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DEVELOPMENT OF VILLAGE HYDRAULICS
IN THE SAHEL COUNTRIES

OVERVIEW AND PROSPECTS

Synthesis

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T A B L E O F C O N T E N T S

	<u>Pages</u>
S U M M A R Y	1
INTRODUCTION	2
I - THE PRESENT SITUATION:	4
1.1 - Population and the Habitat	4
1.2 - The Water Supply Situation	4
1.3 - International Aid	6
II - PRESENT CONDITIONS GOVERNING THE IMPLEMENTATION OF PROJECTS:	8
2.1 - The Administrative Framework	8
2.2 - Surveying of Resources	8
2.3 - Needs and Programming	9
2.4 - Execution of Work	10
2.5 - Maintenance	10
III - PROSPECTS:	12
3.1 - Water Resources	12
3.2 - Implementation Potential	13
3.3 - The Need for Rational Water Management	13
IV - PROGRAMMING:	
4.1 - On-Going Surveying and Evaluation	14
4.2 - Programming	15
4.3 - Strengthening Programming Capacity	16

	<u>Pages</u>
V - IMPLEMENTATION OF PROGRAMMES:	17
5.1 - Study, Execution and Control of Work	17
5.2 - Restructuring of Implementation Capacity	17
VI - MAINTENANCE AND SUPPORTING ACTION:	19
6.1 - Prerequisites for the Improvement of Maintenance	19
6.2 - The Organisation of Maintenance	19
6.3 - Supporting Action	20
 C O N C L U S I O N	 21

SUMMARY

1. A considerable effort has been made, particularly since 1978, to improve the water supply of the rural sedentary population. The Sahel Governments have strengthened their administrative departments responsible for hydraulics and created new para-statal corporations in this sector. International donors have financed a large number of village hydraulics projects.

The position has begun to improve as a result, but is still far from satisfactory: surveys show that only 25 per cent to 30 per cent of the rural population have satisfactory access to water.

2. The efforts made have relied on structures which are less than fully satisfactory. The diagnosis of the national overviews can be summarised by listing the tasks remaining to be performed:
 - knowledge of water resources: great progress has been achieved. A good overall picture of underground water resources is now available, although there are still gaps,
 - planning of actions: this is a weak point of the present system. The population has had little or nothing to do with the design and implementation of programmes, and projects have been thinly scattered geographically,
 - execution of work: the States have set up official or para-statal bodies for this purpose, but they have not given the desired results. Further, the administration has not adequately monitored sub-contracting work,
 - maintenance of facilities and equipment: this is another area of weakness. Neither governments nor aid sources have paid enough attention to it.

However, it should also be underlined that the position is beginning to improve. In particular, greater attention is being paid to planning and more provision made for maintenance.

3. To provide each Sahelian with enough clean water at an acceptable cost is not beyond the bounds of possibility. However, the conclusion to be drawn from the national overviews is that better organisation is required to meet this objective:
 - Improved knowledge and better management of resources. There is abundant underground water in the Sahel, but it is not uniformly distributed. It is necessary to set up systems to collect, store and process data on subsurface water and follow trends, especially in poorly endowed areas.

- More sharply defined roles. The administration cannot be replaced in its role of planning and supervision. It is better to concentrate human resources and equipment, which exist in non-negligible but limited quantities, on these priority tasks and to sub-contract the work itself to official, private or mixed firms, which are in a better position than the administration to perform it.
- Strengthened programming resources to improve the management of scarce resources and reduce costs (regionalisation of programmes, judicious selection of types of facilities and equipment).
- Greater participation of the population. Water sources should be perceived by the villagers' as their own, not as those of the government. This presupposes local participation at the design stage of programmes. Participation is also indispensable to solve the maintenance problem: performance of elementary maintenance by the villagers themselves, financial participation in other maintenance operations and the renewal of facilities and equipment. A National Water Fund could be an instrument of national solidarity in this field in favour of the most deprived regions.
- Preparation of supporting action:
 - . training of executive staff, technicians, artisanal workers and village-dwellers in techniques of management and basic maintenance;
 - . sanitary action to seize the opportunity opened by the availability of clean water to improve the standard of health;
 - . economic development: wherever supplies are sufficient, water must play both an economic as well as a social role: development of market gardening, livestock, craft activities.

