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***Needs and problems
in water supply
in developing countries***

The world's average man

He lives in a hut
He cannot read or write
His energy is sapped by disease
He labors fifteen hours a day
He works on land he does not own
He and his family are always hungry
He will die young

From: Journal of Geography, 1967

INTRODUCTION

The variation in physical environment, culture and history in the part of the earth where poverty prevails is considerable. It is not surprising, therefore, that between the three developing continents (fig. 1) fundamental differences exist, both as to magnitude and character of the problems.

One of the problems affecting water supply is the fast increase of the population. Fig. 2 and 3 elucidate the population problem. Fig. 2 gives the increase of total population per region; fig. 3 shows the world population from data of the UN Dept of Economics and Social Affairs and other sources. An accelerated development - it will be evident to all - is necessary. In this development water will play a critical role. The development of the economy in the countries concerned can only then proceed, if an adequate water

INDUSTRIALIZED AND DEVELOPING REGIONS

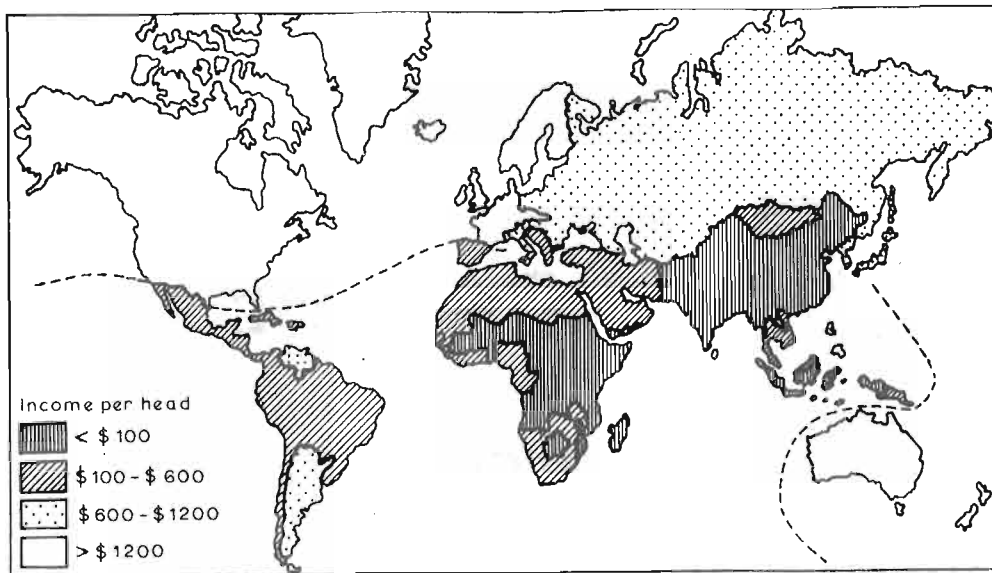


Figure 1 - Industrialized and developing regions

supply raises the public health to an appropriate level, sustains agriculture and industry, and maintains a healthy environment. The Western countries will have to pay their contribution to this development, among other things by making their experience available to the developing regions.

The report of the Club of Rome states in the concluding section that world equilibrium can only become a reality if the situation of the so-called developing countries in an important measure is improved, both in absolute sense, and as compared to the industrialized countries. One of the messages in the report is that improvement can only be achieved by a global strategy.

WATER NEEDS

A priority which was mentioned in many of the 109 recommendations at the U.N. Conference on the Human Environment in Stockholm 1972 was the development and improvement of water supplies. Indeed, next to hunger and growth of population the shortage of water forms a characteristic of the situation in the third world.

Fig. 4 shows the water supply situation in 1970 (deduced from a report of the Director General of the WHO to the Twenty-third World Health Assembly (1)). Fig. 5 gives the same, divided into urban and rural situations. This figure shows that most people without safe water live under rural circumstances, and that most people in rural circumstances live without safe water.

Fig. 6 gives a comparison between the situations at the beginning and at the end of the development decades. Situation 1962 has been based on several different data and the expected situation 1980 has been taken from the results of a WHO-questionnaire in 90 countries, published in the progress report by the Director-General of the WHO to the Twenty-fifth World Health Assembly (2). It can be concluded that from 1962 to 1970 a considerable progress has been booked, especially in the cities. Yet, due to increase of population the development shows a backtrend: also totals not-served still grow. To-day 250 million citizens and more than

