply projects in Panama, Costa Rica, and Guatemala. The catastrophic Guatemala earthquake of 1976 necessitated the total reconstruction of villages along the densely populated earthquake zone in the highlands. With the government so overburdened with other rehabilitation tasks, remarkable work was done by small voluntary agencies, working with UNICEF and a group of dedicated Guatemalan engineers, to help villagers in rural areas rebuild their houses and install water systems. UNICEF's senior drilling supervisor, Alejandro Amoretti, originally from Cuba, played an important role for years in directing the right kind of assistance for village water supply to Guatemala and neighboring Honduras and El Salvador.

:Mexico -- transmitting to the Tzotzils and the Tzeltals

A special integrated project was carried out in Mexico in the 1970's in which UNICEF played a part. This was the Programa para el Desarrollo de los Altos de Chiapas (PRODESCH) -- the Programme for the Development of the Highlands of Chiapas. The population to be assisted in economic and social development, 90 per cent based on self help, were 600,000 Indians in the forested and humid highlands of Chiapas, near the Guatemalan border. No roads or modern amenities existed in the project zone, inhabited by Tzotzils, Tzeltals and other tribes, each with its own language and customs. On their list of priorities, village access roads stood as number one, followed by a long enumeration of other needs. The PRODESCH administration from the outset put its emphasis on agricultural development. In this it was aided by an unusually effective cooperation among UNICEF, FAO and WFP (World Food Programme). Water was an important part of the agricultural aspects of the programme.

The water for the small terraced plots of cultivation came from protected springs, which fed the villages with drinkable water through pipelines. Since a constant flow of water was assured through the regular and high rainfall, there was plenty of excess water for diversion to the fields. At the same time, health education campaigns supported the newly established system of local health care centres and helped spread the understanding of proper water use, sanitation and hygiene. A most original feature was the installation by UNICEF of a powerful radio transmitter at the PRODESCH

headquarters. It broadcast round-the-clock with news, popular music and agriculture-extension and educational messages to the local people in their own languages. It was the first time ever in Mexico that such broadcasts were made in local languages other than Spanish. Radio PRODESCH gained instant popularity. In 1979 there was a daily influx of 250 letters from listeners. One interesting and successful use of this radio station was to alert parents in remote areas to impending visits of immunization teams so that they could bring their children to designated health centres in time for the teams' arrival.

:Peru -- children in Sackcloth

There were few parts of the world where the need for action on behalf of children appeared so compelling as among the Quechua and Aymara Indians of Peru's high Altiplano villages. The children of these descendents of the Incas, barefoot and literally clad in sackcloth, spent their nights in sub-freezing temperatures, sleeping on reed mats on dirt floors in stone huts, without any form of heating. Daytimes, they were largely on their own, neglected by parents who struggled hard for survival in one of the world's least hospitable environments.

A remarkable project assisted by UNICEF in the 1970's was the systematic buildup of village pre-school centers, or wawa huasis, in Puno and Cuzco districts. Operated by trained volunteers, these centers reportedly worked wonders with the small Inca tots, who on entering primary school found themselves with an excellent cognitive and emotional headstart over the other children. One aspect of UNICEF's assistance was to help provide these wawa huasis with safe water, since the seemingly clear streams of the Altiplano are heavily contaminated with human and animal fecal matter. UNICEF provided cable-tool drilling rigs, handpumps, and construction materials for protected springs. Unfortunately, technical support from the government was weak, and it was not until the 1980's that UNICEF was able to provide consultants of its own to help get things going on the spot.

In adjacent Bolivia UNICEF concentrated on aid to spring-fed systems in the Altiplano and handpumps fitted to dug wells in the resettlement areas of the eastern lowlands. Some drilling rigs were also provided to Bolivia. One of these rigs suffered a curious fate. It was highjacked at gunpoint from the Saneamiento Ambiental warehouse in Sucre by a highly intoxicated gentleman, who some kilometers further away promptly capsized the 18-ton outfit in a ditch and disappeared.

:In Paraguay -- the poetry of clean water

In landlocked Paraguay, UNICEF joined up with the World Bank to assist an ambitious water supply program carried out by the National Health Service. UNICEF concentrated on assistance to small settlements, while the Bank financed projects for agglomerations of 2,000 or more inhabitants. The introduction of water supply to the rural Paraguayan communities was accompanied by impressive health and sanitation education campaigns. These were all-out teach-ins in primary and secondary schools, normally scheduled for a whole month. Day in and day out, the school children would be brainwashed with matters concerning water, sanitation and hygiene. In

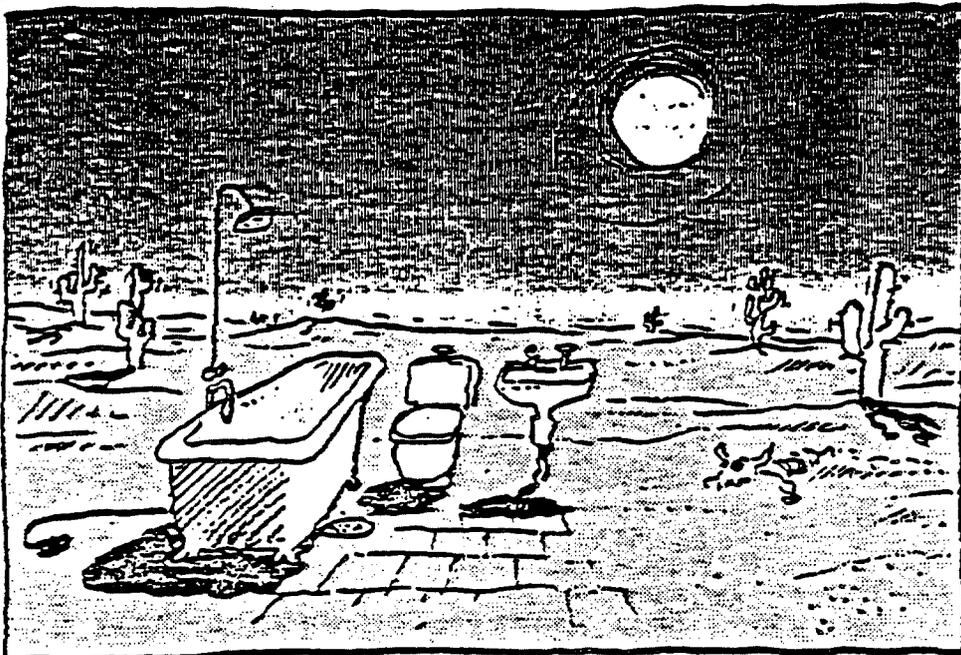
mathematics, they would count buckets. In biology, they would study all the bugs in a drop of untreated water. In Spanish, they would write poetry about the beauty of clean water.

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1980-1986. CLARIFICATION OF OBJECTIVES: INTEGRATION WITH PHC AND "CHILD SURVIVAL AND DEVELOPMENT REVOLUTION".

The period 1980-86 was the first and crucial half of the International Drinking-Water Supply and Sanitation Decade, with increasingly fruitful co-ordination among all parties concerned. Within UNICEF, the drive toward

WATER AND SANITATION DECADE LAUNCHED !



International
Drinking Water Supply
Sanitation Decade
1981-1990

Décennie internationale
de l'eau potable
et de l'assainissement
1981-1990

Decenio Internacional
del Agua Potable
y del Saneamiento Ambiental
1981-1990

Örso NY TEKNIK, Stockholm, Sweden - No. 42, 1980

VATTNETS ARTIONDE

WATER'S YEAR TENS

عقد الدولي لتوفير
مياه الشرب
والمرافق الصحية
١٩٩٠-١٩٨١

infant and child health within the framework of CSDR accelerated the integration of water supply and sanitation with other health measures. New scientific insights into the nature of diarrheal and other water and sanitation related diseases contributed to improved programme and technical designs.

At the suggestion of the UN Water Conference which was held in Mar del Plata, Argentina, in 1977, the UN General Assembly in 1980 declared 1981-1990 to be the International Drinking Water Supply and Sanitation Decade. Its professed goal was perhaps visionary, to provide everybody with adequate water supply and sanitation by 1990, but it did establish an effective rallying point for international cooperation. The beginning of this decade happened to coincide with a clarification and sharpening of UNICEF's policies, linking them directly with the objective of reducing infant and child mortality and morbidity rates. The acronym GOBI -- standing for growth monitoring, oral rehydration therapy, breast feeding, and immunization -- symbolized the practical and very direct measures UNICEF was now emphasizing, shortly to be incorporated into the concept of a worldwide Child Survival and Development Revolution (CSDR) with mass immunization campaigns as the spearhead.

