DESIGN FOR SUSTAINABLE FARMER-MANAGED IRRIGATION SCHEMES IN SUB-SAHARAN AFRICA

Introductions and contributions for the International Workshop

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THEME 3: PHYSICAL SYSTEM AND REGIONAL-NATIONAL SOCIAL ENVIRONMENT

1. Introduction

In the first two themes we have seen which elements of the farming system play a role in the use of the plot , and what social-organizational elements affect the operation and management of an irrigation system. It often happens, however, that certain elements of the use of plots (e.g. inputs), or of the management of the scheme (e.g. allocation of land) are organized by external actors. In such cases the sustainability of the scheme operation, and the scheme performance too, for that matter, not only depends on the appropriate tuning of the irrigation design to the local farming system and local community, but also to the relationships with external actors. These external relationships themselves, however, are liable to the actual functioning of sometimes complex regional, national, and international social systems that reach far beyond the boundaries of the local environment.

As these supra-local systems are often not very 'stable' - fluctuations in prices, or changes in government policies, for instance- , and can hardly be influenced by the farmers themselves, these external relationships may introduce/involve important risks for the operation of an irrigation scheme. For this reason, reducing farmers' vulnerability to lack of rain by the introduction of externally supported irrigated agriculture may go hand in hand with making these farmers subject to increased external risks.

In the previous themes we have analyzed the possible consequences of the characteristics of the farming system and the local community on the plot use and the organization of water users respectively. We have also noticed how important it can be to take these social requirements into account when making a technical design in order to come to a sustainable farmer management

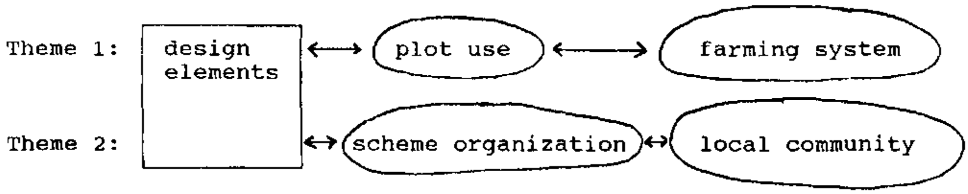

Figure 1.

When particular elements of the use of plots or the organization of the irrigation are organized in cooperation with external actors, we need insight into a much wider scope of social relationships in order to assess the sustainability of the scheme. This requires socio-economic information that is completely different from that needed with respect to the previous themes. It includes knowledge about the performance of government agencies, about traders, banks, and marketing systems. Figure 2 represents these relationships in diagram:

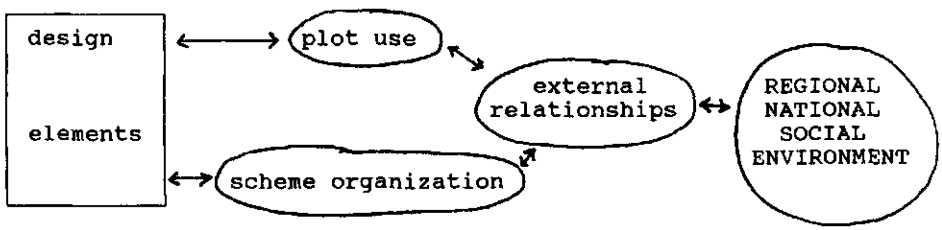

Figure 2.

The external contacts actually have to do with the "externalised" elements of the local farming system, as far as the irrigated production is concerned, and the "externalised elements" of the local community, as far as the operation and maintenance of the system is concerned. These connections are shown in Figure 2.

In the following paragraph the left side of figure 2 is discussed, and some examples are given of how presuppositions about external contacts are used in the design elements. In paragraph 3 the right side of figure 2 is looked at. On the basis of some examples, we will examine how the actual regional, national, and international context may have an impact on the external contacts related to the system. In paragraph 4 some comments are made about to what extent a complete farmer management of irrigation schemes is feasible and desirable within the present socio-economic conditions of Sub-Saharan Africa. Finally, in paragraph 5 several subjects of discussion are proposed with respect to the possibility for designers to advance the "external sustainability" by reducing or by strengthening the needs for particular external contacts, according to the specific regional and national context.

2. The physical design and presuppositions on external contacts

In the introduction on designing six elements of the physical system have been introduced. In the first two themes the presuppositions used in the design decisions concerning plot use and the use of the system have been discussed. In this section we shall examine on the basis of examples what presuppositions about the (future) external contacts may underlie the physical design.

An example with regard to a water source.
The physical design aims at a timely supply of sufficient and qualitatively good water to the fields. The system is therefore dependent on the right choice of water source. The choice of ground water irrigation, for instance, presupposes external contacts to maintain the pump. Farmers depend on a continual relation with outside agencies for the delivery of spare parts, fuel etc. For this reason intensive ground water irrigation, or other types of capital and technology intensive irrigation, are, as a rule, designed for a commercial production. Consequently farmers have to keep up contacts with suppliers and traders for the cultivation and marketing of their crops.

An example with regard to the location.
With the selection of a location the designer usually determines which farmers are going to use the land. The

allocation of irrigated fields to farmers seldom accords with the traditional land-tenure. This means that farmers became liable to external contacts for establishing land-rights for example for signing land agreements or paying tax at regional government deparments.

An example regarding the plot.
The plot shape and plot size chosen have direct implications for the method and degree of mechanization. It is often assumed that an increase in labour requirements for soil preparation can be compensated by more mechanization. The purchase and maintenance of farm machinery ,however, requires contacts with experts and suppliers.

An example concerning water application.
The choice for a particular water application method largely determines to what extent farmers can make use of cheap means and equipment that is easy to maintain, or, with trickle irrigation for instance, depend on banks (for credit), commercial dealers, and transport firms to supply spare parts from abroad.

An example concerning water distribution.
For the water distribution between the plots, canals and irrigation structures are needed. These constructions presuppose a certain capacity of repayment and maintenance, and a reliable external delivery of materials. All methods of water distribution require an organizational structure. In the large schemes it is often assumed that officials from outside hold responsible positions within such an organization.

An example regarding layout.
The layout of an irrigation system has consequences for the individual plot size. Within a system with large, uniform plots, a designer often is inclined to decide upon an intensive mono-cropping production with fertilizers, pesticides, and a high degree of mechanization. This decision presupposes an intensive contracts between farmers and external actors for

the purchase and marketing of all kinds of inputs and outputs.

3. Regional and national social environment and its consequences for the functioning of the irrigation system

From the above it is clear that the physical design presupposes external contacts. We shall now examine how the actual regional and national social relationships may influence these contacts. We shall discuss the right side of figure 2.