POPULATION INCREASE 1960-1970
PER REGION

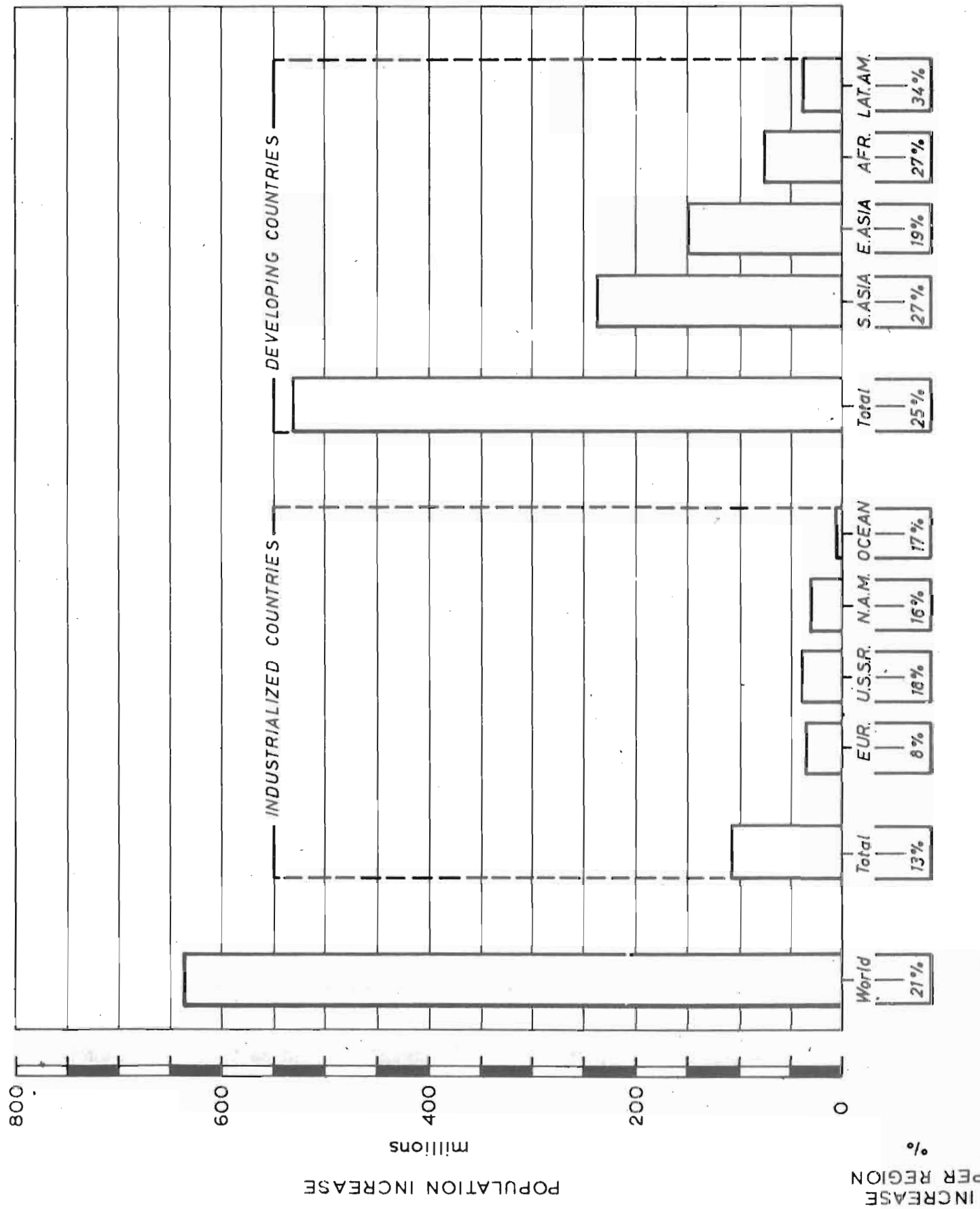


Figure 2 Population increase 1960 - 1970

POPULATION 1970
PER REGION

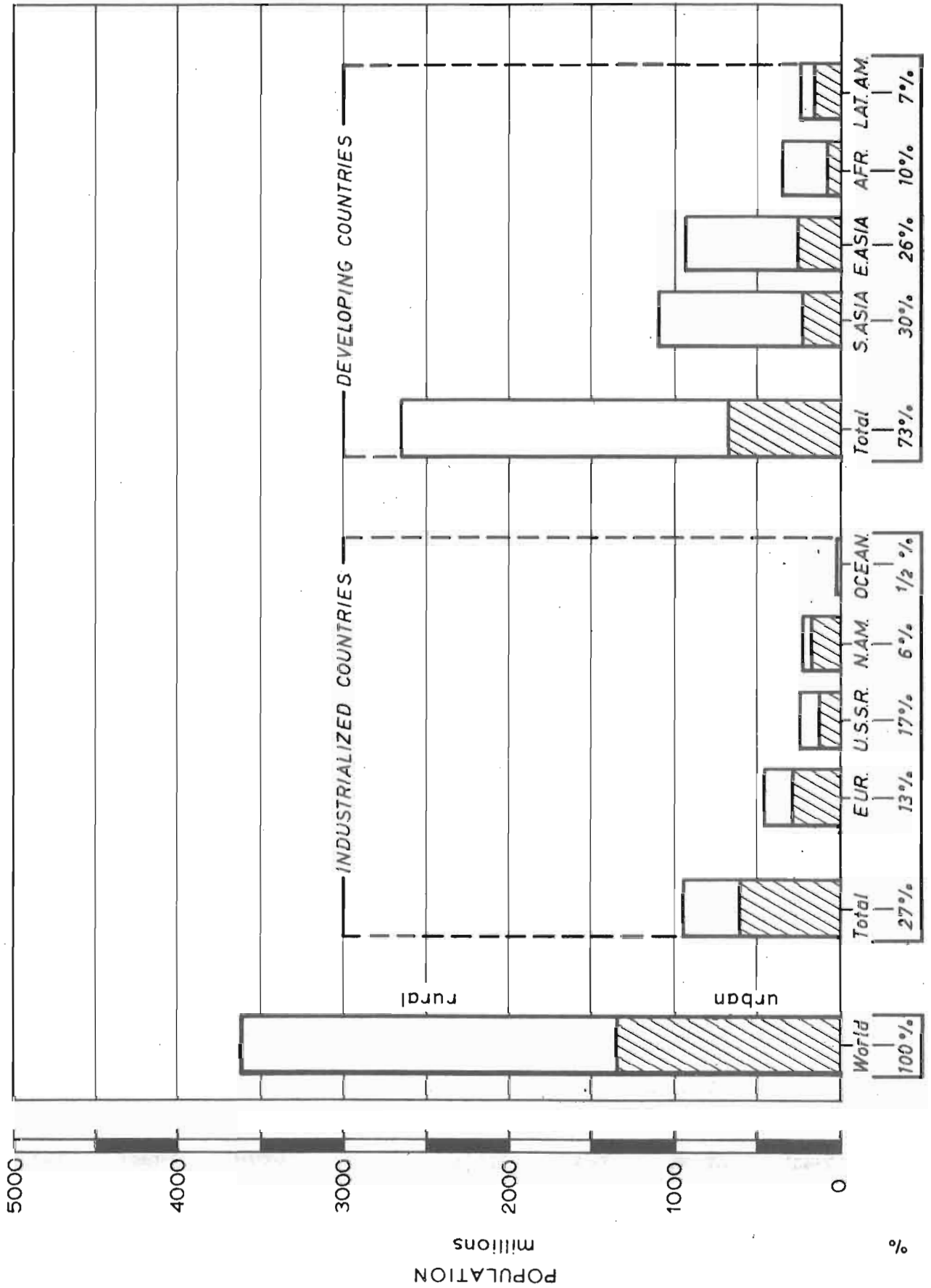


Figure 3 Population 1970

WATER SUPPLY SITUATION 1970