The introduction of "rational" water management presupposes a review of the policies pursued by governments and aid sources.

INTRODUCTION

The fourth Conference of the Club du Sahel held in Kuwait in 1980 instructed the Secretariat of the CILSS and the Club du Sahel to "prepare sectoral planning studies by surveys and exhaustive analyses" in several sectors. Village hydraulics was one of these.

Missions were carried out in each of the Sahel countries (except for Chad) in 1981 and 1982 to perform this task. A report was published on each country: "Village hydraulics in CILSS member countries; an inquiry into and proposals for rational management of water". In addition, the Inter-African Hydraulics Study Committee (IHSC) contributed to the investigation in the form of a broader study of the "conditions of use and maintenance of pumping facilities".

It appeared useful to make a synthesis of the basic observations and recommendations found in the different reports.

Scattered information on village hydraulics in many studies on the region has also been drawn on. Included in particular are project evaluations undertaken by aid sources, village hydraulics and rural development studies performed by the BOAD, the CILSS and the Club in 1981.

It should be made clear that in this report the term village hydraulics is used to cover the water supply of the rural sedentary population, whether the water is used for human or animal consumption, or for farming or artisanal work within the confines of the village. The water supply of nomadic herds and irrigated perimeters is not dealt with in this report and will be taken up in later investigations and analyses.

I - THE PRESENT SITUATION

1.1 - POPULATION AND THE HABITAT

Of the 31 million inhabitants of the Sahel in 1980, approximately 26 million or over 80 per cent were rural dwellers.

The population is unequally distributed geographically. Density is very low in the vicinity of the desert, and increases as one moves south towards higher rainfall zones where water resources become progressively better. However, climatic factors and water resources do not alone explain population distribution: the Mossi plateau in Upper Volta is more heavily populated than the better-watered South-West of the country; the Eastern part of Senegal is almost empty, whereas the peanut basin, where water supplies are no better, is overpopulated. History as much as geography explains why people live where they do in the Sahel.

The result has been to create stresses causing population movements: the displacement or scattering of village populations, urban migration, interprovincial migration, emigration to more developed countries. The map of the human population in the Sahel is a perpetually changing one.

Historical and geographical factors also explain the diversity in the grouping of population: large villages in some regions, small villages or even scattered dwellings in others, temporarily-occupied agricultural hamlets, nomads, and semi-nomads of fixed abode for only part of the year.

The population of the Sahel will exceed 50 million by the year 2000. The percentage of rural dwellers will depend on many factors; emigration to towns and abroad will slow down or accelerate depending on the trend of living standards in villages. Water supply will be one of these factors.

Several scenarios have been simulated. Some involve a very high rate of emigration to towns over the next two decades, such that the number of rural dwellers in 2000 will be no greater than it was in 1980. However, most predict a substantial increase in rural population. The estimate of approximately 40 million rural dwellers made by the CILSS and the Club du Sahel will be taken as a working hypothesis, although it may not be attained (i.e. a 50 per cent increase over 20 years).

1.2 - THE WATER SUPPLY SITUATION

Actual conditions of water supply in villages are still badly known; in the absence of census data, it is not possible to know how many villages have enough clean water over the whole year, whether most of the inhabitants draw their water from subsurface layers, how many use traditional wells, or how many of the modern wells or bore holes constructed over the last few years are actually used.

WHO estimates made in 1975 suggested that one in four inhabitants in the rural zones of the Sahel had access to satisfactory water supplies. This is, of course, only a rough order of magnitude based on many extrapolations. The studies undertaken by the CILSS and the Club in 1977 reached similar findings. The surveys carried out in early 1980 together with the programmes drawn up by the Sahel governments suggest an order of magnitude that is scarcely higher.

Many villages still obtain their supplies using traditional wells or surface waters, in less than ideal conditions. Many still only have limited quantities of water at the end of the dry season; women, who are the traditional water-carriers, must often cover long distances to find supplies, and drawing water using rudimentary tools such as calabashes, inner tubes or recovered packaging, which is hard work indeed.

Clean water, even for those with a modern source of water, is available in few villages because the inhabitants are not aware of all the precautions needed to avoid pollution. How much remains to be done here is indicated by the frequency of intestinal diseases and the infant mortality rate, which is in the range of 150 to over 200 deaths per thousand, between the ages 0 and 1, depending on the country (10 per 1000 in Europe), and 60 per thousand in the 1 to 5 year age bracket. All of this is, to a large extent, due to polluted water.