Changing insights and new developments

There were at first fears among some UNICEF colleagues that WET would be dropped from UNICEF's repertoire of leading activities in favor of measures, like those symbolized by GOBI, which were thought by some to be more cost effective. Apart from this, questions about the value of water and sanitation investments had been raised for some time by specialists and economists at the international level. The debate still goes on, with neither proponents nor opponents having the last word, but with a number of newly discovered considerations to be taken into account.

From the health point of view, for one thing, it was becoming clear that the effects of water and sanitation are not so clear cut as had at first been supposed, since there is such a close interdependence among these and nutrition, other health interventions, education, and a host of other factors. New research had revealed that the "water-borne" diseases of old were not exclusively water-borne. For example, it had been shown that rotaviruses, an important agent of diarrheal diseases, in addition to being spread by the oral-fecal route could be transmitted through the air by coughing.

It was becoming evident that for the evaluation of the impact of water supply and sanitation on health, clear indicators were not as easy to find as had at first been supposed. Thus, measures of diarrhoea incidence are fraught with many uncertainties. The present best bet seems to be to use the same anthropometric measures as those used to appraise the nutritional status of infants and young children and to monitor their growth. But here again, the causes for changes and deviations from the normal range are so manifold and intricate that the conclusion up to now is that water and sanitation cannot be singled out for impact evaluations. Indeed, health impact cannot be measured in absolute terms for any single type of intervention. This was the conclusion of the first international seminar on the subject of health impact of water and sanitation, held in 1983 at Cox's

Bazaar, Bangladesh. The results of the research and studies presented there as well as derived from other institutions in the world are constantly being evaluated by UNICEF. The water supply and sanitation programme in Imo state, Nigeria, which was launched in the early 1980s was the first UNICEF-assisted programme designed from the beginning so that the effects of water and sanitation would be measured in combination with those of primary health care (PHC) and other CSDR measures. (See below, p.36).

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New light on social and economic factors

The social and economic aspects of water and sanitation programmes of the type supported by UNICEF became clearer through a number of studies. A study conducted in Bahr-el Ghazal province, Sudan, in 1980, for example showed an enormous difference in women's use of their time before and after the installation of a handpump. A study on body energy expenditure clearly indicated the beneficial effects of the "convenience factor" of water supply programs in reducing the drudgery of pregnant and lactating women.

In 1982 the World Bank began a study of the economy of handpump systems, and its preliminary findings were presented in draft form in late 1985, confirming, generally, the pragmatic estimates which had guided most of the handpump programmes. Such studies, along with considerable documentation on monitoring and evaluation methodologies, began to provide, for the first time, what could be described as an authoritative body of professional "literature" on low-cost water and sanitation in the developing countries.

A major bottleneck to reaching the goals of the Water Decade was the tremendous investment in "human resources development" required. If the original target was to be met -- adequate water and sanitation for everyone by 1990 -- it would mean adding water supply installations to serve half a million people every day. In the event, the rate of construction was considerably lower. Still, it would require the skills and motivation of millions of people -- engineers, administrators, public health specialists, handpump caretakers, teachers, mothers and children. Not only does this carry with it a tremendous need for training. It implies the need for many professionals to adapt their skills and attitudes to local requirements. Some of the more "high-fallutin'" engineers, sociologists and others may have to modify their concepts of technology and people considerably. Human resources development for the Decade has been taken up by a special task force of the Decade Steering Committee. UNICEF's hopes are that this will lead to a coordinated and well-publicized effort to support the necessary training programmes all over the world. At present, training in well-drilling, handpump installation, latrine construction, sanitation and health education is a primary task of UNICEF's 130-odd water, sanitation and health education specialists -- but their efforts can only meet a very small part of the need.

As concepts wax and wane in any human endeavour, so do buzzwords in the international world. The "grassroots" of the 1970s were replaced -- hopefully for the duration -- by "community participation". "Project Support Communication (PSC)" in UNICEF parlance, was turned into "Programme Communication" to stimulate and support "Social Mobilization".

Behind the buzzwords lay the realization that it was vital to secure not just the villagers' voluntary labor in digging wells and trenches but their involvement in the whole process of decision-making, planning and implementation. It aimed at making the users in the communities aware that the water supply and sanitation facilities were theirs, theirs to use and their responsibility to operate, maintain and repair. The participation of women, in particular, was increasingly emphasized, improved water supply and sanitation being such an important element in their advancement.

Realization of the need for active community participation in water and sanitation coincided with a growing realization of its importance in other social development fields, including child health, education, and nutrition. Consequently, community participation figured to an increasing degree in UNICEF's country programmes as a whole as the decade of the 1980's unfolded.

Health education became mandatory in all programming, strongly supported by the creation of the post of a health education specialist at New York headquarters. An unofficial aim was to widen the scope of the health education element in the water and sanitation programmes to support primary health care, the Child Survival and Development Revolution, and the Universal Child Immunization efforts.

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Further technological developments

Technologies continued to develop. Major advances were made in equipment and materials for water supply. Highspeed drill-rigs were made even more efficient, compact and easier to handle. Compressed air was partly replaced by hydraulics. New polymers began to be used for drilling fluids under difficult conditions. UNICEF continued its co-operation with drill-rig manufacturers to develop lighter and less expensive rigs. Some of the big monsters used in certain areas, as with difficult rock conditions in India, cost up to half a million dollars! They were immensely powerful and efficient, but every cent counted and the rigs had to be kept down in size for transport over narrow and difficult roads and bridges as well as for lower operation and maintenance costs.

Extremely valuable work was done by the UNDP-funded water and sanitation group at the World Bank, including TAG, its Technical Advisory Group, in developing low-cost water-lifting and waste-disposal techniques. The Bank's adviser on these matters was John Kalbermatten, a Swiss-American engineer, who deserves special mention as a veritable pillar of the Water Decade. The importance of the Bank's work in this field to UNICEF cannot be overestimated. The project for developing and testing low-cost latrine designs, for example, laid the technical groundwork for UNICEF's own advocacy (in countries like Botswana, India, Lesotho and Tanzania), the fact that a new design had been tested and recommended by the World Bank giving it considerable prestige.

One success story was that of the VIP latrine, the ventilated improved pit latrine developed at the Blair Research Institute in Harare, Zimbabwe. Its

inventor is an entomologist, Dr. Peter Morgan, whose insights into the psychology of flies led to its ingenious design: flies, attracted by the odors from the pit, fly into it, do whatever flies do, and then, once properly satisfied, fly up the vent pipe on the outside of the outhouse, now attracted by the daylight through the vent. Only -- this is where the fly stops. The flies cannot get out, for a mosquito net covers the open top. The flies have too short a memory to remember where they came from, get confused, buzz around, starve, get weak, fall down and die, not necessarily in beauty. The VIP latrine is an example of a low-cost, "appropriate" technical development that has been used on an increasing scale by UNICEF.

A related UNDP/World Bank project deals with the development and testing of handpumps -- those seemingly simple implements that so often go wrong. UNICEF, which is possibly the world's largest single handpump buyer, has a great stake in this project. The potential world-wide market, China included, is estimated to be one million handpumps a year, benefitting some 150 million new users. Design, quality, cost and ease of operation and maintenance are important considerations. UNICEF, along with several bilateral agencies, actively participates in the project, above all in the field testing of improved designs. By 1986 a huge field testing scheme was underway, involving 2500 pumps of 70 different makes in project areas in 16 countries.

Alternative energy sources for power pumps also began to enter the picture in the 1980s, as solar voltaic cells went down in cost from US \$30 per watt in 1980 to about \$7 in 1985. Consequently, there was a surge in the procurement of solar-powered equipment, especially in West Africa.

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Nigeria -- Imo State: imagination and innovation

The planned introduction of all these elements into WET programmes -- the concepts of the health and social approaches, the complementarity of the various measures -- began to take shape in the first years of the new decade.

One programme in which all these factors were planned for from its very inception was the PHC/water-supply/sanitation programme in Imo State in southeastern Nigeria. It was conceived by the UNICEF Representative, Richard Reid, who rapidly picked out the essential ingredients of GOBI, water supply and sanitation technologies, added a solid build-up of a PHC system with a backbone of Village-Based Workers (the "VBWs"), shook the mixture vigorously and applied it to some of the poorest districts of Imo State. This judicious blend of components and the enthusiasm that Reid infused into the local health teams and water supply technicians, along with the establishment of a good UNICEF support team, made the project a success and a model.