For a farmer-managed irrigation scheme to function adequately, certain conditions must be met by the regional and national social environment. These include:

Price

External inputs, such as pumps, fuel, and fertilizers, should be inexpensive. Price fluctuations should be kept to the minimum.

Quality

The materials supplied should be of good quality and need a minimum of maintenance. Farmers should preferably be able to replace the spare parts themselves.

Quantity

The scheme must be sure of the external inputs required to be delivered in sufficient quantities.

Timing

Government officials and traders should keep their agreements within the time limit set, in order to let farmers operate the system and activate the plots effectively.

Ownership rights

Land and water rights should be fixed so that those concerned know who has and keeps right of use.

Whether these conditions can be fulfilled, depends on what actually happens in the regional and national social(-political) environment. Sometimes the external circumstances are favourable and do not hamper the operation of the irrigation scheme. But often those conditions cannot be met, which may have various regional and national socio-political and economic causes. For a scheme management to be sustainable it is essential to have an insight into these causes. Some of them will be clear from the following examples:

The performance of government agencies (public sector).
Government agencies' activities in an irrigation scheme are partly geared to maintain control over the production process dictated by specific government objectives. This may exclude a sustainable farmer management. Government agencies may also suffer from manpower constraints and excessive collective expenditure, with the result that quality and quantity of the government services needed are adversely affected.

The performance of traders and suppliers (private sector)
Local private traders impose conditions as regards the quantity, quality, and price of the products they want to buy and sell. By doing so they may endanger the marketing of produce, and the delivery of spare parts.

Marketing structures and international price relations
Continually fluctuating and often increasing prices for inputs marketing of fuel, fertilizers, pesticides, etc. and instablility of produce-prices will often limit farmers possibilities to produce for markets. If farmers cannot bear the increasing costs, they will be forced to give up irrigated agriculture.

Conditions imposed by banks
Access to credit in general may be very limited for small-farmers. When banks credit loans they often impose conditions as regards the purchase of fertilizers, the utilization of capital intensive irrigation techniques and the like.

Consumptive credit is often much more difficult to obtain. In order to obtain loans farmers are thus forced to enter into external contacts which may undermine self management.

Access to knowledge and information

The introduction of (new) irrigation methods requires specific knowledge and information about their use. Donors may, in their own interests, introduce technologies that are difficult to handle by the farmers themselves. If training is inadequate, these farmers remain dependent on external experts for the operation, maintenance, or repairs of certain tools, structures etc.

4. Regional and national social relations and sustainable farmer management

Even if planners and designers succeed in taking farmers' views, aspirations, and skills into consideration, the implementation and maintenance of these schemes can be jeopardized by external actors whose actions or policies widely differ from those pre-supposed at the planning and design stages of a project. Since continuity in external support can often not be safeguarded, farmer management will become even more crucial to sustainable irrigated agriculture.

A realistic view and sound assessment of the nature of the regional and national social-political relationships must then be confronted with presuppositions of the physical design in order to judge the sustainability of an irrigation system. This realistic view may lead to the following two observations:

A. External contacts are needed for sustainability.

External relationships are necessary for irrigation schemes to be assured of inputs for its operation and performance. Because of the general tendencies of commoditization and institutionalization of the production process within African economies, it is unrealistic to expects irrigation schemes to operate without external actors in the public or private

sector. In order to judge the sustainability of a scheme, it is important to find out what external actors the farmers depend on for their access to the necessary inputs, and in what way they rely on these actors. Insight into this socio-political environment enables an adequate assessment of the feasibility of the conditions imposed by the physical design. If these conditions can be met, the sustainability will not be jeopardized, and farmers will be certain of viable and profitable relationships with external actors.
This assessment can be of vital importance for the right choice of design elements, especially where certain things are difficult to organize in the local context.

B. **External relationships may undermine sustainability.**
From the examples in paragraph 3 it is clear that the presuppositions in the physical design regarding the regional and national environment, are not always realistic. Unreliable delivery of external inputs and unreliable services threaten the sustainability of schemes. This risk may be minimized by excluding as many external contacts as possible, or, in other words, by increasing the farmers' self management. This conclusion leads to the question of which design elements must be chosen to reduce the number and content of external contacts.

5. Discussion

We have tried to make clear that on the one hand, the designer, from the perspective of the physical design, presupposes certain external contacts, and that on the other hand, these contacts may be influenced by the regional and national social environment. A discrepancy between the two may lead to a situation where the presuppostions with regard to the social environment are not met, and thus the sustainability of the scheme is endangered.

If introducing certain external inputs appears to involve too many risks for a sustainable system-organisation and use of farmers' plots, other design alternatives must be found. At the Workshop we may discuss the following questions and possibilities of promoting sustainable farmer management:

- The possibilities for minimizing the need for external inputs by trying to make these locally available, or by making them unnecessary.

Question: What are the consequences of this for the choice and adaptation of the design elements?

- The organizational design to be changed in order to decrease the risks involved in external contacts. This is possible by strengthening the farmers' organization at scheme level.

Question: What are the consequences not only for the choice and adaptation of physical design elements but also for the organizational design?

Relevant subjects of discussion at the Workshop will be:

* Identifying design choices that are often applied, and analyzing the resultant presuppositions and conditions regarding external relationships.

* Making an inventory of the essential factors hampering the external contacts, and of the reasons accounting for these obstacles from the regional and national social context.

* Trying to find alternative design choices that increase the chance of "externally sustainable" schemes in the context of the African Societies.

1. Introduction: Irrigation in the Senegal River Valley.

As part of its efforts to reduce commercial imports of cereals, which averaged 453000tons between 1981 and 1984 (Afrique Agriculture, 1986, p25), the Senegalese government has adopted a strategy of developing irrigation for food production. To this end, 75% of the agricultural investment budget in 1986-9 was to be used for irrigation development. Of this, two thirds, constituting 46% of all agricultural investment, was to be spent in the Senegal river valley (Afrique Agriculture, 1986, p29).

This emphasis on the Senegal river valley rests on the belief that conditions for irrigated production would be dramatically improved by two factors:

- "l'Après-Barrage": the completion of two dams, one at the top of the river basin, at Manantali in Mali, and the other close to the estuary at Diama which allow year-round irrigation along the whole length of the valley ;

- "le Désengagement": the withdrawal of the state from the supply of agricultural inputs and services to allow provision through commercial markets, which are believed to be capable of providing a more efficient service than the state and at lower cost. Further, withdrawal of the state from close supervision (encadrement) of crop management was expected to encourage private investment in irrigated farming.