The table below gives an estimate of the number of villages in the different countries and of the number of modern water points. It must be interpreted with caution because the data are not homogeneous: some countries have counted villages and remote hamlets and others only villages; "satisfactory" water installations are not defined identically by each country, and some estimates are doubtful.

	Number of villages	Number of modern water points beginning 1982
THE GAMBIA	1 000	225
UPPER VOLTA	7 600	4 800
MALI	10 200	5 300
MAURITANIA	4 100	1 000
NIGER	17 400	6 000
SENEGAL	14 400	1 500
T O T A L	54 700	18 800

(Cape Verde, where conditions are very special (scattered dwellings, use of springs, etc.) has been omitted from the table because its characteristics differ so greatly from the rest of the region).

Given that many large villages need several water points, the total requirement is on the order of 60 000 to 70 000. The actual number of modern water points in use can be taken to be below 18 000, i.e. some 25 per cent to 30 per cent of needs are met in a relatively satisfactory way.

Considerable efforts have been made in the field of village hydraulics, especially since 1978. The position has certainly improved but overall, it remains poor.

It should also be underlined that until quite recently, water played only a small role in village economic development. The construction of modern water points has only rarely been accompanied by the development of activities such as market gardening, small-scale cattle-breeding or artisanal work. Water is used solely for human consumption, even in locations where supplies are more than adequate and could be used for other purposes, by reason of the lack of sufficiently powerful pumps, and because there is little or no co-ordination between the different departments responsible for hydraulics and rural development.

However, it should also be said that things are changing. In a growing number of projects, especially small projects sponsored by private aid organisations, the creation of a modern source of water now provides the opportunity for true development at village level.

1.3 - INTERNATIONAL AID

Over the last few years, the International Community has earmarked official aid funds for the construction of new sources of water to provide more abundant and cleaner water and improve supply reliability. The recent trend of this official aid is given in the table below.

(in million dollars at current prices).

	1978	1979	1980	1981	1982	TOTAL
Official aid commitments for village hydraulics	12	15	13	42	29	111
Share of above in total aid to the Sahel	0.8%	0.9%	0.8%	2.1%	1.8%	1.4%

(The amounts shown exclude technical assistance advisers made available by certain donor countries to the departments responsible for village hydraulics, a number of studies, and a

share of official aid that is administered by Non-Governmental Organisations (NGOs)(*). The true amounts of official aid for village hydraulics is therefore somewhat greater than the figures indicated).

Private aid donors seem to have given this sector high priority, but the exact figures are not known: certainly at least two million dollars per year and possibly much more.

This aid has increased substantially over recent years. Together with the Sahelians' efforts, it has financed the building of most of the modern sources of water reported above. However, it should be observed that aid has been allocated almost exclusively to construction as such. Very little of it has been devoted to supporting actions in the form of training, maintenance of facilities and equipment.

(*) Non-governmental organisations collect and distribute private aid, and also receive subsidies from some official aid sources for specific projects.

II - PRESENT CONDITIONS GOVERNING THE IMPLEMENTATION OF PROJECTS

2.1 - THE ADMINISTRATIVE FRAMEWORK

All the Sahel governments have seen it as their duty to seek the improvement of the water supply of the rural population. Most projects implemented have been part of government programmes: the remainder have been executed by NGOs.

Each of the States created administrative departments specialised in village hydraulics a long time ago. In principle, these departments are responsible for inventorying need and resources, and planning and controlling the use of public funds for the development of new water points. Likewise in principle, other bodies take care of the construction and maintenance of the water points and their equipment.

In reality, the construction and maintenance of water points are undertaken by:

- the departments themselves, which have established well-building teams and drilling agencies,
- official para-statal organisations created to this end,
- private specialist firms, and
- NGOs.

The structure of administrative departments has been improved and reinforced in recent years. Ministries of Water Resources have been created in some countries. However, in the last analysis, these departments have only limited human and material resources, and allocate them to both design and execution functions. Investigations show that neither of these functions are adequately performed in the Sahel today.

These functions are described below.

