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MAJOR CONSTRAINTS IN WATER SUPPLY IN DEVELOPING COUNTRIES

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This study shows that operation and maintenance combined with logistics (materials, spareparts, transport, fuel) as well as cost-recovery are the most severe constraints in water supply in developing countries. The developing countries stress more the lack of trained personnel and funding, whereas foreign experts, and particularly donors, are more interested in cost-recovery. More attention should be paid to the applicability of training as well as to institutional capacity building and management issues. The lack of knowledge of water resources generally poses a more acute problem than the existence of these resources. In spite of differences between the countries selected (Kenya, Malawi, Sri Lanka and Tanzania), there are a remarkable number of similarities. The large number of supporting agencies and projects trying to minimise the constraints seem to give rise to new ones, such as the difficult issue of coordination.

Index words: developing countries, water supply, major constraints, Kenya, Malawi, Sri Lanka, Tanzania.

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INTRODUCTION

The United Nations have declared the 1980's as the International Drinking Water Supply and Sanitation Decade. The goal of the Decade is to supply clean drinking water and proper sanitation for all by 1990. Although this goal will not be achieved in most of the developing countries, the Decade has managed to make external support agencies, and above all, national governments more interested and active in the sector.

Attainment of the goal of the Decade is hindered by constraints, many of them typical of most of the developing world and some of them typical of particular countries or regions.

MAJOR CONSTRAINTS IN WATER SUPPLY SECTOR BEFORE THE DECADE

In 1970 the World Health Organization (WHO) forwarded a questionnaire to the governments of developing countries (Pineo and Subrahmanyam 1975). The constraints, ranked according to their severeness, were as follows:

(i) insufficient internal financing
(ii) lack of trained personnel
(iii) inappropriate administrative structure
(iv) lack of external finance
(v) inappropriate financial framework
(vi) insufficient production of local material
(vii) inadequate or outmoded legal framework

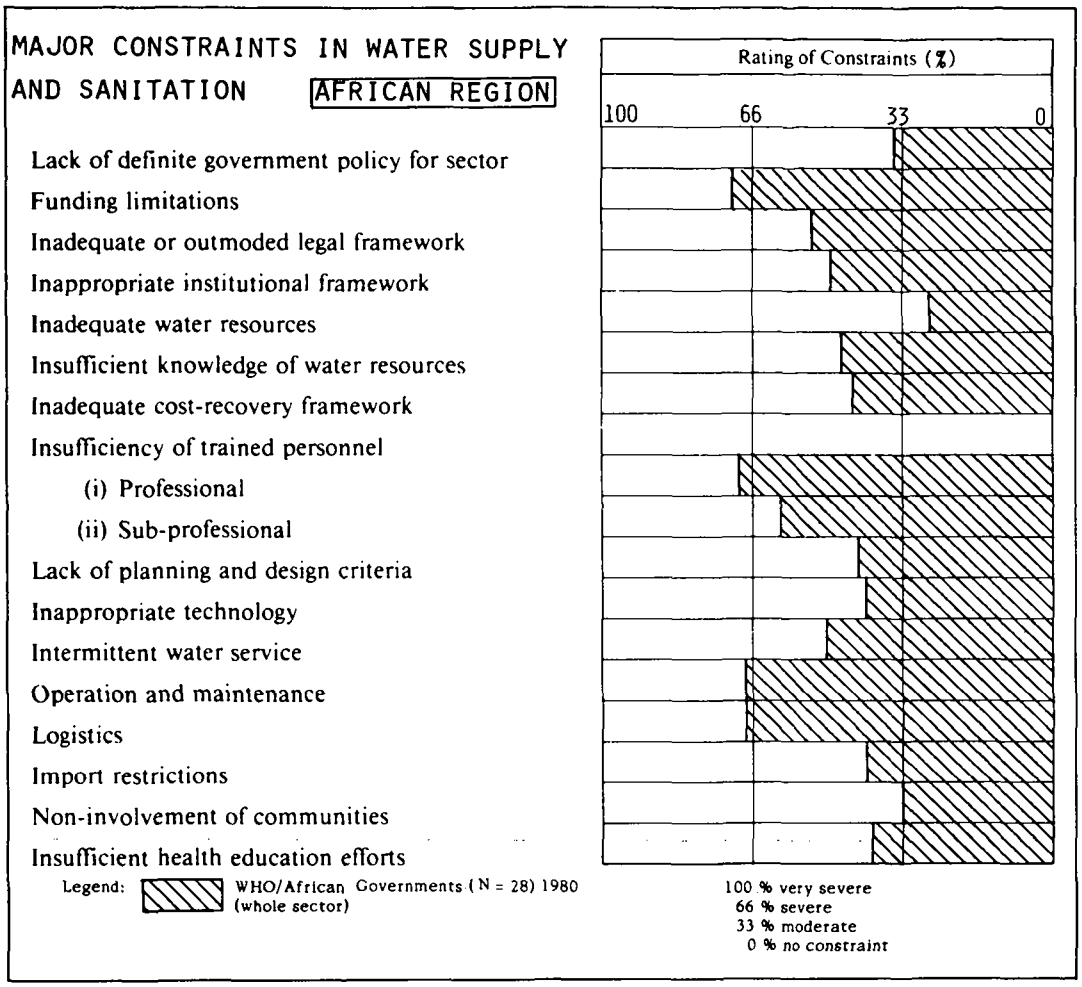

Fig. 1. Major constraints in water supply and sanitation in African region (WHO 1984).

Before the beginning of the Decade WHO organized a large review of national baseline data (WHO 1984) as the basis for a systematic follow-up of the Decade.

The constraints were classified as very severe, severe, moderate and no constraint and they were weighted by three, two and one respectively to give the ranking index. Fig. 1. shows the results from the African region. The results were converted to a percentage scale by the author in the manner shown in the figure.

The most important constraints as seen by the goverments in Africa were funding limitations, the lack of trained personnel, particularly professionals, as well as operation and maintenance and logistics.