At first, the entire idea of solving the problem of rural water supply with

drilled wells and handpumps met with considerable resistance at both Federal government and State levels. While oil prices were still high, Nigeria could afford to plan for infrastructure improvements at much higher technical levels than it could have afforded before the great oil discoveries in the Niger Delta. For water and sanitation this meant water treatment plants, urban distribution systems and sewerage -- at least where there was water around in some abundance, i.e. mainly in the areas close to the Niger river system. However, the largest part of Imo State, and for that matter most other states of Nigeria, have little or no access to surface waters. Groundwater is therefore the only source that can be tapped. Also the small size of the individual villages and the limited reserves and recharge of groundwater would be prohibitive for major waterworks and piped network systems.

Once the original objections had been overcome, Reid with his colleagues of the UNICEF office in Lagos and with the Imo State health authorities, designed an approach based on the drilling of wells and installation of handpumps, accompanied by the training of VBWs. An interesting feature was the mandatory installation of latrines in half of households of each village before their handpumps would be installed. This laudable but difficult approach eventually had to be modified. The programme, nevertheless, was a great success. In 1985, the Federal government of Nigeria, at the insistence of the other state governments, decided to spread the handpump cum PHC strategy over the whole nation, with UNICEF-supported beginnings made in three states, Gongola, Kwara, and River Cross.

An outstanding feature of the Imo scheme was that the emerging art of "WET evaluation" was built into the project from its inception. The London School of Tropical Medicine and Hygiene seconded an epidemiologist, Dr. Deborah Blum, to UNICEF, Nigeria, on a long-term basis to carry out a full-scale health impact study as the Imo project proceeded. It was expected that this study would be a major step in understanding and evaluating the effects of similar projects elsewhere.

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In Africa -- the struggle continues

UNICEF had in the mid '70s established two regional advisers' posts for water and sanitation in Africa, one for Eastern Africa in Nairobi, one for West Africa in Abidjan. With a few exceptions, Africa's wide-flung array of countries, with their problems of exploding populations, environmental degradation, droughts, poverty, and weak administrations, required not only material assistance but help in programme planning, monitoring and evaluation from UNICEF and other external organizations. Moreover, while in other parts of the world, UNICEF's cooperation could be carried out in the framework of regular long-term programmes, in the case of Africa many of the countries, in 1984 and 1985, had to put all their energy anew into combatting the effects of a resurging drought.

When the international community rallied in 1985 to help alleviate the new emergency, it was confronted with many of the same problems faced twelve or thirteen years earlier, for the great plans drawn up by the Sahel countries with UN backing after the 1972-73 drought had only been partly realized. The building of access roads, the expansion of transport facilities, the improvement of range management, the development of better grain and food storage remained largely unattended to. Yet there was more experience available; there were more specialists and equipment. The odds were favorable that whatever funds UNICEF could avail itself of for water and sanitation would be well spent.

Certain projects, in addition to providing potable water for households, involved micro-irrigation for family food production. Projects in Senegal, Mauritania and Mali featuring the cultivation of tomatoes and onions not only contributed to better nutrition but helped keep the local populations from migrating away from their villages. In Sudan the UNICEF/WHO Joint Nutrition Support Programme includes the use of water from sub-surface dams for small-scale cultivation.

In many cases in Africa, the post-1980 programmes tended to include more health and nutrition components. A certain strengthening of UNICEF's technical backstopping is taking place gradually in the Sahel region, and the co-operation between UNICEF and UNCTD (Technical Cooperation For Development) continues. The concepts of sanitary excreta disposal and other sanitation measures began to spread in many project areas.

:The Western Sahel

In the Sahelian countries of West Africa UNICEF generally concentrated on well-drilling and handpump installation, continuing efforts that had slowly gotten underway in the 1970s. It also became involved to an increasing extent with micro-irrigation, as just mentioned. UNICEF also gradually built up its own support staff: in Burkina-Faso, for example, it posted a French hydrogeologist and a Swiss master driller to direct activities in the northern, drier portions of the country. In the Central African Republic and in Chad activities were hampered by the political situation, but from 1984 and 1985 on it was possible to carry out fairly substantial well-drilling activities.

An interesting case is that of Cape Verde, a republic consisting of a group of small islands in the Atlantic, about 700 km due west of Dakar. The islands were not so much granted independence as abandoned by the Portuguese in 1975, and the continued effects of the drought at that latitude caused great hardship. During the '70s and early '80s Cape Verdean engineers drove long "galleries" or tunnels into the flanks of some of the islands' extinct volcanoes, piercing lava barriers to tap the groundwater dammed up against them. Some of this water is so abundant that it is used for small-scale irrigation as well as household use. On some of the mountain tops experimental installations were made of large screens. Moisture from passing clouds condenses on these screens and the resulting drip-off is collected for drinking water. (Further experiments with this method have more recently been conducted in the coastal desert of Peru).

West Africa south of the Sahel

In West Africa south of the Sahel, the wooded-savanna and rain-forest zones did not suffer to the same degree from the drought. Nevertheless, many of these areas experience an annual dry season of up to six months -- a period known in some countries as "the hungry season". Add to this the high incidence of all sorts of diseases caused by lack of water, contaminated surface water, dirt, faeces, lack of health awareness, and -- on top of everything -- the presence of disease vectors breeding in water, such as the anopheles mosquito and the tsetse fly: this all goes to show that UNICEF's assistance in regard to water and sanitation was amply justified in these countries, too.

Some of the countries that were worst affected by these conditions were the former Portuguese colonies of Guinea-Bissau, Sao Tomé and Príncipe, and Angola, along with Mozambique to the east. So was the former Spanish possession of Guinea Ecuatorial. All these gained their independence around 1975 and were left completely on their own with a minimum of basic services intact.

Guinea-Bissau, to cite one example, had no safe rural water supplies of any description on an appreciable scale. After independence a good beginning was made through a UNCTD-managed water-well project headed by a USSR hydrogeologist. UNICEF contributed to this project, including the procurement of a number of the ingenious, though not quite perfect, Vergnet foot pumps, which had been invented by a pair of French engineers working in Ouagadougou.

The second phase of the water supply programme in Guinea Bissau, which began in 1982, was more community oriented. It involved the digging of wells by communities themselves, under the supervision of specially trained local well-diggers, or "puisatiers". The entire project was funded through UNICEF by a special contribution from DANIDA, the Danish overseas development agency. The results were encouraging: there is now a cadre of some 50 well-trained and motivated puisatiers, who are able to work independently.

In some West African countries there was just a trickle of assistance to well-drilling and the like, the pace accelerating around 1985. A favorable exception was Benin, where a solid programme for wells and handpumps had been going on since the mid '70s. Originally a straight-forward drilling programme of the type carried out in India, with India Mark-II handpumps of Malian manufacture being installed, the project broadened in 1985 to include more attention to sanitation and a linkage with primary health care. A recent salute to the effectiveness of the Benin programme was USAID's decision to channel considerable funds through UNICEF for handpump and sanitation activities, and also to link the programme to a major USAID-funded health education effort.

In Zaire during the 1970s UNICEF had cooperated in the planning and supply of materials to some rather sizable spring-protection cum gravity-feed schemes in the eastern part of the country. For a while these activities

waned. The formation of a National Water Supply Commission in 1985 and the drafting of the country's first water resources management and supply plan promised a resurgence of water and sanitation activities. Several external donors were being lined up to assist different parts of the country. UNICEF was scheduled to support well drilling in artesian formations of the centrally-located Bandundu region and spring-protection/gravity-feed schemes in Kasai Occidental and Kivu.

In strife-torn Angola, the first projects were the rehabilitation of water supply systems in the fundas (former Portugese plantations) which were to serve as resettlement areas for refugees and displaced persons. WHO's sanitary engineer designed small water treatment units of concrete which could be prefabricated in Luanda, the capital, and trucked to the project sites. It was soon evident, however, that a different approach was needed to meet the needs of rural people in general. Two rather large down-the-hole hammer rigs were procured by UNICEF with funding from Sweden's overseas assistance agency, SIDA, and brought to Angola. Here they operated under very dangerous circumstances due to the constant state of active warfare in the south of the country, where the roads were often strewn with landmines and there was a constant threat of ambushes.