 DEVELOPING COUNTRIES WHO MEMBER STATES

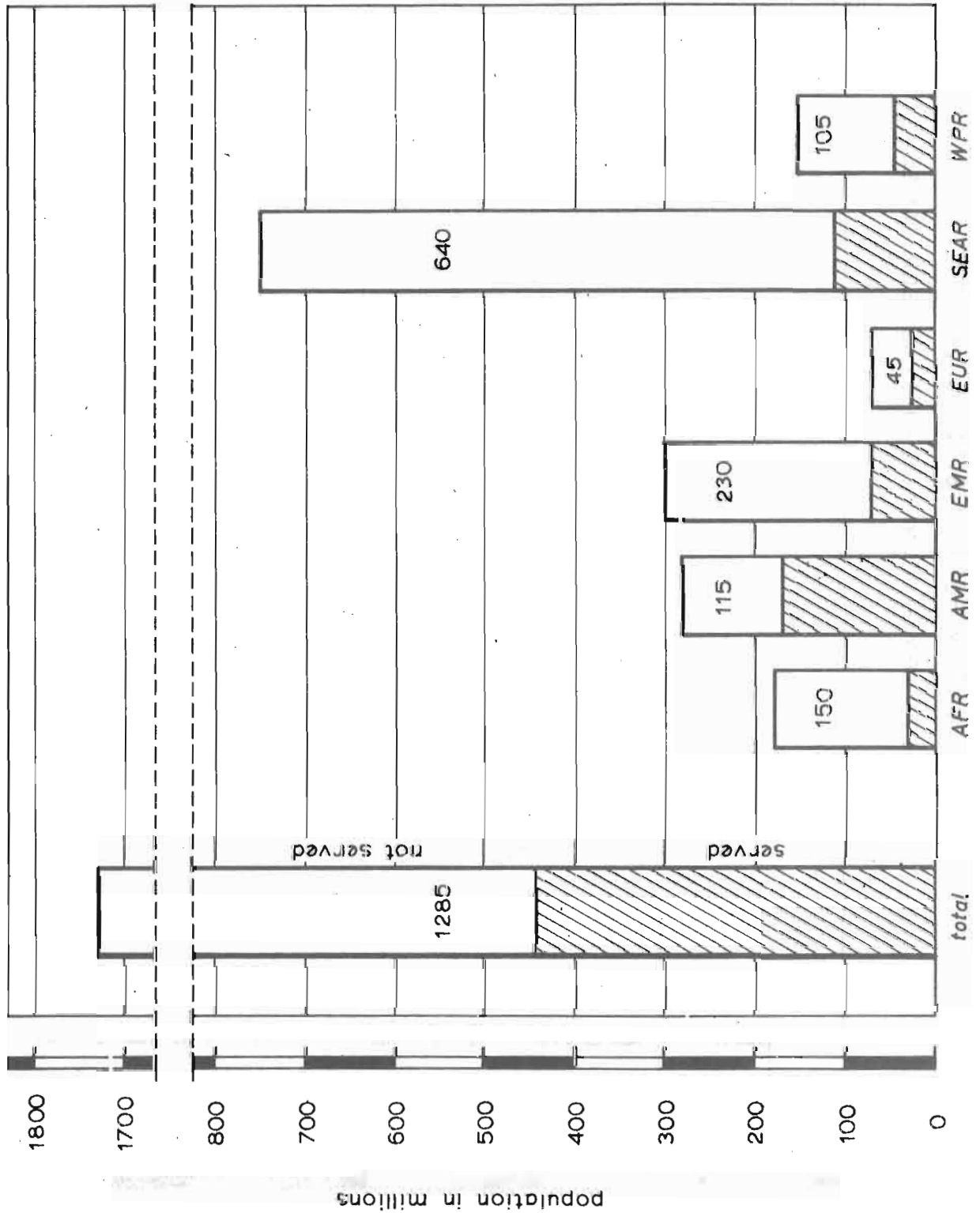


Figure 4 Water supply situation 1970

WATER SUPPLY SITUATION 1970
DEVELOPING COUNTRIES WHO MEMBER STATES

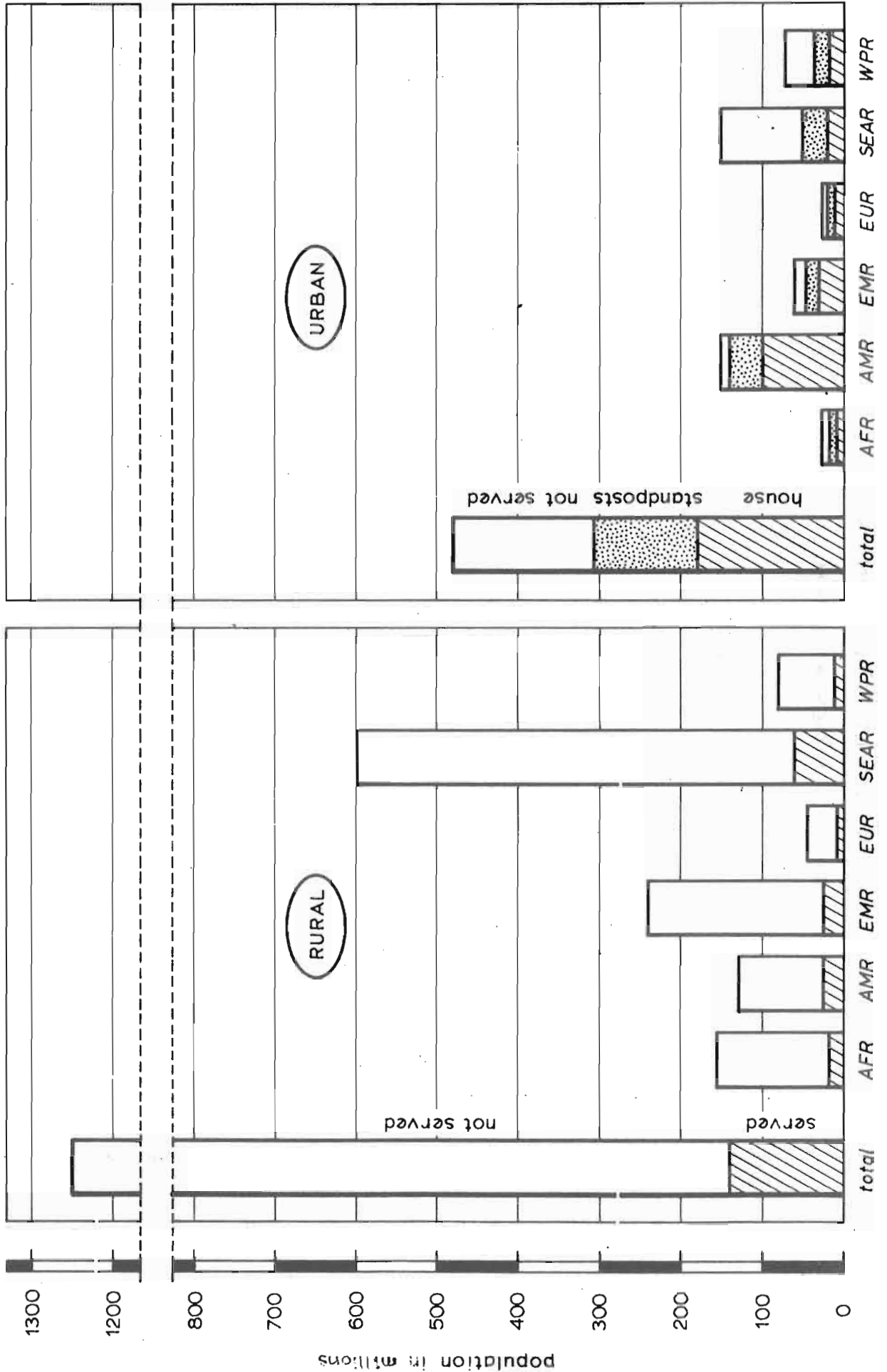


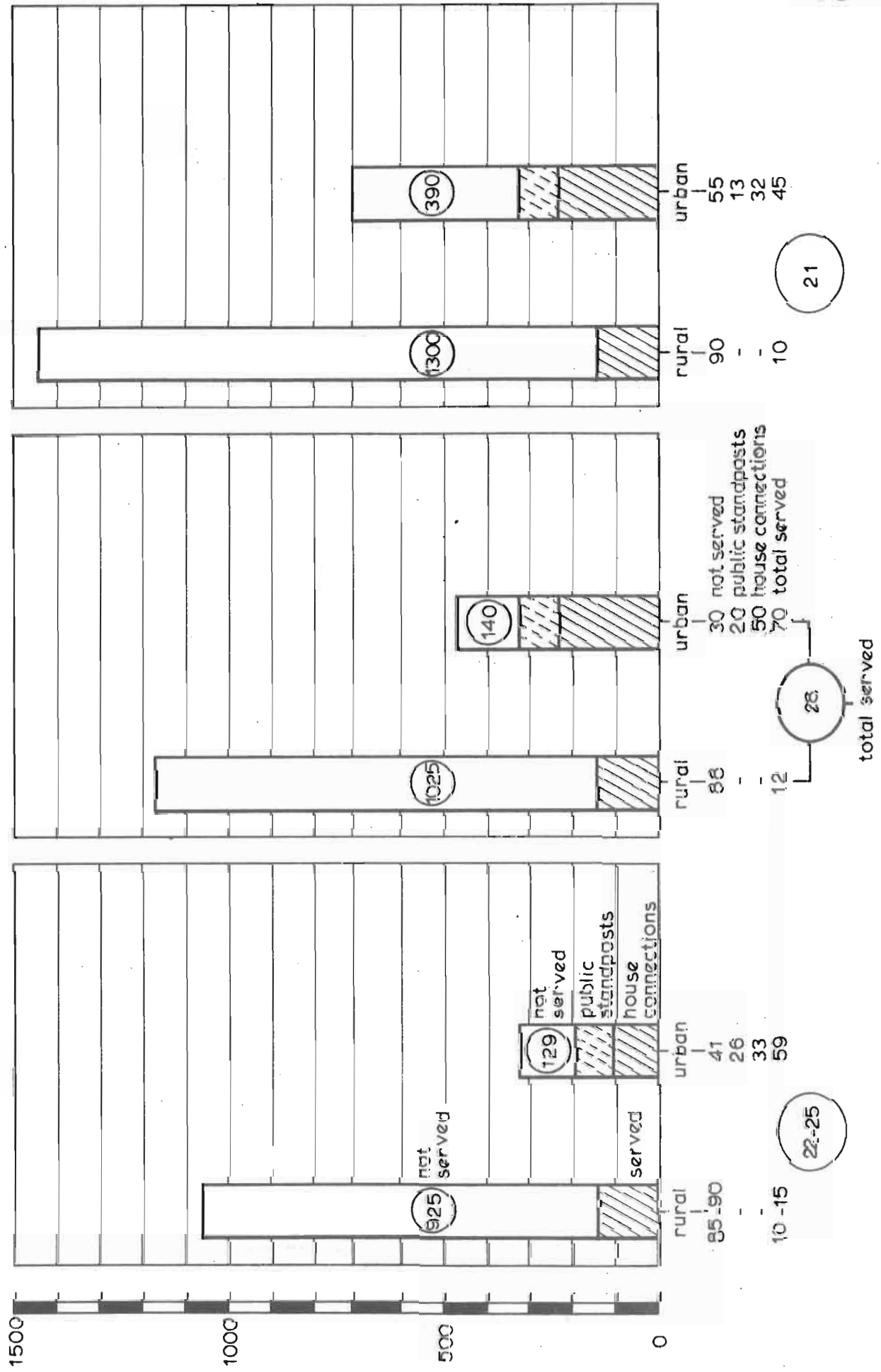
Figure 5 Water supply situation 1970 divided into urban and rural situations.

COMMUNITY WATER SUPPLY SITUATION DEVELOPING COUNTRIES

1980

1970

1962



POPULATION SERVED AND NOT SERVED

millions

%

Figure 6 Community water supply in developing countries.