Overriding constraints at the global level included

- the insufficiency of trained personnel
- limitation of funds
- shortcoming in operation and maintenance
- inadequate cost-recovery from customers

The Americas region ranked inadequate cost-recovery as the most important constraint. Funding limitations were listed at the top by the least developed countries and the most seriously affected countries.

In 1983 WHO together with the Bundesministerium für Wirtschaftliche Zusammenarbeit (BMZ) organized a consultation to review progress in the first three years of the Decade, which was attended by most of the bilateral and some multilaterial support agencies. The consultation identified nine major constraints to be overcome (WHO and

BMZ 1985):

- low government priority to the sector
- imbalance between coverage in urban and rural areas
- lack of integration between sector institutions
- operation and maintenance inadequacies and need for rehabilitation
- shortage of properly trained staff
- inadequate health impact
- poor community participation and choice of technology
- failure to attract more external support
- water resources management

The consultation carried out an opinion survey among the participants listing the following factors affecting human performance, namely

- skill and knowledge
- working conditions
- tools and equipment
- standards and procedures
- motivation
- attitude and ability
- incentives
- supervision
- feedback
- opportunity to perform

In the case of "skill and knowledge" as well as "attitude and ability" the individual plays the key role. For the remaining eight factors management and organization have the controlling influence. Therefore, managerial and organizational skills must also be taken into consideration.

Bilateral agencies reported their evaluation and the lessons learned in a catalogue compiled by WHO (1983). No systematic constraint analysis has been made. In this study the author lists the issues according to their frequency as follows

- operation and maintenance (9)
- manpower/human resources development/training (7)
- community participation (7)
- low-cost/appropriate technology (7)
- socio-economic expertise (6)
- organizations, institutions and management (6)

MAJOR CONSTRAINTS IN WATER SUPPLY IN SELECTED COUNTRIES

Research methodology

As one part of the research project called "Development cooperation projects in rural water supply and sanitation" run by Tampere University of Technology (TUT) and financed by the Academy of Finland, the author sent a modified version of the WHO questionnaire on major constraints to persons having served as foreign experts or project personnel in developing countries. A column for non-constraint was added and logistics (materials, spareparts, transport, fuel) was explained. The questionnaire of this study was limited to rural water supply only. The forms were for the most part completed in 1984 and the comments covered the time period from 1977 to 1985. In addition, some of the above respondents as well as some professionals from developing countries were interviewed with open questions based on the form.

The results for the different countries are not necessarily directly comparable. Instead the relative differences of severeness in each country are most important. A number of the respondents have been working in several of the countries selected. This makes the results at least weakly comparable.

Kenya

The development of water supply in Kenya is negatively affected by the population growth of about 4 % per annum, which is one of the highest values in the world.

The most severe constraints in the whole sector as seen by the Government in 1980 (WHO 1984) were operation and maintenance as well as lack of trained personnel (Fig. 2).

The views of experts (Fig. 2) differ considerably from those of the Government. Operation and maintenance linked with logistics is the most important constraint. The government policy for the sector is not seen appropriate and the cost-recovery framework is seen as very inadequate. Both of these are probably connected with the very common piped water supply schemes with chemical treatment units in rural areas.

The philosophy of low-cost or simple technology in rural water supply is officially accepted in Kenya, but in practice such technology is commonly neglected. So far rural water supplies have mainly relied on surface waters. In this respect the rural water supply project in western Kenya is quite pioneering one using shallow wells equipped with handpumps. The project is supported by the Finnish International Development Agency (FINNIDA 1985).

The legal and institutional framework are not seen as the most problematic constraints by foreign experts. Instead the performance and function of the organizations, as well as lack of cooperation between different institutions, were seen as very severe. Private sector and water associations recently introduced to the sector could probably