:Eastern Africa

In the eastern Sahel, the new drought hit Sudan in 1984/85 at the same time as a massive influx of refugees from Ethiopia took place. The transport situation was extremely weak, and the normal logistic difficulties were complicated by a new rebel movement in the south, despite the Government's attempts to smooth things over by providing the southerners a considerable degree of autonomy. The onslaught of relief workers from various organizations, all of them motivated by compassionate considerations, was at times as difficult to regulate as the movement of displaced persons.

The UNICEF-assisted water supply and sanitation project in Bahr-el-Ghazal in the south was kept going. By 1985, 800 India Mark-II handpumps had been installed in that province and in Equatoria province; but in late 1985 and in 1986 rebel action to some degree curtailed operations. Increased assistance was directed to the arid Red Sea province in the northeast and to the areas to the immediate south which included a number of large refugee camps. Already, before the drought hit, a series of sub-surface dams had been planned for Red Sea Province. The very dry areas of the northwest were also slated for increased assistance.

In Ethiopia the UNICEF co-operation with the National Water Resources Commission gradually moved from the Provinces of Wollo and Tigre to the more centrally located province of Shoa, around Addis Ababa. The UNICEF Representatives during the 1980s oriented the UNICEF assistance more towards sanitation and the links with child health and other basic services.

:Somalia, Uganda

There was a steady improvement and widening of activities in Somalia. Since the late '70s Somalia had been subject to more or less permanent drought and to warfare with Ethiopia over the disputed expanses of the Ogaden. Refugees settled en masse in camps around the Wabi Shebele and other river beds that

lay dry for the greater part of the year. Their women would dig by hand, or at the best with calabashes as their only tools, pitiful holes in the sands of the riverbeds to collect the few drops of muddied ground water that accumulated.

Rapid action was called for, but with the slowness of the understaffed government organizations, the difficulties encountered by UNICEF, and a host of other constraints, there were delays upon delays. These were aggravated by the long lead-time for the supply of equipment and materials, such as drill rigs, casing and pumps. Few shipping companies cared to route their ships to Mogadishu, and the goods frequently were shortshipped, dotting the quaysides of Aden or Mombasa. A careful selection of well sites was required to avoid the large areas underlain with waters with high salinity (chlorides and sulphates). Despite these constraints considerable progress was eventually made. From the refugee areas in the central-southern parts of the country, the emphasis of the UNICEF-assisted water activities was shifted to the even drier north, to the region around Hargeisa, where a strong health and sanitation component was added.

Further south, in Uganda, immediately after the fall of Idi Amin in 1982, a major operation began for the rehabilitation of water wells. Uganda, along with Kenya and Tanzania, had been one of the few colonies, where rural water supply through drilled wells and handpumps had been instituted on a large systematic scale from the 1930s on. Two contracting firms, based in Nairobi, in those years did the drilling and construction work, one the affiliate of a Swedish company, the other the affiliate of a major British engineering group.

Both companies trained local water-well drillers. The Swedish drilling supervisors came up with the design of one of the first appropriate village-level handpumps in the world, the "Uganda" pump, built from standard pipes and fittings with a heavy handle of local mahogany. If the handle broke, the villagers could just go to the nearest forest and cut themselves a new one. At the accession to power of the dictator Idi Amin, in the beginning of the 1970s, some 10,000 wells with handpumps were serving large parts of the rural populations. During a decade and a half of political repression and with the ensuing mismanagement and neglect, a large number of these wells fell into disuse or were wantonly destroyed outright through war or vandalism.

A huge task therefore awaited the UNICEF team, when in spite of continued rebellions and marauding bands of soldiers and tribesmen, the programme for the rehabilitation of these 5,000 wells was formulated. It included the drilling of additional wells, an incipient drive for sanitation with excreta disposal and integration with the PHC programme and the CSDR campaign spearheaded by immunization. Much of the work concentrated on the dry Karamoja region, with a base, workshops and all, in Soroti.

:Djibouti, Kenya

The small republic of Djibouti, nestled around the southwestern corner of

the Red Sea, is part of the hot Danakil Depression, characterized by barren basalts and other former ocean-bottom features on dry land. With UNICEF's assistance, the first effective campaign for rural water supply was launched in 1980. A young water well driller from the American-French coastline of Acadia in the State of Maine, with a background in business administration, in that year plunged right into the water problems of small, scattered and extremely poor settlements. This campaign during the years won high acclaim from the Djiboutians. Even the President of the country himself came to inaugurate some of the well sites.

For a number of reasons, Kenya since its independence in the 1950s had been almost overrun by bilateral aid. UNICEF's water and sanitation inputs in this country never were very large. The most interesting part of work done by any UN organization is the development of programmes of the last few years involving women's advancement as connected with water and sanitation. This is managed by UNDP with substantial funding from the Norwegian government and with UNICEF participating.

:Tanzania and others

Tanzania has been the recipient of massive bilateral aid for many years, but the country is so large and the problems of providing services for its widespread population so difficult that many years of work still lie ahead. This is abundantly true in regard to water supply and sanitation. When in the late 1970s the Ministry of Water submitted its requests for external assistance to various donors, it asked UNICEF to concentrate on the Wanging'ombe Project in Iringa District. The project area lies in the south-central part of the Tanzanian high plateau. No groundwater resources exist in the unusually dense rocks of this area. The water for the scheme comes from a group of productive wells at some distance from the villages to be supplied. It is fed to these communities by a network of pipelines totalling more than 250 km. Community participation in digging trenches and laying the pipes has been particularly strong, backed by the political spirit fostered by the country's "Ujamaa" movement. In the mid 1980's the work was combined with concerted efforts to improve rural sanitation.

In Rwanda and Burundi, two small but populous countries on the eastern rim of the Great Rift Valley, water is easily available in the form of natural springs, and it is usually feasible to pipe water to the villages by gravity flow. Here a large part of the assistance is dedicated to training local craftsmen for the protective masonry and plumbing work.

In Malawi, also, at the southern continuation of the Rift Valley, natural springs can often be used to supply water to villages. The largest part of rural water supply, however, depends on groundwater, with drilled or dug wells and pumps. The government's campaigns for improving agriculture and water and sanitation through its excellent extension services have been quite successful, partly due to favorable traditional village structures, knowledge, and practices. UNICEF support was concentrated on the poorer parts of the lower Livulezi Valley, with strong support to self-help schemes. In the 1980s Malawi pursued intense efforts to improve its primary health care system, with a strong emphasis on health education -- thus assuring good backup for community water and sanitation efforts.

In Zimbabwe, following its independence in 1980, UNICEF helped the government promote water and sanitation as an integrated part of its health programme and provided technical assistance in the search for water in the drier, rockier parts of the country.

In Swaziland, the first attempts to assist rural water supply on the part of a UN organization came from the United Nations Environment Programme, which helped launch a pilot scheme in a small area to eradicate schistosomiasis (a parasitic disease transmitted by freshwater snails) through improved water supply and sanitation facilities. Measures were to include shower stalls and laundry facilities for the farm households -- the so-called "homesteads" -- so that the farm people and their children could avoid bathing and washing in the contaminated watercourses. Through UNEP, UNICEF was included as one of the donors, and gradually the responsibility for supporting the project went over to UNICEF.

In most of the remaining countries of UNICEF's Eastern Africa region, UNICEF's inputs for water and sanitation remained quite limited. In Botswana the lion's share of assistance came from Sweden, with UNICEF contributing only some supplies for piped water to the larger villages. Lesotho's sanitation program, involving the construction of pit latrines, was under the supervision of the UNDP/World Bank Global Project for Low-Cost Sanitation. In Madagascar and the Comoros there was a potential for further assistance, but inputs were low.

Among the southern-most countries of the region, Mozambique received the most considerable UNICEF support for water and sanitation. Assistance was to a large extent directed to the Makonde Plateau, bordering on Tanzania in the north. Its inhabitants, famous for their wooden sculptures, live on top of the plateau, away from the vector-infested river banks and creeks. Here UNICEF helped to provide water from safe sources down in the valleys by pumping it up to the plateau and distributing it to village taps through a series of piped systems.

At a later stage, simple water and sanitation systems around the capital, Maputo, are planned. Large areas in central Mozambique have not been accessible in the more than ten years that have elapsed since independence because of guerrilla action. Once more peaceful conditions arrive -- hopefully soon -- UNICEF will face these even greater challenges.