1000 million rurals are waiting for adequate water supplies.

Maurice Strong, Secretary General of the Conference on the Human Environment stated on water supply two years ago: "A shortage of drinking water threatens to make life in many cities in developing countries impossible. In many cases the problem of shortage of drinking water is much greater than that of shortage of food".

The consequences of a lack of water supply services can indeed be disastrous. It is now universally accepted that by providing a community with safe water, epidemics of water-borne diseases such as cholera and typhoid fever can be prevented, and incidence of these diseases can often be considerably reduced. Other water-borne diseases include dysentery, paratyphoid fever, infectious hepatitis, hookworm, etc.

The possible implications of water-shortages as described above can be illustrated by the consequences of the great outbreak of cholera epidemics in 1867. The disease spread via Canada to Argentina and other parts of the world. As stated by M. G. Candau, Director of WHO (1967), in that outbreak 50 000 people died in Argentina, 130 000 in European Russia, 190 000 in Hungary, 90 000 in Japan and many others elsewhere whose deaths were not recorded. It is estimated that five million people die every year from infectious diseases contracted through water. Dramatic examples of epidemics caused by water show that there is no frontier to stop circulation of water and that its properties must be studied on an international scale as well as a subject of international cooperation.

A result of good water supply is shown in fig. 7 (3).

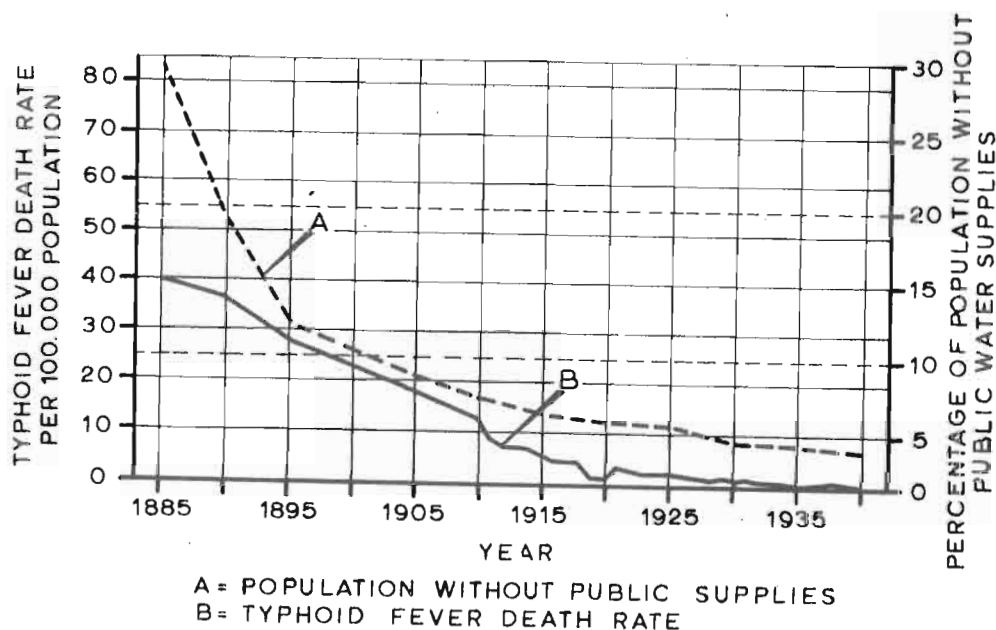


Figure 7. Relation of typhoid fever death rate to percentage of population without public water supplies in the State of Massachusetts, USA

Another aspect of the problem is illustrated by recent national studies in Africa which show that women in rural areas spend so much time carrying small amounts of water - often unsuitable for consumption - that they lack the necessary time and energy to care for their children or to educate themselves. It is not only the construction and exploitation of ponds, wells and other water sources which is at stake, but the basic education of populations in the least-developed parts of the world in the simple facts of hygiene and sanitation.

In order to stimulate an accelerated progress in community water supply during the UN Second Development Decade (1971-1980), WHO proposed the adoption of global targets. Towards 1980 it is attempted to arrive at water supplies for the entire urban world population and for 25% of the rural population. This implies additional water supplies for 500 million urbans and 200 million rurals in 1980. This also implies a total amount of US\$13 200 million, based on the assumption that costs of house connections are approx. US\$38.- and public stand pipes US\$15.- per capita.

In the Third World the history of the West is repeated. Perforced by circumstances, however, a much shorter space of time is available. The water need of the developing countries asks for assistance by the industrialized countries. This means an enormous challenge to the Western world in general and to the water supply in particular.

The task should be a rewarding one. As Dr Jenney states in his terminal report of a mission in Brazil (4): "In the complicated network of economic deficiencies (in the developing areas), the improvement of a man's health is an achievement that will neither create a new need, nor in turn depend upon another capital investment for its success. It is unique in that it is a successful end in itself, economically basic, politically unquestionable, and in most cases technically negotiable. Sometimes, as in eradication of a disease, it is a single investment, ended forever, a paid-up endowment for the infinite future. In the Western world we are living on such an endowment; the developing areas are not, and this most acute difference is reflected in every facet of economic and cultural contrast".

Which, then, are the constraints of a rapid progress in water supply and how far will a different approach to that during the last decades be required? The governments of the countries concerned have in answer to the afore mentioned WHO-questionnaire characterized the lacks which in their opinion cause a meagre progress(2):

- insufficient finances (both internal and external inappropriate financial frameworks;
- lack of trained personnel;
- inappropriate administrative structure and in many cases an inadequate or outmoded legal framework;
- insufficient production and use of local material.

Connected with these basic constraints are many complicating factors which are of regional or local character. Some examples may elucidate the diverging nature of these problems. As in many countries, the groundwater in North-Cameroon remains unattainable for the inhabitants who every day have to walk many miles in order to secure their water supply. Reasons are

insufficient geological insight, a dry climate and impassable roads.

Problems are often connected with town and country planning. In the interior of Brazil the scattered population makes an adequate provision of water unpayable. In many developing countries the "bidonvilles" form an infra-structure in which the construction of supplies is impossible.