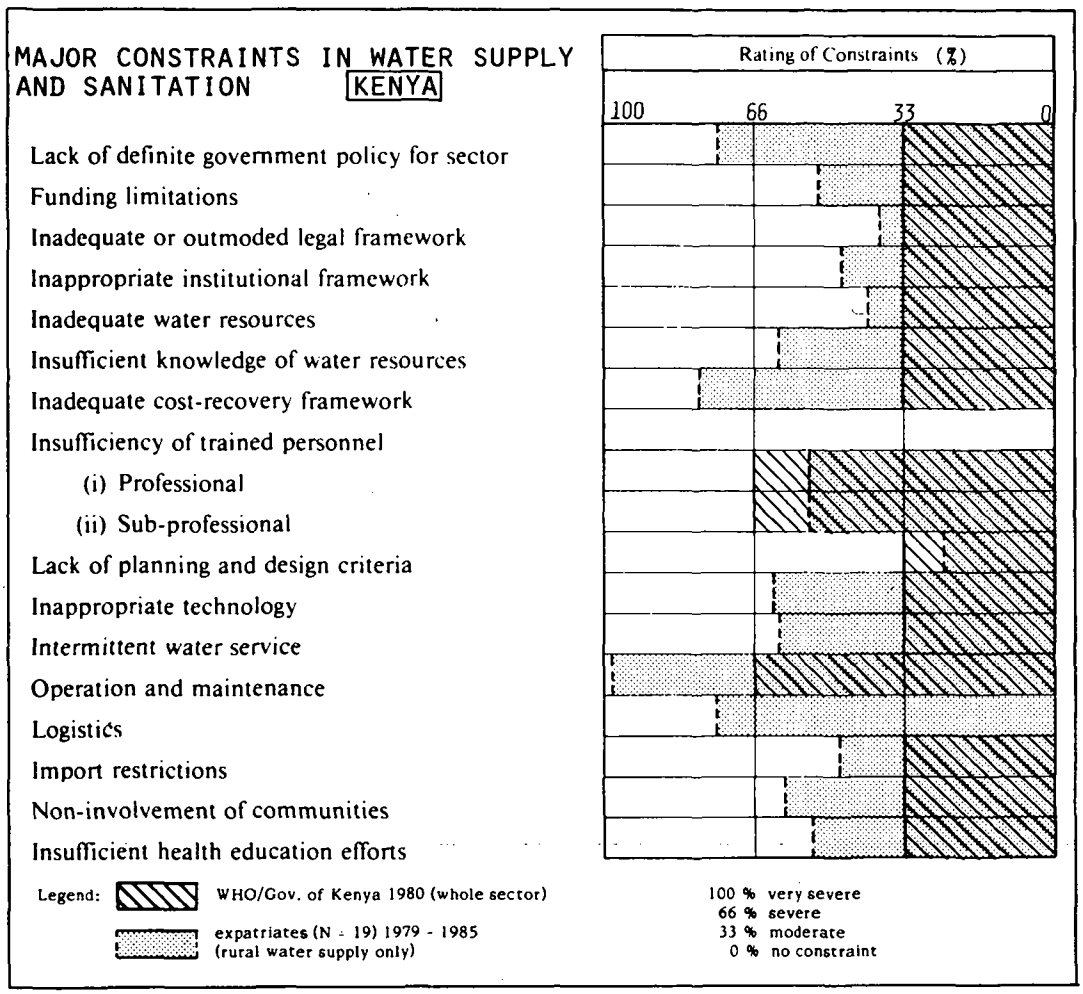

Fig. 2. Major constraints in water supply and sanitation in Kenya.

be utilized more.

The water resources are very unevenly distributed in Kenya. The northern part of the country is desert or semi-desert, but e.g. in Western Kenya the annual precipitation is commonly 2000 mm. The knowledge of water resources, especially of ground water, is limited. This partly explains the bias towards surface waters in rural Kenya. Like Kenya, many parts of Africa are directly underlain by crystalline basement rocks. Aquifers are developed in the weathered mantle (regolith) and in the fractured basement rocks. Although not very productive, these aquifers are of increasing importance for rural water supply (Foster 1984).

Non-involvement of communities is considered quite severe. This is partly due to the sophisticated technology used, which makes it more difficult to participate in different stages of projects.

In 1980 Kenya was assisted by 41 government donors and a huge number of non-governmental organizations (NGOs), quite many of those active in the water sector (Morss 1984). Therefore, the coordination of activities in the sector is quite difficult.

Malawi

The number of replies (eleven) concerning Malawi was the lowest in this study and therefore the results are the least reliable. However, even this small number of answers, added to by the author's personal working experience in the country, accord with the constraints shown in Fig. 3.

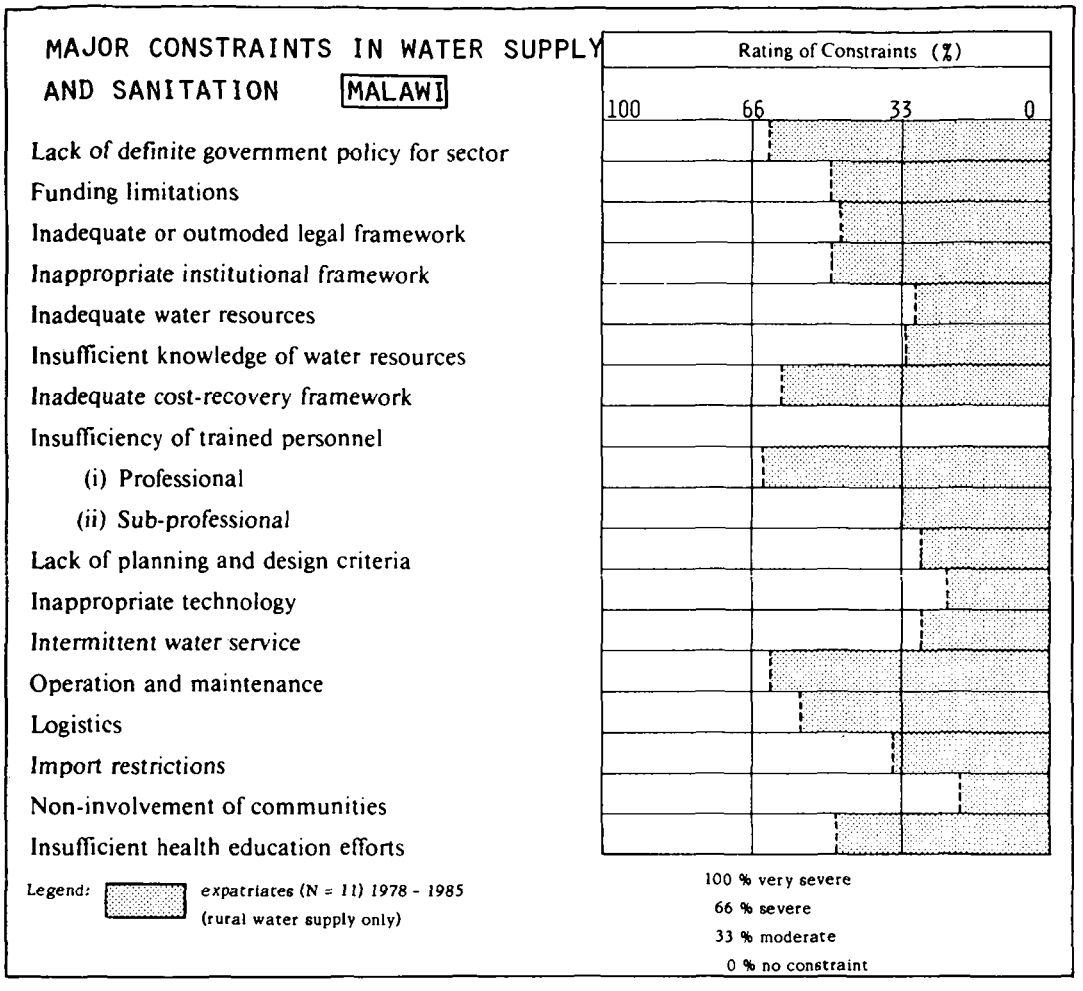

Fig. 3. Major constraints in rural water supply in Malawi.