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Middle East and North Africa -- a widening scope

In this part of the world a wider scope for both funding and policy promotion was opened up in the 1980s, partly through the UN system's promotion of the Water Decade, partly through the initiative of UNICEF's Executive Director and his personal connections with a number of funding and fund-raising organizations in the Middle East. His Royal Highness, Prince Prince Talal Bin Abdul Aziz, of Saudi Arabia played a major role in obtaining funding for UNICEF assistance to water supply and other activities. Among the contributors were AGFUND, the organization that

Prince Talal himself set up to obtain development funds from the Arab Gulf States; the Arab Fund for Economic Social Development (AFESD); and the OPEC Fund. Lebanon received a major share of the additional funding for the continued rehabilitation of southern Lebanon, a program that was phased out in 1985. All the other programs which benefitted were of a long term nature.

:Egypt

Major cooperation with Egypt began in 1981, featuring water supply projects to large villages all the way up the Nile valley to Aswan. These consisted of wells drilled to groundwater, electric pumps, small overhead tanks, and piped systems to standposts, with house connections possible. For smaller villages and outlying settlements India Mark-II handpumps were installed. A well-drilling program in northern Sinai was also launched on the government's insistence. Here the depths to groundwater were so great (up to 1000 meters and more) as to require the procurement of heavy oil-field type drilling equipment.

Environmental sanitation, and in particular excreta disposal, took a longer time to get established as part of the government/UNICEF program. The difficulties were the usual ones: the problem of influencing the beliefs and habits of the villagers and the need for long-range preparation of public awareness. Around 1979 UNICEF assistance was requested for tackling the drainage problem in large villages and towns in the Nile delta. The difficulties of getting rid of excreta and other wastes in these very low-lying areas, subject to flooding, can well be imagined, and in the event UNICEF was able to do little about it. In some parts of the delta, particularly around Alexandria, there were World Bank-funded drainage projects, and in later years USAID made major contributions to urban water supply projects in Egypt.

Morocco accelerated its rural water supply work with UNICEF-assistance. An experienced sanitary engineer joined this strongly community-oriented programme in the early '80s and was able to contribute significantly.

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Asia

In Asia as the new decade unfolded, population increase continued and with it problems of food and nutrition, shelter, environment and water and sanitation. At the same time, some Asian nations emerged as industrialized higher-income countries, with a definite improvement in their quality of life. Japanese trucks, machinery and supplies became a factor to reckon with in water and sanitation around the world. Japan also became a major aid-donor country, emphasizing assistance to family planning but with water and sanitation as a strong component of its community-health assistance.

Singapore, Korea and Hongkong, came to play a prominent role as centers for supplies and entrepôts for logistic support. In the rapidly industrializing Republic of Korea, UNICEF had by 1980 phased out its assistance to a successful rural sanitation programme, all support having been completely taken over by the government itself.

:China - remarkable development, enormous needs

The People's Republic of China, which has seen remarkable development, especially since 1976, still faces enormous needs for improved water supply and sanitation in different parts of the country, including the large cities. For many areas handpumps are the only solution. In the early '80s the government began co-operation with the UNDP/World Bank Handpump Development and Testing Project and built two handpump testing laboratories, one in Beijing and one in Changsha.



The Good Daughter-in-law
by Hsieh Chang-yi

"Early in the morning, the magpies cry,
The newly-wed daughter-in-law is carrying excreta on a pole
Liquid from the excreta stains her new trousers
The hot sweat soaks into her embroidered jacket
The commune members praise her and mother is pleased
All tell her she has got a good daughter-in-law."

Chinese artist (IDRC, Canada)

UNICEF does not plan to go into assistance to low-cost water supply programmes in China on any appreciable scale; the magnitude of China's needs are simply beyond any capacity that UNICEF could muster. (If the problems of rural and peri-urban water supply were approached on the scale, say, of the India programme, a total investment of \$10 billion would not seem unrealistic for an initial five-year period.) In the autumn of 1985, however, UNICEF did begin to plan for support, in the form of materials, to a water supply project in Lunan county, Yunnan province, where 70,000 people would be provided with water from existing dams through pipelines. Related sanitation problems will be taken up in this context. The UNICEF input in this case would serve to illustrate an essential public health point in an "Experience Exchange Project" of high visibility.

:Indochina, Burma

The Indochina Peninsula again attracted world attention when in 1979 the Khmer Rouge were driven out of central Kampuchea (Cambodia) by national and Vietnamese troops. The extent of the Khmer Rouge's mass killings and destruction shocked the world and triggered one of the most concerted relief efforts in history, effectively co-ordinated by UNICEF from 1979 to 1981. The emergency action was then phased over into more regular programme support.

Water and sanitation would have to wait until 1982, since food, health, transport and other more immediate aid had to be taken care of first. The first programming for water supply was limited to repairing the individual systems for hospitals, schools, orphanages, and teachers' and health workers' training centres in the capital and in the district capitals. Two small cable-tool rigs were brought into the country as generous gifts from the workers of a U.K. manufacturer of drill rigs, Duke and Ockenden, for the first drilling of wells for handpump installation in the countryside.

In Vietnam the sanitation activities continued with the construction of the double-vault latrines. Water supply progressed from the urban interventions of the 1970s to a more country-wide approach, emphasizing well drilling and the installation of handpumps in rural areas, with an extension of these services to southern Vietnam. A number of systems were created which were less costly and easier to operate and maintain for the villagers than many of the piped schemes. Drilling operations were concentrated on areas where it was difficult to dig water wells in the traditional way.

To the west, Burma had had a spectacular increase in its rural water supply activities through the Dry-Zone programme, with over 5,000 deep wells sunk from 1976 through 1985. After delivering 11 large drill rigs and ancillary equipment and other supplies for these operations, UNICEF phased out of this programme during 1985 and moved on to a major co-operation with the Ministry of Health in another part of the country, principally the three provinces in the south: Rangoon, Irrawaddy and Pegu. In the soft soils there, with the water tables close to the surface, it was easier to promote wells constructed by the communities

themselves as well as sanitary latrines. This work was closely linked with the existing political and administrative structures and the various other components of a major health development effort.

:Pakistan - a considerable expansion

In Pakistan water and sanitation activities were considerably expanded in different parts of the country. The provision of water supply and sanitation to a number of large villages in a very dry setting was a prominent feature of the Baluchistan Integrated Area Development Programme in the southwest. In Northwest Frontier Province, the accommodation of refugees from Afghanistan posed a major problem, as an estimated two-and-one-half million settled in the border zone. In many cases water had to be trucked in to them in tankers; thirty of these were provided as a gift from AGFUND through UNICEF. As this was a very expensive solution, attempts were launched to provide water by other means such as drilled wells and pipelines.

In the mainstream of village water and sanitation development, one of the most spectacular successes to which UNICEF contributed was the training and deployment of young women as local water, sanitation and health "promoters". The training program was carried out over four years, 1982-86, for 400 young women at the government's school for Community Management at Lala Musa, between Islamabad and Lahore. This was the first time women in Pakistan had been trained for such work and there were many constraints. For one thing, women were not supposed to work together with men, whereas the ideal system was foreseen as having a man-women team working in each village. Some of the young female students in these courses at first came to the Lala Musa school accompanied by their parents for safe measure. Also, the matter of excreta was not supposed to be talked about in the Pakistani villages. The results, after the first years of these courses, were spectacular, not to say startling. The sudden self-assurance of the young, once very timid ladies was highly encouraging, and the potential of the whole development was clearly visible. The problem was to prepare the government to take over the costs for the salaries of these promoters. By the end of 1985, this was still somewhat uncertain, although it seemed that the provincial and federal governments were very positive to the idea.

:India - diversification and expansion

In India, with the 1980s, there came diversification and expansion of UNICEF's work in the realms of sanitation, health education and community motivation. The Government of India continued and increased its funding and, with the state governments, the management of the water-well and handpump installation operations. By the mid-1980s, the Government of India budget for the rural water supply programme amounted to about \$650 million. Presently there are a total of some 3,000 high speed drill rigs in the country, not counting machinery of other types, and thousands of engineers and drillers involved. The handpump industry, with the manufacture of the standardized India Mark-II handpump, has over 40 manufacturers authorized to deliver their products to the different states. It means that these manufacturers have agreed to follow the

standards and submit to regular control of the deliveries. This industry is reputed to employ more than 8,000 people in different parts of the country. Every state is now keen to have some manufacturing capacity of its own.