In the rural areas, social and psychological problems play their role. Here sound information is rarely available and education lacks. In many cases the chlorinated water - unknown smelling - is being used for the washing of clothes, whereas the familiar brook, though polluted, continues to serve as a source of water - and as latrine. In certain areas in Asia the water of the river, used throughout living memory, will remain sacred, however dirty it may be.

In other places the problems are of political nature. Whereas in the country of Kenya rainwater is caught by way of roofs and stored in cisterns, in many other African countries it disappears unused into the soil, as the construction of preliminary facilities would be a reason for the government to refuse assistance in the future.

For the Congo-project, plans are ready. Resulting from this project, enormous boundary-crossing Congo- and Tsaad-lakes would change the climate in Central-Africa, fertilize parts of the Sahara-desert and solve water supply problems in surrounding areas. But due to political implications this is unlikely to come about.

As everywhere sly merchants take advantage of the needs of their fellow-men. In many countries the poor water situation gives them a safe income by asking exorbitant amounts for a few gallons of unreliable water. Prices 5 to 50 times the cost that would be required to maintain a public, piped and treated water system; are paid to these vendors.

APPROACH

Of great importance is the question of how to improve this poor situation. One of the prime constraints might be the lack of decisive governmental intent. Of equal importance, however, is the recognition by the officials of the governments canvassed by the earlier mentioned WHO questionnaire that the number one constraint is the insufficiency of internal financing. This leads all other retardants, such as lack of trained personnel, inappropriate administrative structures, lack of external money, insufficient production of local materials, or inadequate or outmoded legal framework.

Undoubtedly, part of the deficiency exemplified in lack of internal money is bound up with the failure to develop fiscal resources and machinery to reduce, if not eliminate, this financial restraint. Successful moves in this direction are already underway in many developing countries, such as Brazil, Guatemala, Ghana, Tanzania and Israel. The means of introducing these aspects into country campaigns are perhaps the keys to successful implementation (5). A greater effort should be made to tap financial sources within the country. The necessary external financial support will in general come available on the base of carefully planned "bankable" projects. Without doubt the lack of training constitutes a serious shortcoming. Universities in most countries educate engineers. In many cases the education is not problem oriented,

COMMUNITY WATER SUPPLY: TRAINING NEEDS, 1972-1976

Region	WHO-sponsored fellows, 1971	No. of staff requiring training, ¹ 1972-1976												
		Professionals						Non-professionals						
		Managers	Financial personnel	Engineers	Chemists, biologists	Other	Total	Allied health professions	Well drillers	Supervisors	Special artisans	Special clerical	Total	
AFR	41	57	64	272	63	74	530	187	170	290	350	200	1197	
AMR	85	187	127	204	79	97	694	298	248	266	1207	25	2044	
EMR	33	119	137	228	134	64	682	226	127	275	676	170	1474	
EUR	49	-	6	24	6	-	-	36	-	-	-	-	-	
SEAR	23	57	31	170	2505	12	2775	760	40	275	100	100	1275	
WPR	12	289	407	607	158	157	1618	558	402	2000	4004	3820	10784	
Total	243	709	772	1505	2945	404	6335	2029	987	3106	6337	4315	16774	

¹ For whom training facilities are not now available in their countries

Table 1

Community water supply training needs 1972-1976

however. In India, for instance, engineers are available in great numbers. Few of them have been educated in such a way that they can be used in those fields and at those places where the problems are the most serious. Table 1 shows training needs in the period 1972-1976 (2). The greatest need concerns the "non-professional" man for whom training very often does not exist. Next to job-training, and training abroad, instruction of instructors will particularly lead to an acceleration of progress. Another category for which training is badly needed is the managerial and administrative level, which has constituted the limiting factor in Latin-America. Without managerial machinery, the introduction of water supply, either locally, regionally or centrally, is improbable. Time and again physical facilities have been built by one or another of external agents, who then desert the site. Before long, these deteriorate, through lack of maintenance and repair and increasingly fail of their purpose or function. More emphasis on training of this category, through courses and seminars, will undoubtedly contribute to a faster solution of the problem.

At many conferences the insufficient use of local material has been mentioned as one of the basic shortcomings in many regions. Simple solutions using home-made handpumps and bamboo pipes for the extraction and transport of water, coconut and rice husks as filter materials and coagulant aids from locally available materials can certainly contribute to an increased progress of water supplies. In many countries, however, where status is preferred above the unmeasurable impact of good water, simple solutions have not received much attention until today. Gradually, the application of such technologies is gaining interest and much work is being done in this field. Rather than construction of installations based on Western principles, transfer of knowledge and application of know-how adapted to prevailing circumstances will be able to bring about an acceleration of the solution of the vast problems.

Much can be said in this connection on how much water is needed per capita and what its quality should be. Design criteria for water quantity in developing countries vary from 25 l/c.d. to 100 l/c.d. in larger villages. Textbooks often mention 400 l/c.d. In large cities in industrialized regions figures of 800 and more l/c.d. are used. Even in tropical areas people will seldom have a consumption of more than 5 l/d, however.

If, according to D.T. Lauria, the problem of concern is how to allocate scarce resources so as to maximise the number of people served with piped water, then "quantity" is no more important than, say, the design period since both these factors affect system scale which is, after all, the principal determinant of cost. Also, quantity seems to be no more important than "meters" or "public fountains" or "piped house services". The essential trade off is not between quantity and quality but between quality of service and quality of product where quality of service includes the amount of water to be supplied as well as distribution considerations.

It should be recommended also that water demand will depend mainly on the price of water, facilitation of its use, and per capita incomes. Two of these factors, namely price and facilitation of use, can be manipulated by the water supply authority, and hence the per capita requirement is, in fact, a partially controllable variable.

Quality standards are given in (6). It can be questioned if lower standards will indeed have the large impact on progress as many claim. Unwanted effects may in the long run not be counterbalanced by the larger number that could be supplied with water. Low standards may ultimately lead to undermining of the motivation to pay for piped water supplies or even to want piped water at all. And besides, as H. R. Shipman states(7), those who argue the cause of reduced biological, chemical or radiological standards for water should recognize at the outset the seriousness of the implications. Advocates of solving the water supply financial problems by reducing safety standards champion a cause which few people in any country could accept. Of special note to the economist is the fact that the savings in costs which could be achieved by reducing the margin of safety usually built into the quality standards will be likely to prove negligible. The principal points to be stressed concern good engineering, good planning, good operation, good financial policy, and good management.