2.2 - SURVEYING OF RESOURCES

This function is probably carried out best. With the help of foreign aid and the technical assistance from foreign consultants (in particular the BRGM and the BURGEAP), major advances in the knowledge of the underground water resources of the Sahel, have been made over the last twenty years.

Simplifying a great deal, the region's water resources are divided into two main zones:

- recent sedimentary zones. These contain large, continuous and powerful aquifers, offering amply sufficient reserves for village hydraulics. However, some of this is "fossil" water, i.e. reserves formed in ancient, wetter, times, and as a practical matter, they are no longer recharged;

- ancient sedimentary strata. The water here does not accumulate in continuous aquifers, but is located in deformed pockets or cracks in the rock. These resources are much smaller and also harder to locate and develop. Nevertheless, progress in prospecting methods has made the search for water far less subject to the vagaries of chance and progress in boring techniques has made it possible to draw water from cracks which could not be exploited previously because their flow was too limited.

A good picture is now available of the resources in the different provinces of the Sahel and remarkably well-done syntheses, designed for use as basic tools for the administrative departments responsible for drawing up programmes for underground water, have been published.

However, the information is incomplete. For many aquifers, the volume of water which could actually be drawn is still unknown and piezometric readings of their level are not made systematically. And it is of course always desirable to enhance the details known of favourable locations and of the volume of water which can be used, especially in the ancient sedimentary strata.

2.3 - NEEDS AND PROGRAMMING

The situation is much less satisfactory in this area. First, government services, pre-empted by many tasks, especially the execution of work they have undertaken themselves, have generally paid less attention than they should have, to planning the use of public funds. Although many tasks can be sub-contracted, public authorities must do overall planning and programming.

At the same time, somewhat paradoxically, programming has been both heavily concentrated and scattered.

It has been concentrated in the sense that village hydraulics projects - like cereals crop development or reforestation projects - have to a large extent been designed, decided and undertaken without the participation of the population concerned. A technocratic approach to development has been followed, oriented "from top to bottom", villagers being considered as unable to contribute to the design and development of what are nevertheless matters of prime concern to them. Nor has the intervention of foreign aid sources, anxious to implement their own models, facilitated more attentive understanding of the rural world.

Fortunately, the NGOs, acting most of the time outside this technocratic framework, have brought more flexibility to this rigid approach. It should also be underlined that some countries have made an attempt at a different approach with uneven success: wells as an investment in human resources.

As regards scattering, the rule in programming (or what has been referred to as programming) seems often to have been a "scattered" approach. For quite understandable political reasons, action has not devolved on a regional basis, and work-sites have been

scattered to the four corners of the country, with all the problems of organisation, executive staffing and logistics involved (and, in due course, maintenance). Each aid source, interested in its own programme without paying heed to other projects, and the NGOs acting independently, have intensified dispersion rather than containing it.

Some progress has recently been made towards better programming, a regional approach to action and attention to local needs. However, a method which would allow for more rational use of rare resources in the Sahel, in particular human but also financial resources, and taking into account the needs of the rural world, which are not the same everywhere, nor immutable, has yet to be devised.

2.4 - EXECUTION OF WORK

The Sahel States have almost all chosen to have at least part of the physical work of project implementation performed either directly by the government under force account ("régie") or by para-statal organisations whose autonomy is more statutory than real.

This policy, which stems from a legitimate desire for national independence, has not - except in some rare instances - yielded the results expected. On the one hand, cumbersome administrative constraints are incompatible with the flexibility needed for the efficient performance of work; on the other, skilled personnel are too few in number. The cost-effectiveness ratio achieved has been below expectations.

When work has been sub-contracted to private firms because of a shortage of human resources, it has very rarely been monitored or controlled. There is room for belief that this has not been without incidence in costs.

Basically, the policies pursued by the departments responsible for village hydraulics have not really been adapted to their human resource availabilities. Skills are scarce in the region, and the unfortunate fact is that they will continue to be scarce in the short- and medium-term. The best way out is probably to find what is perhaps not optimum but at least a more effective way of distributing limited resources between the different tasks of design, planning, execution and control, and sub-contracting whatever can reasonably be sub-contracted.