UNICEF inputs in the early '80s shifted away from the large-scale delivery of spare parts, with much of its funding going to "software" as opposed to hardware. Particularly, it was directed toward the training of handpump caretakers, who have the principal role in the maintenance and minor repair of the pumps. In spite of brave UNICEF efforts to aid and encourage the individual State organizations to take over full responsibility for the training of these caretakers and to expand it to the required extent, things have not progressed along these lines as well as was hoped. In Andhra Pradesh, for example, in 1984, 86,000 India Mark-II pumps had been installed, but only 6,000 caretakers were trained.

Nepal is not all mountains; it includes a low-lying section in the Gangetic plains known as the Terai. In the '80s, UNICEF's water programme in that country was expanded to include support for shallow tube wells in the Terai fitted with suction handpumps of the type used in Bangladesh. Sanitation became a more prominent part of the Nepal program as a whole, promoted by the construction of demonstration latrines as part of all the water supply programs, whether in the higher reaches of the Himalayas or in the lowlands. Special attempts were made in a pilot project in a small town near Kathmandu to clean up the whole town's environment and stimulate the town dwellers to better hygiene.

:Sri Lanka - strong community participation

A pilot programme for water well drilling in the hardrock areas covering most of Sri Lanka was started up around Hambantota in the south in 1980. It was intended to show the feasibility of the India-type of handpump programme. Although there were problems with the high salinity in some of borewells, the programme was deemed successful enough to warrant its continuation on a larger scale. This was carried out in the north, around Anuradhapura, and later in the Kalutara District southeast of Colombo. Eventually wells were also drilled in parts of the area for the Mahaveli Ganga irrigation scheme.

There was a great need to improve the water and sanitation situation of the extremely poor tea plantation workers living in company housing (the "lines") in the granite hill country around Kandy. This was done through gravity feed schemes from natural springs. One brave attempt was made to experiment with horizontal drilling, but the equipment available reached only 20-30 metres into the cliffs, which was too little.

Some of the work in Kalutara was hampered by the high iron content in many of the wells. Although not detrimental to health, the iron clogged pipes and discoloured laundry. Very simple aeration and filtration plants were devised in the form of fibreglass boxes filled with gravel and sand. These would retain the worst iron contamination and were used with some success.

A notable feature of the Sri Lanka activities was the very strong element of community participation, along with enthusiastic support from the local district governments. This greatly facilitated integrated programming, with PHC and CSDR measures high on the list of priorities. Integrated programming likewise characterized the UNICEF-assisted sanitation project in some of the low-income areas of Colombo, its first venture into the vast problems of the poor urban areas in Sri Lanka.

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The Americas: urban urgency

A salient feature of life in the Americas Region in the early 1980s was the continued acceleration in the growth of cities, illustrated by the oft-quoted figures for Mexico City, which grew from 4 million inhabitants in 1960 to 20 million in the Distrito Federal in 1985. The Americas in absolute terms continued to receive the smallest share of UNICEF's assistance in this decade, but through carefully programmed inputs UNICEF was able to make meaningful contributions to a number of self-help projects in poor urban areas.

In four coastal cities in Mexico, campaigns were launched to help slum dwellers build latrines, not an easy task as the location of their dwellings had been forcibly restricted to low-lying marshlands close to estuaries, which frequently flooded homes and streets. In the programme for the "Pueblos Jovenes" of the "Barriadas" of Lima, Peru, aid was given with designs, tools and materials to construct simple water supply, shower and laundry facilities, along with latrines. Special problems could arise -- how to overcome the opposition of private water vendors, for example, whose profitable monopolies were threatened by the introduction of piped water. This problem arose while planning for UNICEF support in the poor urban areas of Guayaquil, Ecuador, and is presently being studied.

The rural water supply activities with UNICEF assistance continued in the Caribbean. Haiti managed to give a major boost to a new water well cum handpump programme, introducing the India Mark-II pump to the region. Previously cast-iron pumps of traditional designs had been predominant. During the last years in Haiti, this task was greatly helped though the dedicated professional management of the Director of the National Society for Drinking Water, engineer Pierre Sajous. The recent political changes with the end of the 28 years of rule by the Duvalier family, may bring about a further and much-needed increase in activities.

In Central America, after some years of low-key but continuous support to Guatemala, Honduras, El Salvador and Nicaragua, a marked increase of planning for UNICEF-funded water and sanitation activities took place. An entirely new programme for well drilling and handpumps began in 1985 in Belize. By the beginning of 1986 the establishment of an area post for Central America of a joint Pan American Health Organization/UNICEF water supply and sanitation adviser was seriously being considered.

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PART III -- SUMMING UP AND OUTLOOK

Children, water, and the environment

Children, as the most vulnerable group of human populations, are the ones most dependent on their environment. In the parts of the world where most of UNICEF's inputs are applied, the deterioration of the environment is progressing at an accelerating rate. The resulting loss of agricultural production and other means to sustain a reasonable quality of life, including the supply of water and household fuel, tend to sustain high infant and child mortality and morbidity rates.

This degradation of the environment can take dramatic forms. Entire villages on the slopes of the Himalayas in Pakistan, Nepal and northern India are carried down into the valleys, forcing thousands of people to settle in the already over-populated lowlands. In Mexico, a drying up of soil and groundwater resources along with damaging agricultural practices are destroying entire landscapes. Some of the UNICEF-assisted projects in Chiapas risk being laid waste in a few years because of these phenomena, causing wholesale migration of entire communities to the cities, especially to the environs of Mexico City, already perhaps the world's largest urban conglomeration.

The impact of these negative environmental developments on children's lives and well-being is evident and has to be taken into account in planning for the improvement of their condition. At the same time, there have been encouraging technical developments over the past forty years in such environmental matters as water, sanitation, and vector control, and both governments and aid organizations have given greater priority to these environmental considerations.

The rehabilitation of damaged water and sanitation systems immediately following World War II primarily dealt with municipal systems in the more industrialized countries, and the requisite skills and experiences were readily available. This was not the case in the countries comprising the so-called Third World, most of which at that time still consisted of colonies. The independence of the former colonies, the gradual improvement of administrations and human capabilities combined with the development of external sources of cooperation and assistance, slowly led to a recognition of the needs for basic services on a nation-wide scale and the possibility of providing them on a economically feasible basis. Although still incomplete and in some parts of the world interrupted by new bouts of human conflict, this development process, helped by great scientific, technical and industrial advances, seems to be spreading with positive benefits. The problem now, especially in the fields of water supply and sanitation, which require a global awareness and major investments along with participation by the communities concerned, is to help promote the coverage of entire populations in spite of the rapid increase in their numbers.

The health factors -- new insights

It became evident over the past four decades that determining the effects of water supply, sanitation and other environmental factors on health, and consequently the social and economic conditions of communities -- and in particular on children -- was a much more complex matter than had at

first been realized. Biomedical, epidemiological, immunological, nutritional and other research, combined with technical developments and developments in the social sciences, have provided insights which now make it possible to plan more purposefully for remedial action.

This in its turn has greatly stimulated the present integrated approaches to improvements in the health conditions of children and the communities they live in. It has helped in a better combination of preventive and curative measures, including improved vector control, immunization, new drugs (e.g. against schistosomiasis) in combination with the provision of safe water and sanitation facilities. The need for water supply in adequate quantities -- not only better quality -- has been further recognized in its effects on personal hygiene, with a direct impact on other categories of diseases, notably skin and eye infections. Equally important, easier access to household water directly benefits women and older children by reducing the energy they waste on long hauls of water from distant sources, leaving them time and energy for more productive work. Yet another health spin-off lies in the use of excess water from pumps or gravity-feed schemes for micro-irrigation. This can be applied to raising nutritious vegetables and fruits, improving both child nutrition and the family economy.

+ + + +

The remedies: a revolution in technologies and social awareness

The past forty years have witnessed great changes in the awareness of the basic needs of the poorest populations and in the approaches to solve the connected problems. These changes are the result of a trial and error process in terms of concepts, technologies, planning and programming. The need to assist the poorest areas, both rural and peri-urban, prompted a departure from the conventional, strongly urban-oriented approaches.

Thus, in water and sanitation, the overall trend, especially during the last fifteen to twenty years, has led to lower-cost technologies and the development of projects and their implementation on a community basis. Some of the lowest cost handpump installations, e.g. in Bangladesh, can be carried out for as low as \$2 per capita. US \$25 per capita is a normal figure for deeper handpump installations in borewells or for piped gravity feed schemes with public standposts. This compares with costs for high-technology water installations ranging from \$300 to thousands of dollars per capita.