MOTIVATION

The task of the water supply professional in the developing countries is often difficult. Governments must be persuaded that, not only is water supply needed, but it can be designed, constructed, operated and paid for successfully. By and large, this general acceptance of a principle is delayed considerably in urban areas, while in rural areas it is making its way at a snail's pace. An example from Central and South America, where progress in rural water service has been considerable: the available data on the water supply situation in Latin-America and the Caribbean countries show that by the end of 1971 some 152 million of the Region's 287 million inhabitants had piped water supply. In urban areas more than 120 million people, or approximately 78 per cent (vs 59% in 1960) were provided with water supply service either through house connections or public hydrants. The rural population benefited was estimated at 31 million or 24 per cent of the total (vs 8% in 1960).

A comparison of the situation at the beginning and at the end of the last decade demonstrates that many countries of the Region have reached and surpassed the "Punta del Este" goal of supplying water to 70% of the urban population. One country, Venezuela, decided already several decades ago to step up rural service, village by village. It now provides this amenity to some 50 per cent of the rural inhabitants.

The progress made should not only be related to the number of persons benefited or percentage of population covered but also to other aspects, such as the improvement of administration practices, the growing concern for water quality, the wider interest in progress of technology transfer, the development of innovative and autochthonous technologies and, what is extremely important, the increasing recognition by the higher decision makers of the importance and priority of water supply in the overall process of social and economic development. Awareness of the importance for the search of new sources and ways for the financing of water supply works has led to inventive approaches which permitted a new dimension to the water supply programs in some countries. Thus, a new group of capable executives emerged, the ones responsible for the water supply undertakings. Some of the huge water supply entities, which only a few years ago were beset by grave financial troubles and that due to innumerable constraints gave way to serious criticism as to the quality of service offered, have changed or are now rapidly changing into sound and efficient enterprises.

The achievements of the last decade were the result of the considerable efforts of the countries and demonstrated the willingness of the responsible authorities to cope with the water supply problem showing also their decision to meet the challenge that is envisaged for the years to come. Here the motivation was high.

With the same motivation the countries in Africa and Asia will have to develop their water supply program. Only then can technical and financial support be successful. The responsibility lies with the countries themselves, however. The role to be played by the Western world is not that of help from above. The assistance will have to lead to self-activity in the countries concerned.

IRC

The World Health Organization (WHO), the U.N.-organization that among other things is concerned with water supply, has long ago understood that only through cooperation and through use of existing facilities and expertise available in many countries can the problems be solved. Since 1968 a world wide network of Collaborating Institutions is in development of which the WHO International Reference Centre for Community Water Supply (IRC) forms the nexus. The IRC, within this International Network for Community Water Supply, has in principle three tasks:

- documentation, and exchange and transfer of technical and scientific knowledge and information;
- initiation, coordination and conduct of research and development programmes;
- organization and conduct of training programmes and of exchange of personnel.

Because of the serious needs in water supply in developing countries the emphasis of the activities tends to be on problems prevailing there. Nevertheless the Centre has also to play a coordinative role in research and development work in the industrialized world.

In collaboration with WHO, the IRC endeavours to pay a contribution to building up of an infra-structure of knowledge and expertise, with the help of which implementation of works will be facilitated. The objective comprises all those activities which precede actual implementation of water supplies. Next comes the collection of existing information and the development of new knowledge in an adapted and usable form to those persons who actually need it.

The purpose of the International Network for Community Water Supply (fig. 9) in its entirety will be able to provide an invaluable support to the countries. It is expected that Regional Reference Centres and Collaborating Institutions will indeed maintain continuous and close contact with the International Reference Centre in such a way as to constitute a system which will make available multi-disciplinary knowledge and expertise in the field of water supply to developed and developing countries. The whole Network should develop a catalytic action, promoting and supporting activities related to the provision of selected information, research capability and manpower education and training.

After the initial stage of building up and consolidation of this Network, the IRC convened in April 1973 a meeting of directors of Collaborating Institutions, the purpose of which was to delineate a programme of specific activities directed to water supply problems (9). At the Conference 31 participants from internationally operating organizations and institutions discussed existing needs and programmes to be developed. 29 proposals for specific projects were brought forward, of which 6 were ranked with highest priority. These 29 projects, in fact, represent the main areas of needed activities and the 6 highest priority ones indicate programmes from the results of which the largest impact can be expected. These 6 projects are:

- "Application of appropriate technologies", which aims at identification of successful simple, low cost and labour intensive technologies, used in industrialized and developing countries, and at investigation of the practicability of using such technologies, particularly in rural areas.
- "Slow sand filtration in developing countries", which concerns the encouragement of the use of slow sand filters for treatment of drinking water in developing countries and the development of design criteria appropriate for tropical and semi-tropical countries.
- "Health effects of water re-use", aiming at experimental evaluation of the long term effects of consuming renovated water, and establishment of the safe limits of concentration of organics in renovated waste water for drinking water purposes.
- "Impact of community water supply", by which an attempt will be made to evaluate the impact of community water supply and sanitation projects on community health and on the socio-economic life in a community.
- "Development and implementation of systematic training programmes in community water supply", which is directed to the development of specific training projects, based on an identification of the manpower situation in the water supply field in developing countries and of existing capabilities and programmes.
- "Health effects of trace elements in water", comprising the evaluation of an experimental project.

This last project will have the most immediate impact in industrialized countries.

Although the Centre is young, several activities have gained wide interest. A monthly Newsletter gives short reviews of relevant internationally scoped activities and research results. Publications have been issued on the use of iodine as disinfectant, the establishment of a "potential pollution index" of rivers, water supplies for small households, and a reference paper on plastic pipes, and several bulletins with information on current research, and education programmes were compiled. An expert meeting on health aspects of the use of uPVC pipes and polyelectrolytes in community water supply organized by the IRC, has given valuable results and has pointed out new directions for further investigations.