2.5 - MAINTENANCE

The inadequate level of maintenance of facilities and equipment has been increasingly commented on for some years. Government departments have had neither the equipment nor the human resources to maintain widely scattered installations. The population has not felt itself concerned about the maintenance of facilities and equipment which it sees as the government's rather than its own, and in any case, generally has not had the technical know-how needed to perform maintenance. The aid sources have also paid little attention to maintenance.

The outcome has been major deterioration. Foreign donors have had to use part of the funds allocated for village hydraulics schemes for the rehabilitation of facilities or the replacement of equipment which had been installed only a few years ago. This has reduced the rate of creation of new water installations proportionately.

However, it should be stressed that there has been a progressive improvement in the situation. The maintenance aspect has attracted more attention in the design and development of the last generation of projects than ever before; some project designs have included provision for the organisation of maintenance and maintenance training (although others still seem to neglect this aspect of village hydraulics). Some countries have created a national structure for the maintenance of water installations. Local residents are now beginning to participate financially in the maintenance of the equipment they use; this was almost unknown a few years ago. Some countries have created a National Water Fund, one of whose aims is, to finance at least part of the maintenance of facilities and equipment.

Awareness of the needs for maintenance is growing, and concrete measures are beginning to be taken.

III - PROSPECTS

Chapter I described the magnitude of the needs to be met. Given the foreseeable growth of the rural population, and allowing for the renewal of old installations, approximately 60 000 to 70 000 modern water points will probably have to be built by the year 2000 (excluding the Cape Verde Islands and Chad) to generalise adequate water supply.

It is not easy to count the number of water points whose construction is under way or planned in the short term (i.e. for which financing has been secured). The figure seems to be at least 12 000 for the whole of the countries considered.

This order of magnitude demonstrates the substantial effort still required despite the recent acceleration of investment in this field.

There are two questions. Will the Sahel have enough water and the necessary resources to face up to its needs, say, over the next twenty years? Will it find the necessary funds?

3.1 - WATER RESOURCES

First, will water resources be adequate?

It is now known that groundwater, overall, is available in reasonable abundance. While these resources should be more than enough, certain additional points should be borne in mind:

- human water supply is not the sole issue; cattle consumption and water for farming must also be taken into account. Although the high cost of pumping will limit the use of underground water for irrigated farming, this call on resources cannot be neglected;
- water resources are most unevenly distributed geographically. Some layers are fossil or recharged only very slowly; in some areas, the water-bearing strata are difficult to tap; certain layers are subject to major variations in levels which can temporarily dry up wells, etc.

As the volume of water drawn from the reserves rises, careful management of resources will be necessary to avoid jeopardising the future. Some regions are in more danger in the short term than others: for instance, coastal regions where the invasion of fresh water formations by salt water, following excessive pumping, would be irreversible and catastrophic.

Substantial portions of the data needed to manage resources exist already. They will need to be completed, especially by continued measurement of the water level in particular in zones in which the aquifers are discontinuous.

In sum, the resources exist and are generally sufficient at least for the needs of the next two decades, but they must be managed, all the more rigourously when they are scarce; and their uneven geographical distribution must be taken into account in future development schemes.

3.2 - IMPLEMENTATION POTENTIAL

Chapter II has shown that the conditions in which current projects have been designed and implemented have not always been adequate, which raises a second question: is it possible, on the basis of existing resources, to increase implementation capabilities and the pace at which needs will be met? How?

The results of the actions undertaken over the last few years may not always have lived up to expectations, but the Sahel countries have gained worthwhile diversified experience whose value should not be under-estimated. Even if resources, and especially human resources are insufficient, there now exists a potential which can be better utilised. All studies agree on this point.

Implementation potential exists in the government departments, State corporations and private firms. The goodwill of the population can also be mobilised for both development and maintenance. The problem is first and foremost to manage scattered capabilities to best effect and gradually to augment them.

3.3 - THE NEED FOR RATIONAL WATER MANAGEMENT

Existing water resources are not endless; in addition technical potential and experience of village hydraulics exist in the Sahel, but are not over-abundant; the International Community has increased its financial and technical assistance over the last few years, but one thing is certain: neither State funds nor foreign aid are limitless.

Consequently, needs remain very high in relation to resource availabilities.

The general conclusion of the diagnosis of village hydraulics in national reports can be summed up in one sentence: more benefit must be derived from the existing natural, human, technical and financial resources. A "rational water management" policy must be put in place; the management of water availabilities, of technical and human resources and financial resources so as best to meet needs, compose the three interlocking aspects of such a policy.