With the completion of the dams in 1987, l'Après-Barrage became a reality, and the rapid growth awaited in irrigated food production has come to be regarded as dependent upon the pace of state withdrawal. This paper describes the extent of this withdrawal in early 1989, and identifies emerging responses in irrigated farming and their implications for irrigation design. It is based on field work carried out from January to March 1989, during which , interviews were held with SAED officials, commercial traders, and members of farmers' organisations in the delta (on the large perimeters Lampsar, and Grand Digue-Tellel-Kassak), and in the middle valley (at Guedé, Nianga, and on the Ile à Morphil).

Large and small scale irrigation

For the purposes of this paper, the Senegal river valley will be divided into three regions: the delta (from the coast up to and including the perimeters at Dagana), the middle valley (from Dagana to Dembakane), and the upper valley (from Dembakane to the Mali-Senegal frontier).The 1988 OMVS inventory puts the total irrigated area on the southern (Senegalese) bank at 39270ha, all of which obtains water by pumping from the river. Prior to SAED disengagement two distinct irrigation sectors were recognised.

Large-scale irrigation is concentrated in the delta (with two exceptions, Guedé and Nianga, in the lower middle valley) on heavy clay soils, many of which are sufficiently saline to exclude all crops but rice. The present infrastructure dates from the 1970's, when pumped irrigation superseded earlier systems of partially-controlled flooding. Water is supplied to units of a thousand hectares or more by large electric pumping stations, pumping from the main river course or from a secondary natural watercourse, the Gorom Lampsar. In the latter case double pumping is involved at certain times of the year when the level of water in the main riverbed is insufficiently high to supply the Gorom-Lampsar, which is then fed by a pumping station at Ronkh. Land distribution was carried out according to the criteria of 0,5ha per "actif" and as a result household units frequently have total holdings of 1,5ha, rising to several hectares in some cases. The relatively large landholdings require mechanised tillage, a generalised use of herbicides for weed control, and seasonal hired labour during harvest.

Small-scale irrigation is concentrated in the middle and upper valley, where perimeters of 20-40ha were typically constructed on the medium to light-textured soils of the levees of the main courses of the river. These small-scale schemes (PIV - Périmètres Irrigués Villageois) were established from 1975 onwards, with the principal objective of ensuring the food security of farmers in the period of lower than average rainfall which began in the early 1970's (Engelhard et al. 1986; Adams, 1981) and severely restricted traditional crop cultivation dependent on rainfall (in the upper valley) or the river flood (in the middle valley). Each PIV was irrigated from the river by a float-mounted diesel pumpset, the running costs (fuel, spare parts, operator) of which were met by those cultivating the irrigated plots. The size of individual holding on PIV's varies between 0,1 and 0,5ha, but is most commonly 0,2to 0,3ha, and practically all operations are carried out manually, including tillage.

With the exception of about 7500ha operated as a commercial sugar plantation, by the 1980's all the irrigated areas were divided into smallholdings, allocated to individual farmers by the irrigation management body: the village authorities in the case of small-scale schemes; the state management corporation (SAED - Société d'Aménagement at d'Exploitation des terres du Delta du fleuve Sénégal) in the case of the large-scale schemes. The SAED, formed in 1965, played a central role in both types of scheme, however, by undertaking design and construction of the irrigation work, provision of technical and input supply services including tractor hire, operation of the large pumping stations (large perimeters), and supply and maintenance of small pumpsets (PIVs). This had the important consequence that farmers' irrigation organisations have been shaped by conditions in which the state had responsibility for the supply of key factors of production.

Table 1 sets out some comparisons of large and small-scale irrigation as it was in 1984, on the eve of the withdrawal of SAED.

Table 1 comparison of cropping on large and small scale irrigation, in the 1982-83 and 1983-84 seasons (extracted from OMVS, 1985)

	total net irrigable (ha)	percent of irrigable area cultivated			
season:		rainy	cool dry	hot dry	total
1982-83					
large	8878	61%(rice)	6%(tomato)		67%
small	5761	58%(rice)			
		+4%(maize)	27%(maize)	11%(rice)	100%
1983-84					
large	9056	79%(rice)	5%(tomato)		84%
small	7894	57%(rice)			
		+5%(maize)	28%(maize)	3%(rice)	93%

In table 1, data for two seasons shows the heavier emphasis on rice in the large perimeters of the delta. On the small perimeters, rice occupied a smaller proportion of the total irrigable area, with the remainder being largely made up by maize. Comparisons of rice production on small-scale and large-scale perimeters by Engelhard et al. (1986,pp252-9), indicated that on PIVs production costs are lower and output per unit of land is higher. However, the percentage of output marketed is much lower (5%) than on large-scale schemes (40-60%). There is evidence that on some PIVs the small area per cultivator is insufficient to grow enough food even to support cultivators' families (Engelhard et al.1986, p258). Since most of the crop grown on PIVs is used by the cultivators' own household, the cash costs of production (mainly pump operation and fertiliser) must be met from earnings from other sources, such as livestock, and not infrequently from remitted earnings of the 20-40% of the active population emigrant to Dakar, France and elsewhere (Diemer and van der Laan, 1987, p93). On both types of perimeter the direct production costs were covered by credit from the supplier of inputs and services: SAED. Failure to repay this credit had by 1984 resulted in the accumulation of debt arrears of 255 million frs cfa in the valley as a whole (SAED, 1986), with the the overall level of indebtedness running at a higher level on larger perimeters, and constituted an underlying factor in the SAED withdrawal policy.

While the effects of SAED withdrawal are the main subject of this paper, these can only be understood in the context of evolving socioeconomic relationships within the rural communities using irrigation.

Irrigation and land tenure

In contrast with the largely ignored land reform legislation (Engelhard et al. 1986, p62; Diemer and van der Laan 1987, p153-4), the construction of irrigation infrastructure has been seen as effecting an irreversible transfer of tenure from the land's traditional users to the members of the irrigation group. As a result traditional landholders resisted irrigation construction, particularly in the middle valley, on the low-lying "cuvettes" used for flood-recession farming.

Diemer and van der Laan (1987, pp139-141) argue that in the Halpulaar villages of the middle valley access to irrigated plots is more egalitarian than traditional land tenure, because socially disadvantaged castes descended from slaves, who had no traditional land rights, have access to irrigation comparable to that of descendents of slave-owning castes. However, domination of irrigation associations by older male heads of households has been followed by the development of separate village associations to improve access to irrigation for women (Gaudet,1988; Blijdorp,1987), and younger men (Engelhard et al.1986, p336). The latter, known as "foyers" have developed particularly in the delta, where emigration to seek wage work is less common than in the middle and upper valley, and, as a result, there is greater pressure among the youth of the delta to obtain access to irrigated land. Irrigated plots were originally allocated to heads of family groups organised in "cooperatives" of about 400 members. Since 1984, the cooperatives have been replaced by smaller units: the "sections villageoises" of 100-200 members, but tenure of individual plots has remained unchanged. Holdings are therefore concentrated in the hands of older men, who make up the membership of the Sections Villageoises, providing younger men little scope for cultivation other than on their older relatives' land. The first foyer, aimed at providing independent access to irrigated farming for young people was established at Ronkh in 1972, and this provided the lead for many others throughout the delta, which are now loosely affiliated to an umbrella association, "l'Amicale des Agriculteurs de Walo". The foyers have attracted support from foreign development agencies, particularly NGOs, which has assisted them in setting up in the delta small-scale irrigation using small diesel pumpsets as in the PIVs of the middle and upper valley.