The most severe constraint is the lack of professional staff. This is partly due to the fact that Malawi allows expatriates to take line positions in Government at all levels (Morss 1984). On the other hand, this perhaps could partly explain the generally quite satisfactory development of the sector since independence.

The foreign experts find the lack of a definite policy for the sector and the problems of operation and maintenance the next most severe constraints. As a landlocked country Malawi has special logistic problems.

As for water resources, Malawi is quite lucky to have a precipitation of 700—2000 mm a^{-1}. So far the most well-known progress has been achieved by constructing gravity schemes utilizing mountain streams in different parts of the country. This activity started on a minor scale in the 1960's and increased following a step by step approach. However, the potential for further schemes is now practically exhausted.

For ground water utilization special designs of hand pumps and well structures have been developed. The technology selected seems to be reasonably appropriate for the existing conditions. The involvement of communities has been quite successful and has gained international reputation.

Although the constraints as viewed by foreign experts seem to be relatively moderate one could ask, like Morss (1984), whether Malawi's capacity to run its own affairs and establish its own policies has been given sufficient attention.

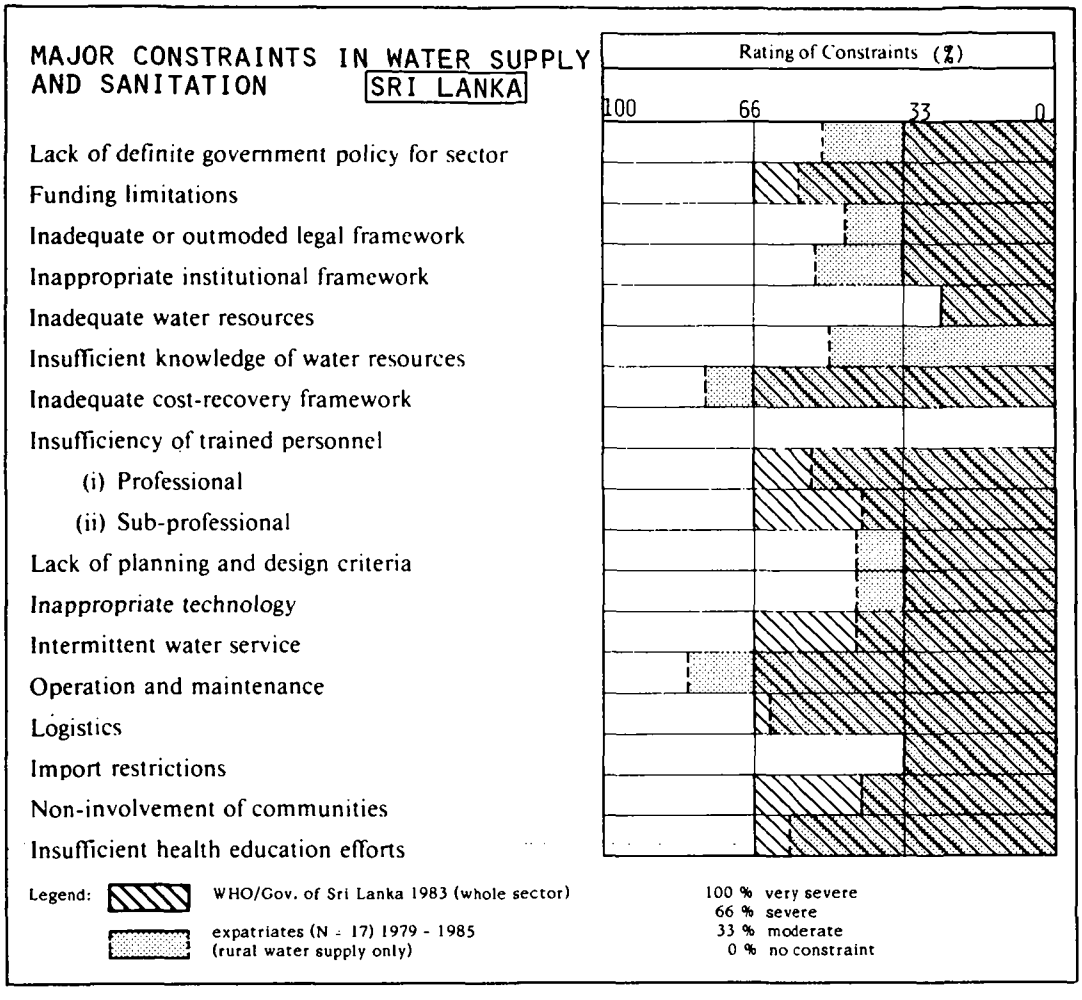

Fig. 4. Major constraints in water supply and sanitation in Sri Lanka.

Sri Lanka

The most important constraints in the whole sector as seen by the Government in 1983 (WHO 1984) were related to funding, cost-recovery, trained personnel, operation and maintenance, non-involvement of communities as well as insufficient health education efforts.

The foreign experts regarded operation and maintenance linked with cost-recovery and logistics as the most severe one. Figure 4 shows the views of the two interest groups.

The legal framework is relatively satisfactory, but land ownership can often cause problems for community water supplies. The institutional framework generally exists. Still, recently large donor support from United States Agency for International Development (USAID) has been given for overall development of the institutions, including administrative, organizational, management and material support.

The annual precipitation in about 650—1000 mm in the so-called dry area covering about 65 % of the country. In the south-western part of the country the values are 1800—5500 mm. The knowledge of ground water resources is again quite inadequate. The Harispattuwa water supply and sanitation project supported by FINNIDA (1983), is mainly utilizing ground water.

The availability of trained personnel is affected by the drain to oil-producing countries.