A number of concrete proposals for the development of rational water management are set out in the national reports. The present paper will now examine these proposals, starting with programming.

IV - PROGRAMMING

Programming involves defining the actions to be undertaken, their order of execution and the resources to be employed. It presupposes the presence of one or several objectives. In the particular case of village hydraulics, the aim is to improve the quantity and quality of the rural population's water supply without forgetting that water is not only used for human consumption, whence its "social" role, but should also have an "economic" impact whenever possible: drinking water for village cattle, irrigation for market gardening.

It also presupposes that priorities are defined, and the guidelines laid down on what could be referred to as a "water development strategy". Each State is of course responsible for its own definition. This point will be returned to in the discussion below.

4.1 - ON-GOING SURVEYING AND EVALUATION

The first step is obviously to acquire knowledge:

- Knowledge of needs, the real needs of the population, and not typological needs as perceived from an office chair in a capital. It will probably be necessary in the future to obtain greater support than in the past from decentralised structures to assess these needs.

To the extent that groups of villagers develop which are not mere emanations of government services but true producer associations, or groups specialised in water supply are created, these groups are the future opposite numbers of the official hydraulics authorities;

- Knowledge of existing water points, their location, characteristics and equipment;
- Knowledge of resources, the volume of data available has already been referred to. These data must be stored and accessible and must also be improved (critical surveys of flow tests, development and follow-up of piezometric networks);
- Knowledge of techniques, construction and maintenance techniques, specifications for equipment and materials, results of experiments with and use of equipment and materials.

All these data should be stored in a water documentation unit within the national department. Computers are now cheap enough to envisage computerised storage and data processing.

It should be observed that competent personnel are too scarce in the region to be wasted on collecting data on techniques in each State. This information could be advantageously collected and processed at regional level and circulated to each national unit (which presupposes compatible computer systems). There probably is no need to create a new structure for this purpose.

Three organisations dealing with water exist in Ouagadougou: the CILSS, the CEAO and the CIEH. They could agree to collect information in common, circulate it among States and, more generally, act as a pool of expertise at the service of their Member States.

4.2 - PROGRAMMING

This is obviously the key stage at which it is necessary to correlate:

- "social" and "economic" needs, and the motivation of population to participate in investment;
- resources, specifying them if necessary by additional study;
- equipment and human resource availability;
- estimated costs.

Given the magnitude of the needs to be met and the limits to available resources, it will be indispensable:

- to define priorities, for instance, should priority be given to projects which allow an "economic" use of water for market gardening or small-scale cattle breeding? Or should emphasis be placed on social needs, and modern water points established in those villages whose water supply is most precarious?

The creation of a water strategy at the national level is necessary in this regard. If this is not done explicitly and with due reflection, decision-takers will in any case be compelled to apply an implicit strategy, but one which has not been discussed;

- to avoid "scattering", which increases the cost of projects substantially, by defining a regional development strategy;
- to plan at the design stage of programmes how maintenance will be organised: who will be responsible for the different levels of maintenance? How will the persons in charge of maintenance be trained? And will it be financed through the participation of local communities, from the national budget, out of a national water fund, or in some other way?
- to secure co-ordination between village hydraulics programmes, small-scale rural development actions using water, and sanitary actions.

The national sectoral reviews include many interesting suggestions on the choice of the types of facilities to be built, either wells or boreholes, which summarise the experience gained over the last twenty years. There can be no single recommended alternative; the choice depends on a set of criteria: the terrain, demand, the desired pace of construction, the possibility of undertaking reliable maintenance of borehole pumps, etc.

4.3 - STRENGTHENING PROGRAMMING CAPACITY

The diagnosis of the current situation has underlined the inadequacies of programming. It will no doubt be necessary to strengthen the capacity for this in the national water department. A few suggestions can be made:

- creation of a team specialised in programming within the National Water Department, whose mandate precludes any function of execution. This team will receive support from:
 - . the water documentation unit,
 - . regional rural development organisations, village groups, etc.
- creation of a National Water Committee at the policy level to define the broad lines of a water strategy and of regionalisation.