One of the objectives of disengagement by SAED was to reduce obstacles to private investment in irrigated farming. Since 1984 such investment has been made possible through the allocation of land in the delta (by rural councils) to wealthy individuals, and to associations of farmers (Groupements d'Intérêt Economique). In the three cases visited on the Grand Digue-Tellel-Kassak perimeter, the formation of a GIE to run small-scale irrigation was a means whereby wealthier members of the Section Villageoise provided access to irrigated land for their less wealthy or landless relatives.As in the case of the foyers, these investments in irrigation have taken the form of "PIVs" irrigated by small diesel pumpsets.

Water management and equity

A common feature of large-scale irrigation perimeters is that the large pumping stations aim to keep the water level in the principal canals at a constant level during the crop growing season. At this level the system design allows water to be drawn simultaneously into all parts (termed "modules") of the secondary system. Within each module (area 20-70ha) the water is insufficient to irrigate the whole area simultaneously, and delivery of water to each tertiary canal must be rotated. This rotation of water is the responsibility of a Section Villageoise, which may cover one or several modules. The distribution of water to different plots from the tertiary canals is organised by the "groupements". One groupment is usually responsible for a single tertiary canal, which will irrigate an area of 15-20ha, known as a "maille hydraulique".

In this design the responsibility for the organisation of distribution of water between farmers rests with the farmers' organisations: the Section Villageois and the groupement. The water-management responsibility of the main system managers (in this case SAED) lies only in starting up the pumps at the beginning of the growing season and shutting them down at the end, and maintaining pump operation to keep the canal filled in the interim. Water management by farmers on large-scale schemes is similar to that on PIVs, except that on the latter farmers also control the pumping system. However, whereas on PIVs the organisation of water distribution is integral to the operation of the PIV, this is not always the case on large-scale schemes in the delta, where farmers readily identify groupements which have agreed a sequence for irrigating individual plots, and those which have not.

Where irrigation of plots has been organised according to an agreed rotation, the usual system, noted by Diemer and van der Laan (1987, p133) on PIVs of the middle valley, is that the irrigation schedule stipulates only the sequence in which individuals can take water, not the quantity or duration. Thus, each irrigator takes as much water as he wishes, before giving way to the individual next in the sequence. Diemer and van der Laan (1987) state that on PIVs this system provides a very equitable distribution of water between participants . However, interviews with farmers on large perimeters suggest that the system can give rise to serious inequity of access, particularly at the start of the growing season, if those at the rear of the sequence have to wait a long time for their turn. On the perimeter of Nianga, a delay of two weeks to a month was said to occur in completion of a complete cycle of irrigation. A delay of this magnitude at sowing time could easily reduce the potential yield of the crop. One reason given for such a delay was lack of maintenance of the tertiary canal system, which reduced flow rates and increased the time required to apply a given amount of water to the fields.

2.The Disengagement of SAED

The programme

The new agricultural policy, announced in 1984, stated that the SAED would begin a programme to terminate its activities over a period of five years in order that these be taken over by "private operaters and peasant organisations" (Afrique Agriculture, 1986,p27). The process was to be effected in stages. In the first stage, from 1984 to 1987, SAED was to withdraw from the provision of credit, the supply of inputs, and rice marketing. Preparations would be made to withdraw, in a subsequent phase from the operation of the rice mills, machinery repair and maintenance, and from the operation and maintenance of the primary infrastructure on the large canal systems. A first step in these preparations was the formation of four autonomous management units to run these continuing SAED activities until they could be handed over to commercial operaters. These units were: URIC to run the rice mills, UAC to run the central machinery workshops at Ross Bethio, UGE to manage the water supply to the large perimeters, and UARE to carry out maintenance on existing irrigation infrastructure and to to carry out new irrigation works. The last two were also based at Ross Bethio, in the middle of the delta area where the majority of large perimeters are situated.

Of the functions from which SAED was to withdraw immediately, agricultural credit was to be taken over by the Caisse National de Crédit Agricole de Sénégal (CNCAS), a mixed state and commercial bank set up in 1984. The supply of fertilizers and pesticides, together with the provision of agricultural machinery was to be undertaken by commercial enterprises. Marketing of paddy was to be the responsibility of the Sections Villageoises (SV), SAED merely paying for paddy delivered to the rice mills. The remainder of this section summarises the implementation of this SAED withdrawal.

Credit

Although CNCAS was established in 1984, it was not until 1986 that a protocol was signed between CNCAS and SAED establishing the conditions for farm credit in the Senegal river valley. In the meantime SAED resorted to increasingly drastic efforts to recuperate accumulated debts from peasants on large-scale perimeters, culminating in the refusal to supply water and the effective closure of over 5500ha of the irrigation system in 1986 (Dieye,1988; SAED,1986,p7; OMVS 1987,pp4,21). The rainy season of 1987 was the first in which CNCAS credit was used to finance input purchases, with a total of 110 million cfa[1] credit extended to creditworthy farmers' groups in the delta . The loans for the 1987-88 agricultural year were all repaid in full, and in the following year, 1988-89, a total of 550 million cfa was advanced in credit for the rice crop, of which 126 million was to farmers in the middle valley, through CNCAS branches opened in Podor and Matam, and 424 million for farmers in the delta. Analysis of credit notes used to pay suppliers of goods and services (who later cash these at CNCAS), indicate that about 75% of the credit agreed by CNCAS with farmers organisations in the delta was actually used, and that about 40% of this was used to pay for machinery hire, 45% for fertilizer, and the remainder for herbicide.

The terms of CNCAS credit are that, firstly the borrower must deposit 15% of the value of the loan, secondly that interest is paid at 14% on the loan, and thirdly that farmers organisations are collectively responsible for repayment. This last condition means that it is up to each organisation to recoup debts from its individual members. Under the protocol agreed between SAED and CNCAS, all applications for CNCAS credit must first be checked by the local SAED delegate and must carry written SAED approval. Given the large number of organisations with debt repayments in arrears with SAED, the CNCAS loans have frequently been granted on the condition that outstanding debts to SAED be repaid over a 3-year period.