The technology used was earlier biased towards surface water supply schemes. Development cooperation projects laying stress on simple techniques

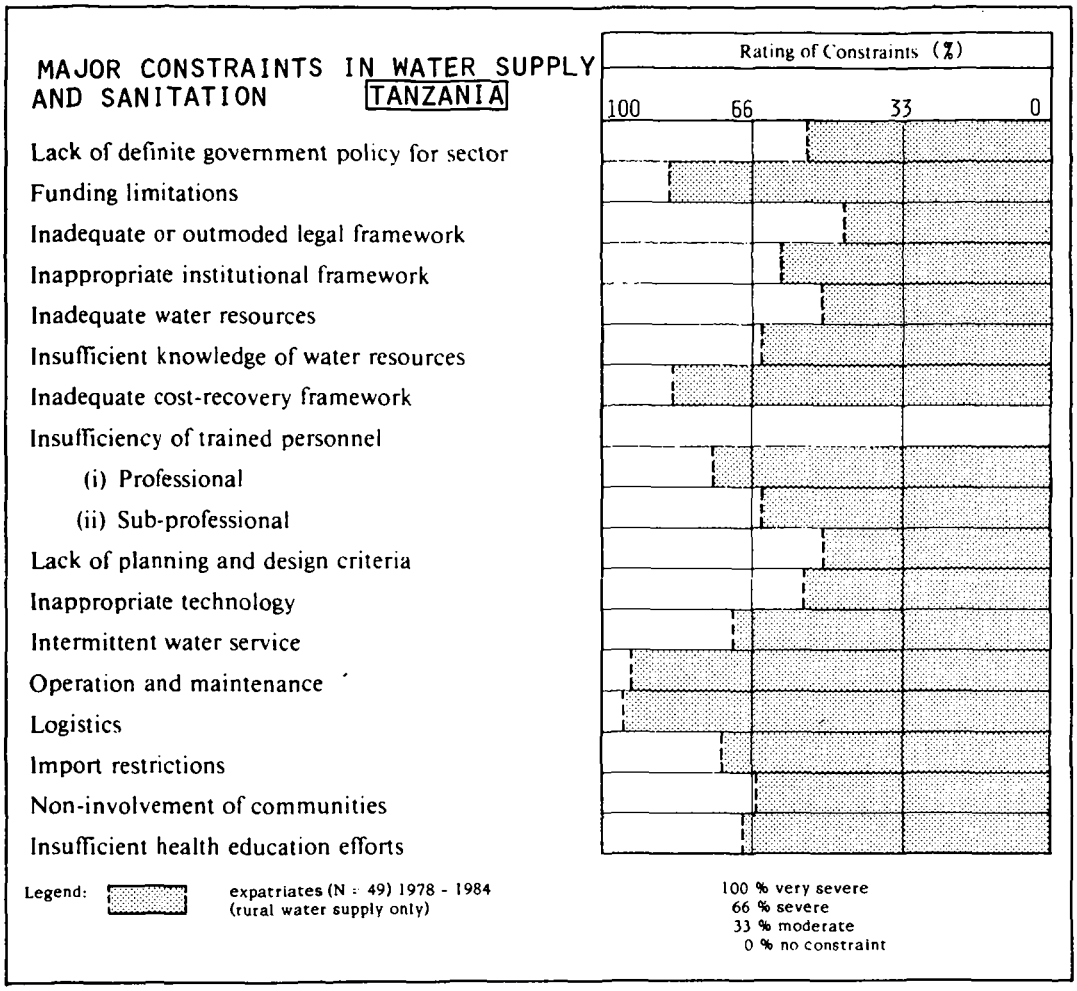

Fig. 5. Major constraints in water supply and sanitation in Tanzania.

are changing this situation.

Other comments dealt with internal and outside pressures affecting particularly externally supported projects in the sector. Lack of coordination between the external agencies as well as the institutions in the sector seem to be severe.

Tanzania

As far back as 1971 the Tanzanian government launched a twenty-year rural water supply development programme with the objective of the present water decade. This programme is one of the most ambitious in the developing world.

Since the 1970's Tanzania has received external support from more than ten countries. Now most of the regions have got their water master-plans, most of which are implemented by projects supported externally, especially by the Scandinavian countries, including Finland.

The total number of answers concerning Tanzania (forty-nine) is considered to give quite reliable views on the constraints. Operation and maintenance linked with logistics and cost-recovery were regarded as the very severe constraints by foreign experts, as shown in Fig. 5.

The number of operative rural schemes, particularly the piped ones equipped with diesel pumps commonly constructed till the latter part of the 1970's, is extremely low. A number of schemes implemented with external support are not functioning because of the lack of fuel. This problem is connected with the technology used, which in the

present economic situation is in many cases beyond the country's economic capacity. Low-cost technology, such as hand-pump wells, is accepted in practice. However, the hand-pumps need maintenance and it is conceivable that even hand-pump wells present too high a level of technology. Large scale use of hand-pump wells was introduced by the Dutch-supported project in Shinyanga, soon followed by the project in Mtwara and Lindi regions supported by FINNIDA (1984).

The supply of spareparts through the Ministry's central store does not seem to function. The externally supported projects are usually allowed to arrange the purchase via direct channels. The purchase of different materials and spareparts will be one of the major difficulties after the present development cooperation projects have been phased out and responsibility transferred and accepted.

The Tanzanian Governments's early decision to supply all the population with water free of charge makes it very difficult to arrange cost-recovery. It seems to be the growing opinion in all developing countries that at least part of the operation and maintenance costs should be contributed by consumers.

Funding limitations were also regarded as a very severe constraint in spite of the fact that Tanzania receives relatively the highest amount of external support per capita among the selected countries. Because of the economic crisis during the last few years the government has had serious difficulties in paying the local component of the development cooperation projects. This component is commonly under 10 % of the total project costs. Because the questionnaire was not clearly defined, operation and maintenance costs have probably been partly included in this category.

Institutional framework is in principle quite well established. However, the coordination of activities in the sector and between other sectors is not functioning. The efficiency of the Ministry in charge of water development is weakened by quite frequent changes in ministries and departments, lack of incentives and motivation as well as frequent changes in the duties of national personnel. The Regional Water Engineer's (RWE) offices are administratively under the Regional Development Director (RDD) and therefore the Ministry cannot have sufficient control over the sector.

Water resources in Tanzania are quite unevenly distributed. In some areas the limited quantity of water is the major constraint, sometimes worsened by the low quality of water. The inadequate knowledge of water resources is still commonly a more severe constraint.