With these and other studies and projects listed in the annual reports, the IRC endeavours to sustain the targets of the United Nations Second Development Decade, thus contributing to an accelerated implementation of water supplies to millions of people unserved today.

CONCLUSION

Many organizational aspects in the countries concerned will have to be improved, if the above goals are to be reached. As conclusive contribution, the IRC uses its 'transferring capacity' to take from the report of a WHO expert committee five points for discussion:

Water quality standards are essential for the purposes of surveillance, both in the interests of public health and for operational control. Existing international and regional standards provide a basis for national standards, which should reflect the stage of development of the country. In framing these national standards, limits for bacteriological and toxic substances cannot be sacrificed, but it is recognized that local situations may demand some relaxation of certain chemical and physical requirements. At all times, however, drinking water standards must be adequate for safety and their application must be simple to supervise:

The development of professional societies and waterworks associations at the national and international level is highly desirable since, among other functions, they can bring pressure to bear for the benefit of community water supply development. It is important also not to overlook the encouragement of community interest at the local level that these sources can provide:

There would be undoubted advantages if research institutions and universities interested themselves in the water supply problems of their respective countries. A close liaison between such institutions and the operative departments responsible for water supplies would be mutually valuable and should be encouraged:

Promotion of community interest and participation is essential for the initial and continuing success of any community water supply programme:

The construction, management, operation and surveillance of water supplies demands the services of trained and experienced personnel, professional and sub-professional, if the large investments made in these facilities are to be protected. International assistance has been, and should continue to be, of value to governments in the training of these men. In view of the large numbers of personnel and diversity of disciplines required, however, and to ensure effectiveness, the bulk of training should be carried out within the country concerned.

Many disciplines must be applied to fight against the thirst of the world. Proper management is one of them. Technology is another.

The need for technology is still there. Most of the world's population is on the edge of starvation despite today's science and technology. These human problems must be faced. The problem for management is how to advance science and technology, how to apply them, and how to apply them with compassion and attention to the human consequence.

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THE INTERNATIONAL NETWORK FOR COMMUNITY WATER SUPPLY

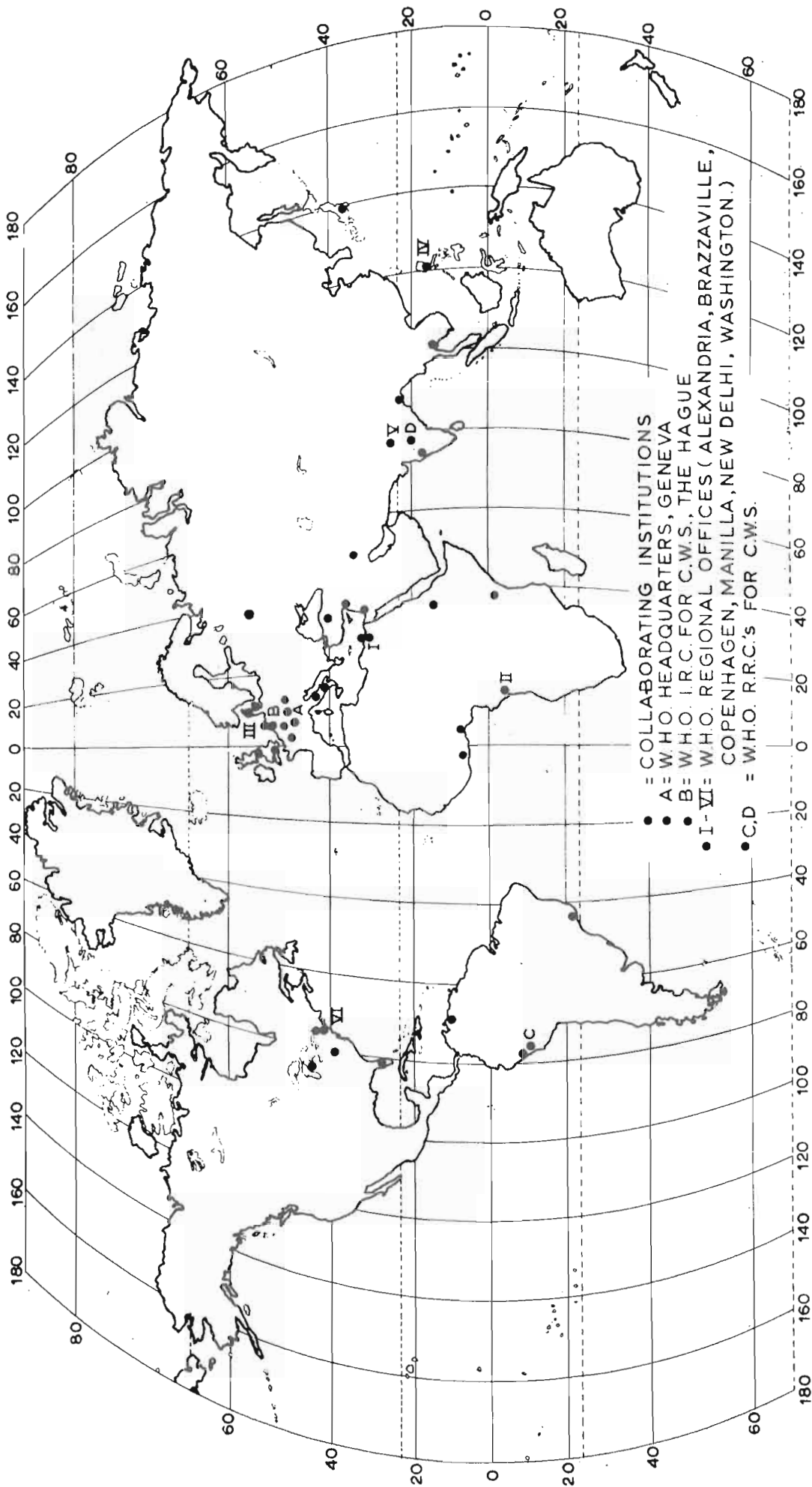


Figure 9 The international network for community water supply