V - IMPLEMENTATION OF PROGRAMMES

5.1 - STUDY, EXECUTION AND CONTROL OF WORK

The analysis of the situation of village hydraulics has shown that administrative departments study, execute and control programmes. This accumulation of tasks is detrimental to the smooth performance of any one of them.

In the future, roles must be more distinct:

- the administration's role is first to prepare calls for tenders and especially to establish the specifications of facilities and equipment, then follow up and ensure that the project is carried out in conformity with accepted practice, and finally to take delivery of the completed project.

It is also up to the administrative services to ensure that maintenance, scheduled at planning stage, is effectively performed after the entry of facilities into service. This point will be amplified below.

- the role of contracting firms.

A number of ways in which the efficiency of working methods for wells and boreholes could be enhanced have been suggested in the national sectoral reviews. They include in particular the creation of mobile mechanised workshops (already in use in Niger) for the construction of cemented wells.

The CIEH has produced a special report on pumping facilities. It lists the advantages and drawbacks of the various kinds of hand-operated pumps used in the region, and the testing programmes for new pumps presently under way. A project for the manufacture of hand-operated pumps is envisaged in the region.

Emphasis should be laid on the value of limiting the number of models of pumps used, or, in the future, the number of models manufactured locally, to ease problems of the storage and distribution of spare parts, thereby facilitating maintenance.

The same remark applies to drilling and well-digging equipment.

5.2 - RESTRUCTURING OF IMPLEMENTATION CAPACITY

Administrative departments are poorly armed to execute the work, but they alone can perform the function of programming and controlling the use of public funds.

The long-term objective should be the creation of national autonomous firms, independent of the administration. They could be official, private, or mixed and would be responsible for drilling wells and boreholes.

In the short- and medium-term, recourse to foreign firms is probably indispensable in order to accelerate the pace of construction; however, a policy of assistance for the creation and development of national firms should be promoted systematically.

In some countries, well-digging is done by traditional craftsmen. These wells will continue to play a major role in water supply. This craft must be preserved and extended.

VI - MAINTENANCE AND SUPPORTING ACTION

6.1 - PREREQUISITES FOR THE IMPROVEMENT OF MAINTENANCE

The studies of recurrent costs have shown the difficulties met by the Sahel States in maintaining and rehabilitating existing water installations. The effort required to provide the rural population as a whole with enough water has been discussed; it is incommensurate with what has been done up to now. This means that a system making the State fully responsible for maintenance and rehabilitation activities and financing, cannot be generalised.

A few suggestions as to conditions for improving maintenance are set out below:

- first, it seems indispensable to have the inhabitants of villages contribute financially to the cost of rehabilitation and maintenance of facilities and equipment. This should be possible: they pay something in any case to cover the annual cost of traditional pumping units. A CIEH study shows that the cost of upkeep of a manual pump (which greatly reduces physical effort!) is rather low. Experience shows that many villagers are motivated enough to set aside money for maintenance or even to invest in a modern water installation, supplying abundant water.

However, financial participation must be subject to an agreement at the design stage of projects and stipulated at that time in a contract between the administrative department and an ad hoc group of villagers.

- This implies reducing capital and maintenance costs to the minimum and taking them into account in programming, in particular in the choice of the types of facilities and equipment to be installed.
- The cost of maintenance can be reduced if it is performed by the local population and village craftsmen trained in the necessary techniques.
- State participation should be envisaged, e.g. in the form of a National Water Fund, but it should be well understood that this financial aid is only to supplement the investment made by the local community. The National Water Fund could be a tool of national solidarity and act to balance relatively well-endowed areas which can provide funds for maintenance with poorer areas, or to balance areas in which water can play a major economic role with those in which it will mainly play a social role.

6.2 - THE ORGANISATION OF MAINTENANCE

The application of the above principles will require organisational measures.

At village level, the creation of a group, whether a producer association or ad hoc group, will be necessary. The group will be the spokesman vis-à-vis the administration at project preparation stage and later, the manager of the water installation. The group will have to appoint one of its members to collect and manage funds, and perhaps another to be responsible for basic maintenance.

Still at village level, this makes it desirable to train craftsmen to be able to carry out more advanced maintenance and simple repairs on the facilities and equipment.

At the county and provincial level, spare parts centres should be created to supply village craftsmen, and specialised teams set up to provide them with technical assistance and undertake more complex maintenance operations. These specialised teams need not be part of the administration, which is probably not the best qualified for the actual performance of work.