The number of trained personnel at different levels is relatively higher than in many other least developed countries. Therefore, there already exists a potential for development if only the human resources could be fully utilized.

Discussion

The form proved to have its limitations missing e.g. management-oriented constraints. In addition, those persons not personally interviewed probably interpreted the questions in different ways. The original WHO form was designed for the whole sector, whereas this study concentrated on rural water supply. Therefore, there might be a slight urban bias. Additionally, it is evident that intermittent water service is rather the result of inadequate maintenance than a constraint. However, the questionnaire gives a reasonably reliable figure on the major constraints in the countries selected as seen by national governments and foreign experts. The number of answers given by national experts from the developing countries was quite limited. These answers were not included when ranking the constraints shown in Figs. 2—5.

In spite of differences between the countries selected and between the different areas in each country, there is a remarkable number of similarities. Operation and maintenance combined with logistics as well as cost-recovery are seen as the most severe constraints both by national governments in developing countries and by foreign experts. The developing countries place more stress on the need for trained personnel and funding, whereas foreign experts are more concerned about cost-recovery.

The results obtained are by no means surprising. In 1938 Bunher (cited by Donaldson 1984) summarized the problems of water and sanitation in Latin America as follows

- The drinking water sector efforts were concentrated in a few urban areas
- The operation and maintenance of the systems were often poor
- There was usually a lack of trained technical and managerial personnel
- The systems were usually inadequate to cover the area served
- Financing was often a problem
- Organizational problems were more common than technical ones

At least the second, third, fifth and sixth aspects are the major constraints as seen by the two interest groups of this study.

Chambers (1974) noted in his study on rural development in East Africa that

> "Too often a lack of high—level manpower was used as an excuse for poor performance and for failing to probe into its causes and as a polite expression to cover up culpable inefficiency and corruption".

Probably more attention should be paid to the quality of training and its applicability to the tropical developing conditions as well as to motivation and incentives.

In development literature, especially that by non-technical reporters the term "appropriate" is often used as a synonym for low-cost. The author's view is that appropriate technology should include all possible levels of technology from low to high. Low or simple technology should be used in the construction or implementation of rural water supplies, whereas high technology is particularly applicable to water resources inventory (e.g. deep ground water investigations). This matter was also raised by a number of experts interviewed in this study.

CONSTRAINTS CAUSED BY INTERNATIONAL AID

The foreign aid of the 1970's which supported general programmes (personnel and materials support) has changed in favour of specific project aid with more donors. This is true of water supply as well. According to Morss (1984) this project and donor build-up is having a negative impact on government institutions of developing countries. He points out the large number of projects with their own specific objectives and the competitive nature of donor interactions.

In the water sector there is a high number of supporting agencies, e.g. in Tanzania there are more than ten bilateral agencies in the sector in addition to multilateral and non-governmental organizations. In fact the bilaterals have introduced coordinating activities during the last few years in Tanzania. Some attempts to coordinate activities were made as far back as the early 1970's.

In this study especially the few professionals from developing countries mentioned the need for more coordination.

Moris (1977) wrote that observers from the industrialized countries tend to ignore the cumulative impact of constraints upon the systems. He concludes that the major reason for the weakness of the transfer of western management innovations has been the general preoccupation of the outside agencies with semiautonomous projects as their main focus.

On the other hand the experiences of institutional support in the form of materials and experts, who have not their own facilities or purchase channels have proved to be quite disappointing. Therefore, agencies like the Swedish International Development Authority (SIDA) changed their support mainly to project-type aid during the late 1970's.

MINIMISING THE CONSTRAINTS

There are many types of constraints, some of them permanent and hardly ever to be eliminated, such as water resources. Others can be binding in the short run, but many may be changed as time goes by.

There are also man-made constraints set by political situations in developing and donor countries (Miser and Quade 1985).

In this study a number of noticeable differences between the interest groups of national governments and foreign experts were noted. The results seem to fit with the ideas of WHO report (1981) which states

> "Too often the constraints are regarded as the cause and not the symptom of inadequacy and a solution may be sought by simply increasing the amount of funds or hiring more central agency staff when in many cases those measures are merely palliative".

Instead of palliative measures we should find long-term solutions focusing on underutilized resources rather than on increasing pressure on overworked and frequently underpaid national professionals.

In this study it has been possible to present the views of two interest groups. Fig. 6 shows a hypothetical scenario of different interest groups and their views on how to close the gap between needs and resources (Subrahmanyam 1982). One alternative is to lower the needs by lowering the service level or unit cost, or by serving only the unserved or less served groups. This alternative is favoured by the donor countries. The other alternative is to increase resources either by national sector allocations or external aid. Naturally the interest groups in developing countries favour the increase of external aid, whereas the donor countries support