The use of high-speed water-well drill rigs has made it possible to sink 50-metre wells (150 feet) in hard rocks in one eight-hour shift, as against one to four months with traditional equipment. The handpump types of yesteryear had to be redesigned radically in order for each pump to effectively serve hundreds of villagers daily. The combination of such technologies is now bringing water supply to another estimated 45 million people in India each year. New sophisticated filter media with strong germicidal properties promise to further improve water quality. The lowering of costs for solar energy will contribute to an easier flow of groundwater to remote communities. Subsurface dams are increasingly

coming into use in tropical and subtropical regions, where the waters in open dams disappear too rapidly through extreme evaporation rates.

Similarly, sanitation technologies have moved towards low-cost options with the use of local materials and locally acceptable designs. This pertains especially to excreta disposal. Installations such as the "VIP" (Ventilated Improved Pit) latrine are coming into wider use and help lower the risk of infections via the fecal-oral route. Recycling of wastes and the composting of fecal matter for the production of fertilizer and biogas may not have won universal acceptance but are practiced in a number of countries with direct economic benefits for the local populations.

Social approaches

The old "top-down" type of programming and project implementation left in its wake thousands of unusable costly installations in the form of derelict water treatment plants and broken handpumps, leaving the communities in the same or worse health conditions as before. The same pertained to the scant efforts to promote environmental sanitation, a subject even less enticing to the communities. A full realization of the need for community participation, combined with the appropriate motivation and education, came about generally only during the 1970s. This concerns any type of activity, but is particularly relevant to the very basic services of water supply and sanitation, which require concerted agreement and action on the part of the people who stand to benefit.

In this context, the particular importance of women's role is worth noting. Not only are women the traditional providers of water or "managers" of their own households, but they are the educators of infants and young children as well as of the older girls. So far, however, in relation to project planning and participation, they constitute a little or poorly used resource. In parts of rural Pakistan, the training and use of women as village sanitation workers has made for a kind of breakthrough in traditionally male strongholds. In Ethiopia the surprising strength of the village women's associations is further supported through easier access to water.

The recently intensified action in the field of human resources development is an important factor in strengthening the social basis of water and sanitation programmes. This includes training of people at all levels -- government, technical support staff, social workers, and above all community workers themselves. Insufficient skills and their uneven distribution are still the principal bottlenecks that have to be overcome. Health and sanitation at village level, a good part of it directed toward the children, is the final and most important step in human resources development.

Finance and administration

A vast investment in funding and administrative capacity is clearly needed to bring about the equally vast improvements that adequate water and sanitation would bring to the children and families who still lack

these necessities. Less than half of the needs have been covered to date. Yet there is reason for encouragement. Communities seem more willing and interested in contributing their share to the financing and upkeep of facilities. Governments in the developing countries now have national plans and corresponding budget lines where there were none before. Administrations in many countries are better geared to support the work.

New insights, increased levels of activity, and corresponding planning and management complexities have led to the increased use of evaluations for more efficient monitoring and administration. The systematic development of new evaluation techniques and methodologies is still under way, and the ultimate effects of the various water and sanitation programmes on the health and lives of children will probably take a long time properly to estimate and evaluate.

+ + + +

International action and UNICEF's role

Action in the fields of water supply and sanitation has advanced over the past ten years more than anybody might have anticipated even around 1970. This development is being facilitated by unusually concerted and politically non-controversial actions among the different countries in the world, thanks in part to the influence of the International Drinking Water Supply and Sanitation Decade 1981-1990. A considerable part of the present trend towards improvement in this field in the majority of developing countries would seem to be due to the "Decade's" promotional impact. The Decade does not constitute a programme in itself, and its goal of adequate water supply and sanitation for everybody by the year 1990 will undoubtedly remain unfulfilled in many countries, but at least a beginning has been made. UNICEF's role is impossible to assess properly, since it involves such close cooperation and coordination with others: governments, international agencies, and other agencies -- hundreds of them. It is difficult to state where the work of one agency begins and another ends. Yet UNICEF's concern for the poorest segments of rural and peri-urban populations has certainly contributed to a more rapid coverage of these groups on a national scale in many countries. Its effective cooperation with a number of major international organizations, notably WHO, UNDP, UNDTCD and the World Bank, has developed into what is probably one of the best United Nations support actions at any time in a specialized field.

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Outlook

The dependence of children on their physical environment and environmentally-related basic services has been brutally, tragically illustrated during the past fifteen to twenty years through enormous ecological catastrophes: on a large scale in Africa; on only somewhat smaller and slower scales in parts of Asia and the Americas. The

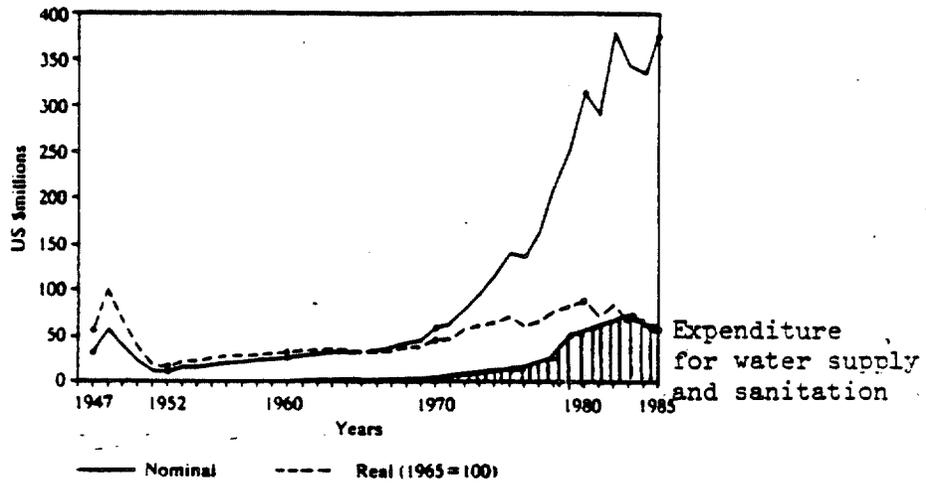
question of water and sanitation for child health and welfare has to be seen in this wider environmental context.

Up until now there seem to have been positive advances in children's immediate environment in most developing countries -- although these advances are in danger of being outbalanced by the still rapid population increase in large parts of the world. The greatest uncertainty is in the threat of the deterioration of the environment at large, caught in the cycle of overpopulation, deforestation, overgrazing, overcultivation, erosion, dessication and desertification.

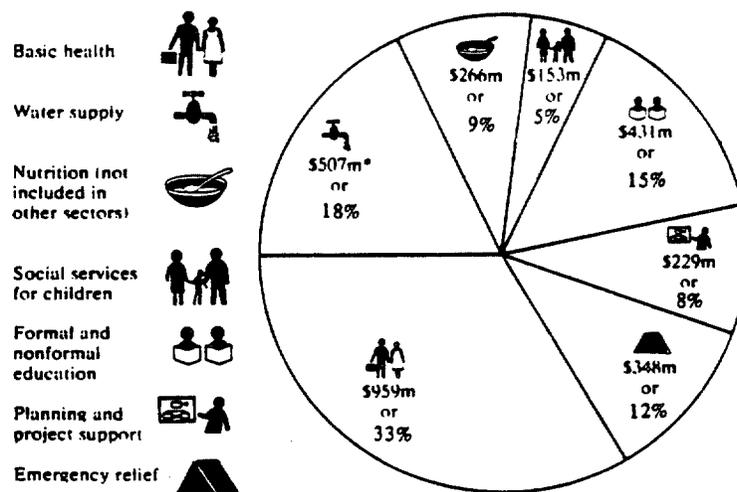
The next great step to take will be increasing the awareness of the environment. For this, a motivational and educational effort of unprecedented dimensions is overdue. It will have to be directed to adults and children alike and will have to be accompanied by practical measures, involving agricultural extension and all phases of community development. After all, the children of today face an environmental heritage in many respects more depleted than it was forty years ago.

ANNEX I

Unicef Total Income 1947-85
Real and Nominal Terms



Expenditure on Programmes by Sector 1947-85



* Expenditure for water supply incurred prior to 1970 is included in basic health.