As indicated above, CNCAS credit plays a larger role in financing input purchase in the delta than in the middle and upper valley. This is for a number of reasons. Firstly, following the announcement of SAED withdrawal, a number of foreign development agencies involved in the construction and management of irrigation in the middle valley (e.g. FED in Podor, KFW in Nianga, Netherlands government in Ile à Morphil) financed the provision of a fund of working capital for each farmers irrigation group within their project area, thus reducing the need for CNCAS credit in some areas. Secondly, alternative income sources, from livestock sales and from non-farm (often migrant wage income) sources had previously played a significant role in financing input purchases, so that withdrawal of SAED credit was less important. Thirdly, mechanised tillage is not generally used on PIVs so that direct production costs are lower. Finally, on small-scale perimeters payments were often spread throughout the growing season because inputs were only purchased when they were needed. Withdrawal

1 Note: 50 CFA francs = 1 French franc
310 CFA francs = 1 US dollar. (1989 exchange rates)

of SAED from the supply of inputs such as fuel and fertilizer seems likely to make credit more important, however, because although commercial suppliers may have facilities for storing fuel (where they also sell to transport operators, for example), it is unlikely that they will do so for fertilizer. Van Tilberg (1989) noted that grain traders in Senegal never make purchases in order to keep grain in store, and the experience of the 1988-89 season in the Senegal river valley suggests that this is largely true of traders in fertilizer (see below). Absence of local fertilizer stocks will mean that farmers' irrigation groups must order all their inputs from traders in advance, tying up more cash for the whole growing season. However, long lines of communication between the CNCAS in St Louis and the villages of the middle valley have caused delays in the release of credit. At least one village irrigation group contacted, that of Boké Mbaibé and Salsalbé, had, as a result of delays in CNCAS credit, sought and obtained an alternative source of working capital by negotiating to use cash deposits made under the world food programme (nominally reserved for capital investment projects) for this purpose. However, not all farmers in the village were prepared to accept the risk of paying for a whole season's fuel and fertilizer in advance, and only 10ha out of the total perimeter area of 18ha was to be cultivated. This highlights the important point that the withdrawal of SAED has shifted the burden of risk decisively onto farmers. It may also be noted that, since traders supply no goods on credit, the CNCAS loans paid for (in the form of interest) by farmers effectively increase traders' sales at no cost and risk to traders themselves.

Agrochemical Supplies

Following the initial announcement, in 1984, of its withdrawal from the supply of inputs, SAED decided to stop supplying pesticides immediately, as an "experiment" to assess the capacity of commercial suppliers and farmers to take over. The result was a collapse in pesticide use with serious reduction in yields, particularly in the tomato crop in 1985-86 (SAED, 1986). The following year SAED began supplying pesticides again, and continued to do so until the 1988 rainy season, which was the first occasion on which fertilizer and pesticides were supplied by commercial enterprises.

Fertilizers used in the principal (rice) crop in the Senegal river valley are urea (46% nitrogen) and diammonium phosphate (DAP: 18% nitrogen, 46%P2O5). DAP is manufactured by SENCHIM in Senegal, and imports are not permitted. Urea is imported, in theory by any organisation which wishes to do so. In practice SENCHIM is the only organisation that imported urea for the 1988-89 agricultural year. Interviews with the SENCHIM management in Dakar indicated that the annual fertilizer consumption of the Senegal river valley, excluding the sugar estate at Richard-Toll, was 6500tonnes, a figure they consider less sensitive to changes in fertilizer prices than the consumption of fertilizer within the country as a whole. A question frequently posed is whether the withdrawal of SAED would significantly reduce the amount of fertilizer applied by farmers, with negative effects on rice yields. The available evidence suggests that this has not happened in general terms. SENCHIM records indicate a total of 3450tonnes of SAED stock outstanding at the beginning of the 1988 rainy season, which are believed to have been sold, and a further 3375tonnes sold to traders supplying the valley, giving an overall total of 6825tonnes for the 1988-89 agricultural year. At the level of individual farmers or their organisations a more variable pattern can be discerned, in which fertilizer rates applied appear to depend on farmers' assessment of the other constraints on crop growth. Thus, where growing conditions are good (e.g SV Thilene, in the Lampsar perimeter) fertilizer rates are above those recommended, but where irrigation is problematic, as in the case of the SV Tellel Peuhl who occupy land at the tailend of the Grand Digue-Tellel-Kassak perimeter, fertiliser use is less than half that recommended, and in individual cases is zero.

As in the case of credit, fertilizer supply differed markedly between the delta and the middle and upper valley. In the delta, fertiliser availability does not seem to have been a problem for farmers growing the 1988 rainy season rice crop. The concentration of large-scale irrigation and the relatively short road distance (300km) to

Dakar, presents traders with a good prospect of finding buyers for large consignments of fertilizers. In the middle valley, however, irrigated perimeters are small and dispersed, and access is limited by bad roads which may become impassible during the rainy season. Under these conditions few traders are interested in supplying fertiliser to individual villages, and in the Ile à Morphil, for example, the local SAED administration had to intervene to secure fertilizer supplies in the 1988 rainy season. It did this by organising contacts between suppliers and village irrigation groups, and by maintaining a local stock of 100tonnes of urea for cash sale to irrigation groups in the Ile a Morphil area. This is considered a short-term stop gap, however, and the Ile a Morphil SAED director feels that in future individual PIVs will need to combine their fertilizer orders and delivery points in order to make the deal sufficiently attractive to traders.

Machinery Use

Mechanised tillage has always been practised on the large perimeters of the delta. In the middle valley farm machinery has been less important because the small plot size (0,2-0,3ha) and the lighter texture of the "fondé" soils of the PIVs meant that hand cultivation is feasible. The larger plot size of the new "intermediate" perimeters now coming into production at Dioumandou and SaldéWala makes it likely that the impact of mechanised tillage will soon be more widely felt in the middle valley, but the remarks that follow refer principally to the situation of the delta.

The withdrawal of SAED from the provision of agricultural machinery was implemented through two principal means. Firstly, the centralisation of all equipment operation and maintenance in the newly-formed Unité Atelier Central (UAC) at Ross Bethio to improve efficiency and to prepare for privatisation (SAED, 1986 p24); secondly a policy of reducing the work carried out by the tractor fleet in order to allow commercial tractor hire to take over. This latter policy was implemented by not carrying out repair work, but instead taking SAED tractors out of service when they required repair. In the 1988 rainy season UAC estimated that about 85% of tillage in the delta was undertaken by private tractor operators, which would correspond to about 10700ha. CNCAS credit notes indicate that about 60% of this was financed with CNCAS credit.