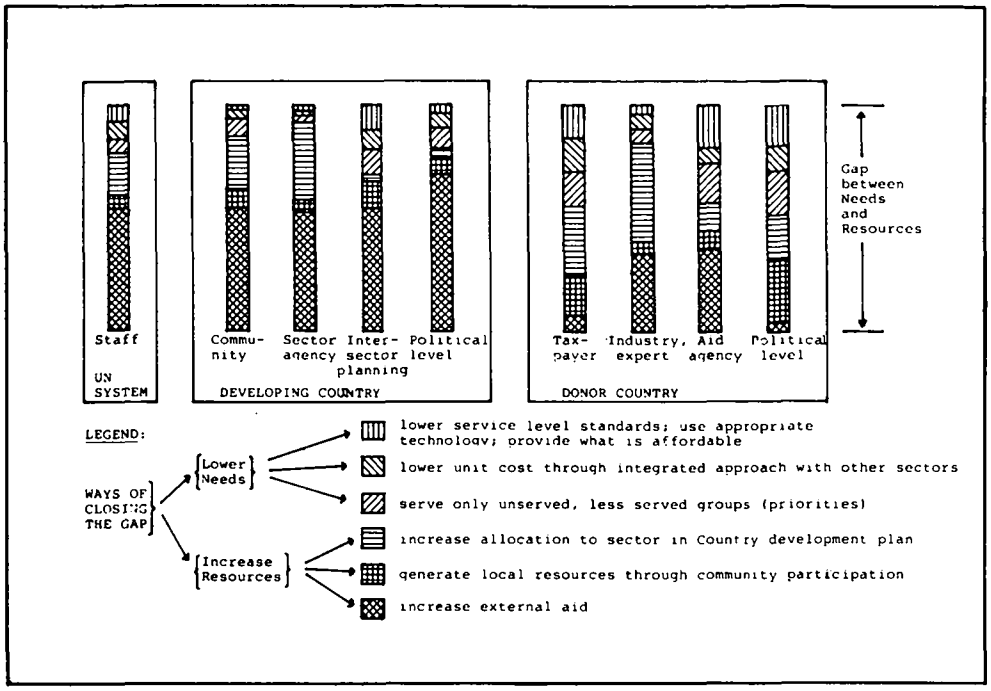

Fig. 6. How to close the need-resources gap: a hypothetical scenario of viewpoints of main groups of actors (Subrahmanyam 1982).

national sector allocations. The two extreme groups are the political level in the developing country and the tax-payer in the donor country. Although the figure is hypothetical, it probably gives quite a good overall picture of the views of different interest groups. A compromise in large-scale national and international cooperation is therefore necessary.

Ahman (1980) divides the constraints into two types: performance oriented "variables" and programme oriented "variables". The performance oriented "variables" have principally to do with the technological type and the service level. The change can be made by reducing costs. The programme "variables" include programme policy, technological mix and time distribution. In the latter category the main type of limiting or critical factor is the public pressure on politicians and administrators.

The WHO/BMZ consultation in 1984 clearly indicated that donors have moved towards consensus positions on important issues like

- coordination
- cost-recovery
- institutional and human resources development
- community participation and the role of women
- appropriate technology
- sanitation and hygiene education

The need for coordination was also pointed out recently by the OECD (1985) Development Assistance Committee. Thus there are many signs and examples that coordination is taking place between the supporting agencies. However, the exchange of ideas and information flow between different development projects, whether supported by the same donor or different donors, are equally important. The overworked personnel of national institutions and donors will certainly prefer effective consultations rather than just meetings for their own sake.

Coordination should in fact be optimized, not maximized. Chambers (1974) pointed out that the words coordination and cooperation are often much favoured by visiting missions, when instead they should be trying to see how to get things done. One can actually hear the call for coordination quite often in developed countries also.

At the beginning of the Decade the following major issues were reported by UNDP (1980):

- rural emphasis and community participation
- education and community support

- training required personnel
- choosing the right technologies
- maintenance

These issues are in principle easy to agree on. However, community participation has often been presented as the most important means for solving the constraints of the sector. The author's view is that instead of a strategy community participation should rather be seen as an objective in itself. The World Bank (1986) speaks of community input, which means contributions in the form of cash payments, labour, maintenance, etc. Its key issue is that rural communities can afford to contribute more to water supply than commonly believed so far. Also, it is evident that the right or appropriate technology often does not exist, and therefore in the selection we should lay stress on applied technical research and development. The worldwide hand-pump development project is one good example.

In its recent policy paper the World Bank (1986) pointed out that the original quantitative goals of the Decade are unlikely to be met. It is not simply a question of inadequate amounts being invested. Because of lack of community input and proper maintenance, systems are going out of operation faster than new ones are being constructed. Therefore, a fundamental reorientation of policies and investment strategies is needed.

IMPLICATIONS OF CONSTRAINTS FOR ALTERNATIVE STRATEGIES

As a whole, we can present the following ways for coping with the constraints.

Constraints seen as limiting or totally inhibiting factors

Constraints as limiting factors.

When constraints are seen as limiting factors we can change our objectives and needs, e.g. by lowering service level. If it is not possible to organize operation and maintenance for hand-pump wells, we could improve our water supply by temporary solutions or a step by step approach. Berhane (1984) has suggested this kind of strategy for rural water supply in Ethiopia by constructing improved open wells instead of covered wells with hand-pumps. The Swedish International Development Authority (SIDA) has in principle accepted the approach of improving traditional water sources as one alternative in Tanzania (Hannan-Andersson and Andersson 1985). The economic capacity of the area to be served must be seriously taken into account. We have to ask whether even hand-pump wells are of too high level of technology for low capacity areas.

Constraints as totally inhibiting factors

When constraints restrict alternatives certain objectives cannot be achieved (Miser and Quade 1985). The alternatives are screened and those affected by constraints are seen as not feasible. A total withdrawal of a donor from a country is an example of this.

Constraints to be overcome

More time for development

This alternative suggests that more time should be allowed for promotion and for a felt need to arise among consumers. The approach has been commonly used by missionaries. For bilateral or multilateral donors this is quite critical since the decision-makers, and particularly the taxpayers in the donor countries, usually want to see results as soon as possible.

Reorganizing the use of resources

It is possible to concentrate resources in the fields which most need them. Organizational and managerial procedures can be developed without necessarily increasing resources. One possibility is to concentrate the activities in a limited geographical area and proceed to the next one after the first area has had its water supply needs satisfied. This could economise on transport needs. One drawback of this approach is that people can prefer other services like dispensary. In fact, it is now generally accepted that a felt need for improved water supply should exist before starting a water project.

In the case of personnel management different types of incentives could be used to motivate towards better performance. One possibility which is quite popular in developing countries is to decentralize the activities down to local levels-regions, districts, etc. However, this seems to be quite a difficult issue because central control over the sector is always needed to some extent. The level and amount of professionals are also a serious limiting factor.

Attract more international resources

The relative appropriation to the sector in national budgets could be raised. The first years of the Decade show, generally, that it has not been possible to get sufficiently high government priority for the sector.

The second alternative is to transfer resources from urban schemes to rural schemes, so that the whole sector remains self-sustained.