ANNEX I

Unicef expenditure from inception through 1986
(\$ million)

	<u>1947-50</u>	<u>1951-59</u>	<u>1960-69</u>	<u>1970-79</u>	<u>1980-86</u>	<u>1947-86</u>
Long-range aid:						
Health services	8.0	26.0	97.7	313.8	481.4	926.9
Mass disease control campaigns	12.3	56.7	82.2	*	*	151.2
Water and sanitation	*	*	*	156.3	409.0	565.3
Child nutrition	5.4	19.1	47.3	87.0	124.8	283.6
Social welfare services for children	*	*	9.1	49.3	111.1	169.5
Formal education	--	--	30.3	170.9	158.7	359.9
Nonformal education	--	--	2.4	27.7	71.3	101.4
General**	--	--	6.3	62.3	212.7	281.3
Total long-range aid	25.7	101.8	275.3	867.3	1569.0	2839.1
Emergency relief***	82.3	34.8	11.1	42.7	209.3	380.2
Total programme aid	108.0	136.6	286.4	910.0	1978.3	3219.3
Programme support services	0.3	14.1	42.4	158.1	359.9	574.8
Total assistance	108.3	150.7	328.8	1068.1	2138.2	3794.1
Administration costs	6.6	10.6	25.5	97.9	261.2	401.8
Total expenditures.	114.9	161.3	354.3	1166.0	2399.4	4195.9

* Included in health services.

** This assistance cannot be broken down into the above categories. It includes mainly planning and project preparation, project support services and project support communication.

*** Not including expenditure for rehabilitation of facilities damaged or destroyed in emergency situations which is distributed into appropriate categories of assistance.

ANNEX I

One Year of UNICEF Co-operation
for Water Supply and Sanitation: 1986

<u>COUNTRY</u>	<u>EXPENDITURES</u> (in US \$)	<u>BENEFICIARIES</u>	
		<u>Water Supply</u>	<u>Sanitation</u>
<u>West Africa</u>			
Angola	1,169,000	30,500	2,000
Benin	402,000		
Burkina Faso	688,000		
Cameroon	213,000		
Cape Verde	166,000		
Central African Rep.	494,000		
Chad	11,000		
Gambia	163,000		
Ghana	303,000		
Guinea	216,000		
Guinea-Bissau	307,000		
Liberia	25,000		
Mali	669,000	27,000	
Mauritania	2,000		
Niger	189,000	161,000	29,000
Nigeria	2,214,000	75,000	25,000
Senegal	157,000		
Sierra Leone	80,000	100,000	1,200
Togo	2,000		
Zaire	393,000	174,000	
<u>East Africa</u>			
Botswana	106,000		3,000
Burundi	401,000		
Comoros	104,000		
Djibouti	47,000		
Ethiopia	2,656,000	621,000	20,000
Kenya	58,000	17,900	15,800
Lesotho	203,000		
Madagascar	114,000		
Malawi	31,000	19,000	13,400
Mozambique	419,000	123,400	
Rwanda	198,000	20,000	--
Somalia	479,000	51,000	1,500
Uganda	2,878,000	190,000	
United Rep. Tanzania	454,000		
Zimbabwe	193,000	11,400	3,600

ANNEX I

One Year of UNICEF Co-operation
for Water Supply and Sanitation: 1986

<u>COUNTRY</u>	<u>EXPENDITURE</u> (in US \$)	<u>BENEFICIARIES</u>	
		<u>Water Supply</u>	<u>Sanitation</u>
<u>Middle East and North Africa</u>			
Democratic Yemen	108,000	N/A	N/A
Egypt	1,118,000	77,000	12,000
Jordan	2,000		
Lebanon	3,906,000	3,200,000	
Morocco	285,000		10,000
Oman	7,000	N/A	N/A
Sudan	1,516,000	112,500	3,200
Tunisia	692,000	215,000	3,800
Yemen Arab Republic	351,000	50,000	8,000
<u>Americas</u>			
Argentina	109,000	135,000	1,100
Belize	138,000	N/A	
Bolivia	412,000	60,500	12,000
Colombia	-0-	N/A	4,700
Costa Rica	90,000	4,000	N/A
Cuba	25,000	N/A	
Dominica	27,000	N/A	N/A
Dominican Republic	-0-	N/A	N/A
El Salvador	20,000	N/A	
Guatemala	199,000	39,200	38,400
Guayana	35,000	2,800	30,000
Haiti	700,000	122,000	
Honduras	-0-		
Jamaica	26,000		
Mexico	188,000	N/A	
Nicaragua	82,000		
Panama	17,000	0,600	
Paraguay	43,000	7,700	10,900
Peru	148,000	45,000	N/A
Other Caribbean Regional Urban Eastern Caribbean	249,000		

ANNEX I

One Year of UNICEF Co-operation
for Water Supply and Sanitation: 1986

<u>COUNTRY</u>	<u>EXPENDITURES</u> (in US \$)	<u>BENEFICIARIES</u>	
		<u>Water Supply</u>	<u>Sanitation</u>
<u>South Central Asia</u>			
Afghanistan	57,000	115,000	61,000
Bhutan	107,000	14,800	N/A
India	12,239,000	3,256,000	469,000
Maldives	66,000	12,000	3,000
Nepal	1,434,000	107,500	24,500
Sri Lanka	1,162,000	241,600	90,600
<u>East Asia & Pacific</u>			
Bangladesh	1,360,000	6,778,000	103,800
Burma	2,558,000	325,500	1,406,900
Indonesia	1,117,000	382,800	9,500
Kampuchea	1,327,000		N/A
Lao P.D.R.	287,000	90,000	N/A
Pakistan	2,619,000	309,300	42,000
Papua New Guinea	34,000	N/A	N/A
Philippines			
Solomon and other Pacific Islands	77,000	N/A	
Thailand	802,000	1,257,000	32,000
Vietnam	2,205	71,500	0,300

ANNEX II -- SELECTED BIBLIOGRAPHY

- ARLOSOROFF, Shaul et. al.: Community water supply: The handpump option. The World Bank, Washington, D.C. 1987.
- BEYER, Martin G.: The WET history. Water and sanitation in UNICEF 1946-1986. UNICEF WET Monograph No. 2, UNICEF, New York 1987 (unabridged).
- BLACK, Maggie: The children and the nations. UNICEF, New York 1986.
- BRADLEY, David, WHITE, Gilbert and WHITE, Anne: Drawers of water: Domestic water use in East Africa. University of Chicago Press, Chicago, 1972.
- BRISCOE, John, FEACHEM, Richard G. and RAHAMAN, Mujibur M.: Evaluating health impact. Water supply, sanitation and hygiene education. IDRC, Ottawa, Ontario, 1986. (Co-published with UNICEF and ICDDR,B.)
- GLASGOW, Muriel (Edit.): Promoting health behaviour in water and sanitation programmes. Report of a Working Group, UNICEF, New York, 25-29 March 1985.
- GLENNIE, Colin: Village water supply in the Decade: Lessons from field experience. Wiley, London, 1983.
- JORDAN, Tom: A handbook of gravity-flow systems. Intermediate Technology Publications, London, 1984.
- MA Yansheng and ELMENDORF, Mary: Insights from field practice: How women have been and could be involved in water supply and sanitation at the community level. Inter-Agency Task Force on Women and Water for the UN Steering Committee for Co-operative Action on the IDWSSD, November 1984, New York.
- SAUNDERS, R.J. and WARFORD, J.: Village water supply: Economics and policy in the developing world. Published for the World Bank by the Johns Hopkins University Press, Baltimore, 1976 (A World Bank Research Publication).
- SPIEGELMAN, Judith M. and UNICEF: We are the children. A celebration of UNICEF's first forty years. The Atlantic Monthly Press, Boston/New York, 1986.
- TATA Economic Consultancy Service (Bombay): Semi-industrial projects assisted by UNICEF in India. (Part on India Mk-II handpump.) UNICEF Regional Office for South-Central Asia, New Delhi, Dec. 1984.
- UNICEF: Water supply and sanitation. Programme Field Guidelines, Book E. Draft, UNICEF, New York 1987.
- UNICEF: From the UNICEF waterfront. Newsletter, issues 1 - 34, UNICEF, New York, 1975-1986.
- UNICEF/WHO: Joint study on water supply and sanitation components of Primary Health Care. UNICEF Document E/ICEF/L.1386, New York, 15 December 1978.
- UNICEF: Guidelist AQUA (Equipment and materials for water supply and sanitation). Under preparation for publication 1988. UNICEF, New York.
- UNICEF/WHO: Joint study on water supply and sanitation components of Primary Health Care. UNICEF Document E/ICEF/L.1386, New York, 15 December 1978.

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