Although many individuals and organisations in the delta operate tractors, the bulk of the hiring is done by a few companies. One of these, SOGEC based in St Louis, operates a fleet of four tractors which were hired to cultivate a total of 3700ha for the 1988 rainy season. This corresponds to almost a third of the area cultivated in the delta. By comparison, SAED has some 30 tractors currently out of service awaiting repairs prior to transfer to the private sector. The precise form of such transfer was still under study in 1989, but two consequences of the present situation may be identified. Firstly the eventual re-entry into service of this equipment will have a major impact on the hire market, and, indeed, SOGEC managers stated that they were unwilling to expand their own fleet until the future of the SAED fleet had become clear. Secondly, the existing equipment for hire is extremely scarce, which makes it more difficult for farmers to carry out tillage at exactly the right time. Timing of tillage is critical because it must take place before the release of irrigation water into the main canals, usually timed for late July or early August (in previous years water pumping could only start when the river level started to rise at the beginning of the flood). Tillage carried out too early carries the risk of weed growth in the fields following early rains in July. Effectively, therefore, all tillage for the rainy season rice crop in the delta should be carried out in July. This, coupled with the shortage of tractors, has placed a strong emphasis on speed in tillage operations, and this has resulted in the abandoning of ploughing followed by harrowing in favour of a single pass with an offset disc harrow. Whether this has any detrimental effect on rice output is the subject of some discussion. Several of the farmers interviewed lamented that they would prefer to plough their fields, because, although twice as expensive (35000 cfa/ha instead of 17000 cfa/ha for a single offset pass), it would deal more effectively with perennial weeds, and in particular the "riz au rhizome" (Oryza longistaminata

A.Chev.et Roehr) which had become so bad that whole fields had been abandoned to it. Research by WARDA/ADRAO indicates that the offset harrow may in fact be quite effective in controlling this weed , but only if used twice, with an interval sufficiently long to allow the drying out of the rhizomes and their physical removal from the field (van Brandt, 1982). In short, a practice which requires considerable time and labour. Other farmers, notably in Thilene, pointed to another, more fundamental, factor causing weed infestation: reduced drainage. This results in greater moisture availability for weed growth outside the cropping season, and can keep the soil too wet for mechanised cultivation.

Until the SAED tractor fleet has been finally transferred to private hands, it will not be possible to see the final pattern of machinery use. Discussion within SAED centres on possible patterns of ownership and use of machinery, and a preferred option appears to be to equip the Sections Villageioses with their own machinery for hire to their own members, along the lines followed with some success for five years by the "Sections d'Utilisation de Machines Agricoles" (SUMA) on the Nianga perimeter (Podor). However, it is clear that irrigation and drainage conditions will have a major impact upon the efficiency of machinery use, and it is this aspect of SAED "disengagement" that I shall consider next.

Irrigation

Within the plans drawn up for SAED withdrawal, no timescale has been established for the transfer to the private sector of its management of the supply of irrigation water. Instead, the 3-year programme starting 1987 laid down that SAED should begin charging farmers the "true cost" of its services. Since the role of SAED in the supply of irrigation on large perimeters differs from that on PIVs, each case will be considered in turn. On the PIVs of the middle and upper valley SAED supplies maintenance spare parts for the diesel pumpsets which supply water from the river. Farmers' organisations pay for the cost of all parts and materials (oil, filters etc) but not for the mechanic's time. There is little sign of change in this policy.

On the large perimeters SAED has a more central role in water supply, with responsiblity for operation and maintenance of the large pumping stations and the main water distribution and drainage canals. For this service farmers pay a fixed charge each growing season, which was increased in 1985 from 25000cfa/ha to 41000cfa/ha for rice.This increase coincided with a reorganisation whereby the operation and maintenance of water supply on large perimeters, previously the responsibility of managers at perimeter level, became centralised at delegation level. In practice this only affected the large perimeters in the delta, as the two large perimeters in the middle valley, Nianga and Guedé, were allowed to retain their autonomy. In the delta a Unité de Gestion d'Eau (UGE) was formed, with two principle divisions based at Ross Bethio: "Gestion Hydraulique", responsible for planning water distribution and invoicing farmers; and "Exploitation", charged with operation and maintenance of the large (electric) pumping stations supplying the canal network, and with planning the annual programme of canal maintenance. However, the execution of canal maintenance was to be contracted out to another Unité based at Ross Bethio: l'Unité de la Régie d'Aménagement et d'Entretien (URAE), into which had been gathered all the canal maintenance equipment previously under the control of individual perimeter managements.

As with the formation of UAC, the centralisation of earthmoving machinery into a central URAE appears to have been motivated partly by a desire to improve the efficiency of equipment use and partly by the intention of forming a unit suitable for privatisation. However, whether through shortfalls in foreign funding due to a fall of the value of the dollar in 1985 (SAED,1986 p15), or to competing commitments to undertake construction of new irrigation, the outcome for canal maintenance appears to have been little short of disastrous, with weed growth so serious in the principle drains that farmers at Thilene (Lampsar) complained that their cultivable area was being reduced by waterlogging. The deterioration of drainage was felt particularely acutely in the 1988 rainy season because heavy rain increased the water to be drained. In the case of 400ha at Debi Mboundoum perimeter the fields were so waterlogged that the rice crop could not be harvested. Under these circumstances SAED acknowledges that it can hardly expect farmers to pay the "true cost" of canal maintenance - commonly given as 30000 cfa/ha in addition to the existing 41000 cfa/ha charge - which SAED is unable to guarantee will be carried out (SAED, 1986 p25).

Rice marketing

The major step taken in SAED withdrawal from crop marketing is to transfer to farmers the responsibility for loading and transport of paddy to the mills. SAED remains in charge of the three rice mills in the Senegal river valley, pending their refurbishment and transfer to the private sector. In principle SAED only buys rice delivered to the mills. However this is fully implemented only in the delta, where the farmers' organisations record the amounts marketed by individual members, put the paddy in sacks and hire transport to the mill. In the case of the PIVs in the middle valley, however, transport scarcity, and the relatively small quantities of paddy marketed by individual villages have meant that this element of SAED withdrawal has not been implemented. On the Ile a Morphil, for example SAED buys paddy in the villages, and undertakes the transport to the mills.

SAED purchases paddy for 85frs cfa/kg, payment being made 10-14 days later. This price, increased from 66frs cfa/kg in 1985, leaves practically no milling margin with the consumer price fixed at 130frs cfa in April 1988, and thus reduces the scope for purchases by commercial traders. This, together with prompt payment in recent years, has sharply increased the percentage of paddy marketed through SAED (see table 2). In earlier years, delays in SAED payments coupled with farmers' need to pay seasonal harvest labourers resulted in paddy sales to private traders for as little as 50 frs cfa/kg. SAED is able to pay the higher price for paddy because it receives 180frs cfa/kg for milled rice (38% above the consumer price) from the government Caisse de Péréquation et de Stabilisation des Prix (CPSP), which in turn finances its purchases from profits made on handling cheaper-priced imported rice.