The third alternative is to get more resources from the beneficiaries. This community input can be based on monetary or non-monetary contributions. It is clear that even a partial contribution will increase the sense of ownership and responsibility thus motivating to maintain the systems in function.

Linking water supply with agricultural, forestrial, industrial or any productive field could be a way to raise funds for operation, maintenance and even investment. This productive use could produce an improved drinking water supply as a by-product of the main activities.

Attract more external resources

The alternative of getting more support from external agencies is often seen as a means of overcoming contraints. For instance, Tanzania has succeeded well in getting this support from quite a number of agencies. It is common for donors to cover about 95 % of the investment costs of rural water supply projects. However, it is not clear to what extent donors will support operation and maintenance costs, if any. In any case there is a limit to external support if we wish to promote local initiatives and action. Too high a dependence on external sources can be quite dangerous for national capacity building.

Development of technology

So far too little attention has been paid to applied technical research in the sector in the developing world. Hand-pump and low-cost sanitation development projects are good examples, but probably many others are needed as well.

Institutional capacity building and development

Technical assistance within development cooperation usually means support to national institutions in the form of human or material resources. These institutions are often already existing and seldom new ones.

The second alternative is to support the development of small private enterprises and contractors which could help in manufacturing, implementation and even operation of water supplies. This alternative seems to be becoming more accepted than it used to be in previous years in developing countries.

The use of local, private voluntary organizations (PVO's) such as women organizations, could be one possibility for transferring the responsibility to the local level.

Use of experience from other developing areas

The technological, economical and organizational experiences from other areas of the country concerned and other developing countries are not always fully utilized. Often information is better available in a donor country than in the developing country itself.

Human resources development

Human resources development is necessary, though not sufficient alone, in all the main alternatives for coping with constraints. It is obvious that none of the alternative approaches mentioned will be appropriate as the only solution. Instead, an appropriate combination of these issues could form strategies to be applied.

CONCLUSIONS

In spite of differencies between the selected countries and between the different areas in each country, there exists a remarkable number of similarities.

(i) Operation and maintenance combined with logistics are the most severe constraints in all countries as seen both by the national governments and by foreign experts. There must be a contribution from consumers either in the form of cash payment, labour or other efforts. At least a part of the operation and maintenance costs should be paid by the consumers.

(ii) The developing countries lay more stress on the lack of trained personnel and funding, whereas the foreign experts and particularly donors are more interested in cost-recovery.

(iii) The developing countries have made great efforts to train their national personnel. The quantity of trained manpower has increased, but probably the content of training programmes should be more applied to the con-

ditions in tropical developing countries. The university syllabi seem to be biased towards surface hydrology and hydraulics instead of practical water supply and sanitary engineering.

(iv) Lack of training is probably not the most severe constraint. Instead more attention should be paid to the capacity of national institutions to manage all the necessary activities. If the performance of the individual is to be improved, managerial and organizational factors must be taken into consideration in addition to skill training.

(v) The low-cost technology approach is now accepted by all the parties. However, in practice too sophisticated schemes are still constructed. In rural water supply also high technology is needed, but usually in special areas like inventory of deep ground water resources.

Applied technical research in practical water engineering should be increased. The solutions developed in and mostly for temperature climates do not necessarily work in rural areas of developing countries.

(vi) The location and quantity of water resources vary a lot in different areas of developing countries. In spite of the lack of water resources especially in drought-hit areas, the knowledge of resources is even more insufficient.

(vii) Community participation is important. However, it should rather be seen as an objective than a strategy. It would be more appropriate to speak about community and consumer involvement or contributions than just participation.

(viii) The external support by development agencies can partly abolish the constraints. However, the high number of agencies and projects seem to bring other constraints such as the need for coordination, which should in fact be optimized, not maximized.

(ix) The strategies used so far in the sector must be rethought. Ways for coping with constraints culminate in cost-recovery issues.

ACKNOWLEDGEMENTS

This work is a part of a larger research project on rural water supply and sanitation in developing countries, financed by the Academy of Finland. The author wishes to thank Prof. Matti Viitasaari and Course Director Pentti Rantala, Tampere University of Technology for their continuous encouragement and discussions. The author is very grateful for all the colleaques in the sector for sharing their experiences.

TIIVISTELMÄ

Tämä tutkimus perustuu maailman terveysjärjestön kehitysmaiden viranomaisilta keräämiin aineistoihin, kirjoittajan tekemiin kehitysmaissa työskennelleiden henkilöiden haastatteluihin ja kirjallisiin kyselyihin sekä kirjoittajan työskentelyyn kehitysmaissa.

Sekä kehitysmaiden hallitukset että ulkomaiset asiantuntijat pitävät kaikissa kohdemaissa (Kenia, Malawi, Sri Lanka, Tansania) suurimpana ongelmana käyttöä, kunnossapitoa, kuljetuksia ja varaosia. Kehitysmaat itse painottavat koulutetun henkilökunnan puutetta sekä rahoitusta. Asiantuntijat samoin kuin kehitysyhteistyöjärjestöt pitävät pahimpana ongelmana käyttökustannuksia ja kustannusvastaavuuden puutetta.

Vaikka vesivaroista on paikoitellen puutetta, suurempi ongelma kuitenkin on se, ettei niitä tunneta tai osata tutkia riittävästi. Sektorin koulutusta tulisikin soveltaa nykyistä enemmän kohdemaiden olosuhteisiin ja täydennyskoulutusta painottaa johtamiseen liittyviin asioihin. Kehittyneiden, lauhkean tai kylmän ilmaston maiden tekniikka ei välttämättä sellaisenaan sovellu kehitysmaihin. Tämän vuoksi tulisi sovellettua vesiteknistä tutkimusta lisätä esim. integroimalla tutkimus osaksi kehitysyhteistyöprojekteja.

Vaikka kussakin kehitysmaassa on omia tyypillisiä ongelmia, on niissä pitkälle samanlaisia piirteitä. Kehitysyhteistyötä harjoittavien järjestöjen suuri määrä näyttää tuovan mukanaan uusia ongelmia kuten vaikeasti toteutuvan koordinaation.

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