It would be more desirable, as suggested earlier regarding the implementation of projects, to leave it to specialised official, private or mixed firms.

6.3 - SUPPORTING ACTION

Carrying out the actions listed above will necessitate a major effort in the training of:

- government executive staff in their tasks,
- executive staff and technicians of contracting and maintenance firms,
- village water workers, in management and basic maintenance, and
- rural craftsmen.

One of the functions of the water authority could be to organise the training and recycling of village water workers and rural craftsmen, e.g. through training seminars.

It has also been stressed earlier that the development of a modern water point does not, by itself, necessarily improve village sanitary conditions. The precautions to be taken to avoid polluting water installations (suitable latrine facilities, etc.) so that water which is clean when drawn and will still be clean when it reaches the final consumer, are not really obvious to those who do not possess basic notions of hygiene. People must be trained in basic hygiene at the same time the water installation is constructed. This teaching task could also be undertaken by the water administration, in co-operation with the health departments.

CONCLUSION

In the report "Village hydraulics and rural development in the Sahel" (BOAD-CILSS-Club du Sahel - 1981), the capital cost for 60 000 water installations up to the year 2000 was estimated at 350 billion CFA francs at 1981 prices or \$1.27 billion at 1981 prices.

It can be seen that the funds allocated to village hydraulics in 1981 are quite close to the level required for completion of the programme within twenty years. The rural population has made a considerable effort in the field of water supply. It will probably have to be intensified if each Sahelian is to be able to count on an adequate and reliable supply of clean water within roughly twenty years. In any event, the objective does not seem to be beyond the bounds of possibility.

However, it can also be seen that this very considerable effort raises several problems.

First, a financial problem: it would not serve much purpose to make substantial investments if the capital is allowed to go to ruin through lack of maintenance or obsolescence. Even though it may be desirable for the International Community to participate in funding maintenance to avoid deterioration of facilities, this assistance can only be temporary. The Sahelians cannot remain forever dependent on foreign aid sources for the supply of a basic need like water.

This presupposes a solution to the financial problem which is possible if the communities undertake whatever maintenance they have the skills to do and pay for the rest. The cost is not overwhelming, and ultimately, the question is more one of organisation than financing. State participation, e.g. via a National Water Fund, could help the most deprived communities in meeting their costs.

The rehabilitation of facilities and the overhaul of equipment presupposes the development of credit systems to enable communities to spread the expenditure over time. This is also as much a question of organisation as of financing.

More generally, it may be asked whether more emphasis should be placed on what has been referred to as the "economic" role of water. Attention has so far mainly been focused on the "social" aspect, i.e. the provision of clean water, easier access, etc. Of course, this essential objective cannot be abandoned. However, the social does not exclude the economic aspect. Water can be used for several purposes: market gardening, livestock, the diversification of food preparations, and to provide additional income. It is also a factor of economic development; to the extent this is more true in future than it has been in the past, the village hydraulics programme will not lay an unbearable financial burden on the region.

The insufficiency of human and material resources is another problem. The national reports show, once again, that it is essentially one of organisation. The existing resources are limited, but they could be used more efficiently. A re-definition of the roles of the different agents responsible for planning, construction and maintenance is necessary, and should bring about a restructuring of the sector.

Once this organisational problem has been dealt with, the overall programme described above will become realistic.

Hence the need for the active participation of the population. This could be the general conclusion of this overview of village hydraulics in the Sahel. Sahelian authorities and aid sources are attempting to improve the water supply of the rural population. They have had limited but encouraging success and the situation has started to improve. However, up to now this water has been "donated" to the population: it is a gift from the government, foreign aid sources or NGOs.

The effort remaining to be made is greater than that applied up to now, and it can be clearly perceived that a generalised and satisfactory water supply will not be had without technical and financial difficulties which would no doubt be insurmountable if the present path is followed. The problem now consists of re-directing action, on the basis of the substantial and precious experience gained. Water must become the population's concern. Communities must become involved in the design, development, maintenance and financing of water points and in the rational use of water. Water must become a development factor and not just a gift from the State, made for social reasons.

This presupposes a revision of their policies by governments and aid sources, which is the price at which the objective of water for all will be attained.