Table 2 Rice production and marketing.

season	paddy production	marketed paddy (SAED)	
	tonnes	tonnes	as % of prodn.
1982/3	54300	20115	37
1983/4	75411	25520	34
1984/5	77188	15695	20
1985/6	80955	21973	27
1986/7	80799	18969	23
1987/8	85371	30686	36

source: section suivi et evaluation, SAED.
N.B. paddy production data are estimates from crop samples.

In this section I have set out briefly how the State development corporation SAED has carried out its withdrawal from the provision of agricultural inputs and services in the Senegal river valley, and some of the immediate effects. These may be summarised as follows. Where the process has advanced most, as in the provision of credit, agrochemicals supply and rice marketing, there has developed a discernable advantage in favour of the delta, where communications are better. In the middle valley, the privatisation process has not yet generated a commercial alternative to intervention by SAED or development agencies, particularly for the PIVs. Where state withdrawal has been less complete, as in farm machinery rental and in the operation and maintenance of irrigation, there is evidence that that the pre-privatisation reorganisation of SAED has resulted in a deterioration and greater scarcity of provision of these services. This is particularly apparent on large perimeters, where inequity in access to water and, to a lesser extent, machinery, can be seen to cause great disparity in agricultural productivity.

3. Irrigated farming in the aftermath of state disengagement.:

Effects on the organisation of irrigation

The disengagement of SAED has altered the organisation of irrigation in the Senegal river valley in two principle ways:

1. the expansion of a small-scale irrigation sector in the delta.

2. the creation of a commercial function for farmers' irrigation organisations.

The first of these is illustrated by table 3, which shows that while the area of large perimeters remained static between 1984 and 1988, small-scale irrigation was extended so that it now accounts for more than half of the total irrigated area on the southern bank of the Senegal river.

TABLE 3 Net irrigable area totals for different types of perimeter

(data from OMVS 1988)

year	1976	1980	1984	1987	1988
large perims	7083	9465	12577	12989	12940 ha
small perims (upper/middle valley)	352	3577	7271	11991	12783 ha
small perims (delta)	691	1191	2191	4315	5853 ha

Although the largest absolute increase in small-scale irrigation took place in the middle and upper valley, the fastest expansion rate (160% in four years) was in the delta, where small diesel pumpsets now irrigate an area corresponding to 45% of the total surface under large-scale irrigation. This development of small-scale irrigation in the delta is not state-funded, and hence corresponds to the outcome which the policy of state withdrawal intended. It is run by three different types of organisation, mentioned earlier: "foyers", "groupements d'intérêt économique" (GIE), and private farmers. Although referred to as "PIVs", small-scale perimeters in the delta differ from those of the middle valley in that plot sizes are larger, and cultivation is mechanised.

The role of irrigation infrastructure in establishing "irreversible" land tenure was noted earlier in the context competition for land between different elements of rural communities in the middle valley. It is possible to see that state disengagement, by encouraging the recent proliferation of small-scale irrigation in the delta, has launched a similar and accelerating struggle for land tenure in which wealthy individuals from urban areas are active.

We noted in the previous section that SAED withdrawal has had the consequence that farmers' irrigation organisations must negotiate for credit and input deliveries and must organise the transport and sale of the crop. This has in some ways promoted collaboration between different irrigation groups. In villages in the delta, for example, many younger people participating in new irrigation through foyers or GIE are members of families which have plots in large perimeters. Therefore, a multiplicity of irrigation organisations may exist within a single village. The example of the village of Thilene may illustrate this. The village has a Section Villageoise with 66 members, organised in six groupements, with rights to farm 105ha of irrigated land within the (large-scale) Lampsar perimeter run by SAED. The village youth association (foyer), formed in 1976, acquired a perimeter of 20ha, irrigated with a diesel pumpset and with infrastructure constructed with SAED assistance in 1981. This was subsequently extended to 30ha and farming diversified to include tree plantations, bananas and market gardening, as well as rice production. Two years ago the SV and the Foyer both invested in another small perimeter of 35ha, on which 32 participants occupied plots of 0,5-1ha each to grow rice in the 1988 dry season. Significantly, the arrangements for credit (with CNCAS), input supply (with traders), and rice marketing (with SAED) are formally handled for all three irrigation organisations in Thilene village by the Section Villageoise, although the "peseur" - charged with keeping records of all purchases and sales by individual members - is in fact a member of the foyer. In this case the small-scale irrigation may be thought of as constituting additional autonomous "groupements" which, like the six groupements on the large-scale perimeter, uses a single village-level entity (the Section) to administer commercial transactions.

While such a close link between large-scale and small-scale irrigation may not exist in all other villages, the emergence of such an organisation suggests that to the logic of organisation for water management the disengagement of SAED has added a logic of organisation to meet financial objectives. Thus, a distinction is emerging on large perimeters of the delta area between the "groupement", concerned primarily with irrigation management on areas of 15-30ha, and the "section", concerned with administering the commercial activities of farmers at village level, thus embracing several groupements. A further development along the same lines is the SUMA experience on the Nianga (Podor) perimeter, where the section also has responsibility for operating and hiring agricultural machinery. The separation within farmers' organisations of day-to-day irrigation management from input supply and crop marketing finds echoes in developments in the middle and upper valley: in the regional federation of irrigation groups in the Bakel area, and in the proposal by SAED director on the Ile à Morphil that villages should collaborate in groups of 10-15 to improve their bargaining power with traders and transporters over the supply of inputs and the marketing of paddy. Evidently, such collaboration between villages will be more difficult than the administration of the same activities within a single village, but, given the lack of interest on the part of traders, there may be no alternative if input supplies are to be secured in that area.

While commercial pressures resulting from disengagement have promoted closer collaboration between irrigation groups, there is also evidence that, at another level,they may open the way for greater differentiation among farmers. We have seen earlier that present systems of distribution of water within the groupement do not ensure equity, to the extent that it is not uncommon for members of a groupement on either large or small perimeters to lose their crop entirely because of inequitable water distribution within the groupement. Data on production costs and paddy yields for individual holdings on large perimeters in the 1988 rainy season, given in table 4, suggest that, even where farmers do not lose their crop, yields may often be too low to repay production costs.

Table 4. Breakdown of direct cash costs of production of irrigated rice in four different Sections Villageoises on
large perimeters in the Senegal river valley, 1988 rainy season.

Section Villageoise	Cost Breakdown: CFA Francs/hectare							Yield (paddy)		
	water	agrochem	machin.	seed	harvest	interest	Total	kg/ha	value	Costs as % of yield value
Tellel-Peuhl II										
(Grande Digue-Tellel-Kassak Perim.)										
mean (of 5)	41000	9901	20600	9838	15624	0	96963	2171	184595	52
highest	41000	11550	35000	12390	34500	0	134440	3995	339575	39
lowest	*41000*	*13083*	*17000*	*9916*	*2666*	*0*	*83666*	*566*	*48166*	*173*
Diagambal										
(Lampsar Perimeter)										
mean (of 5)	*41000*	*45870*	*17000*	*20032*	*15187*	*7076*	*146166*	*2678*	*227696*	*64*
highest	41000	61425	0	14160	42420	7309	166314	4000	340000	48
lowest	41000	20270	17000	21048	1655	4435	105409	804	68344	154
Thilene										
(Lampsar Perimeter)										
mean (of 6)	41000	41959	17000	14191	53843	7148	175143	4202	357200	49
highest	41000	59726	17000	21013	45000	9130	192870	6636	564143	34
lowest	41000	29295	17000	10170	16666	5509	119641	1525	129679	92

With the advent of collective reponsibility for loan repayment, such inequity in irrigation is translated into indebtedness of disadvantaged farmers towards other members of the section. Failure to pay these debts can and does result in the debtors' loss of cultivation rights, which are generally taken over by somebody prepared to pay off the outstanding debt. The question of whether such a process is leading to the accumulation of cultivation rights in the hands of fewer landholders requires further detailed study. It is evident that reduced availability of both land and water caused by the deterioration of main canals on large perimeters in the delta, reported above to have resulted from the SAED reorganisation associated with disengagement, increases the likelihood of farmers obtaining such low yields and accumulating debts.

In the middle valley, lower levels of purchased inputs used in rice production on PIVs means that production costs are lower. Moreover, the more diversified income base of farmers has allowed them to meet the costs of failed crops, particularly from livestock sales (see below). We may note, however, that a move towards larger cultivated surfaces requiring mechanisation, through the construction of "intermediate" perimeters will tend to reproduce the problems experienced in the delta. The costs of mechanised paddy production on the new small-scale perimeters in the delta were found to be the same as those on neighbouring large-scale schemes.

Effects on the productivity of irrigation infrastructure

Table 5 compares the irrigable area and the area cultivated for rice production in the agricultural years beginning July 1984 and July 1987.

TABLE 5 Irrigable area and area sown with rice in 1984 and 1987, Senegal river valley, left (Senegalese) bank.

agricultural year, starting July:	1984	1987
total irrigable (ha)	21973	29295
area sown in rainy season	16959	13883
area sown in hot dry season	465	3852
Total rice area	17425	17735
rice area as % of irrigable area	79%	60%

(source: OMVS and SAED)

It shows that rice area has remained static, and this underlies the relatively small (10%) increase in rice production over the period (see table 3). Not only is rice area declining as a proportion of irrigable area, but it is increasingly distributed over the two growing seasons. The major redistribution of rice growing from rainy season to dry season is the direct consequence of the completion of the Manantali dam, which, together with the barrage at Diama, now ensures a year-round supply of fresh water for irrigation in the delta. This shift in cultivation shows farmers on large schemes in the delta following a pattern of farming apparent several years earlier on the PIVs of the upper and middle valley, where dry season irrigation has always been less restricted than in the delta (cf table 1). To illustrate this land use pattern more clearly, table 6 sets out the cropping history on two large perimeters visited in 1989, for the previous three seasons.

TABLE 6 Proportion of land cultivated in three successive seasons in different irrigation perimeters, Senegal river valley.

season		cool dry	hot dry	rainy	total
starting month		nov.87	mar 88	july 88	
perimeter	net irrigable	% cultivated, and crop			
SV Diagambal (Lampsar)	350ha	11% tomato	55% rice	27% rice	93%
Guedé	343ha	44% tomato	16% rice	43% rice	103%

The irrigable land is fairly completely used, but is not all cultivated at the same time. Instead, part of the area is cultivated each season. It is important to note that this multi-season farming does *not* correspond to the double cropping (two crops per year from the same land) which the year-round provision of irrigation was intended to promote.

Bastiaansen (1988 pp13-14) links the decline in intensity of land use on PIVs in the Ile à Morphil to the increase in price of inputs in the early 1980s, which he feels was a disincentive to produce rice and which encouraged farmers to grow a cheaper (but less productive) crop of maize, particularly on lighter soils. Against this, it may be said that there is reason to believe that farmers in the middle valley are interested in maize and sorghum not only because they are cheaper to grow, but also because they provide better livestock fodder than rice straw. Dry-season livestock fodder is valuable: farmers in Dioudé Diabé (Ile à Morphil) claimed that the sale of a single sheep could pay the pumping and fertilizer costs of growing rice on a 0,2ha plot on their PIVs.

It is true that production costs have increased but that is principally due to the removal of subsidies on agrochemicals in 1984. There is little evidence that disengagement itself has resulted in higher prices for inputs relative to the price of paddy.

The appearance in the delta of the system of subdividing the land for cultivation in different seasons indicates a more fundamental factor blocking the double cropping of land. The problem is that if two rice crops are to be grown, the available rice varieties and seasonal temperature constraints dictate that the dry season crop (sown March) must be harvested in less than a month to allow sowing of the rainy season crop in July. To achieve this, farmers need both a high level of mechanisation and close control of irrigation and drainage of their fields. We have seen that it is in these areas that SAED disengagement has been accompanied by a deterioration of services.

4. Issues in irrigation design

Repayment of infrastructure costs

An obvious, but fundamental contradiction in the disengageme nt policy stems from the expectation that private investment by farmers, among others, would not only finance new irrigation infrastructure, but would also increase the rate of irrigation construction. In practice, where farmers have invested in new irrigation, by constructing small-scale schemes in the delta, the rapid rate of construction has been achieved by using rudimentary design, often consisting of little more than earth canals and dykes. While construction has been cheap, repairs to earthworks at the start of each season are costly. The lesson to be drawn is that, if farmers are to pay for the irrigation infrastructure, then funding must form part of the design. In particular, the question of spreading capital investment costs over a long period may need to be incorporated in perimeter design, possibly through modular expansion or development of the infrastucture in a number of phases, with cultivation being possible from the first phase onwards.

Labour and mechanisation implications of plot sizes.

The evidence obtained in this study suggests that, in the delta, labour and machinery shortages act as a barrier to growing two successive rice crops in the nine-month period (March-November) allowed by temperature. This constraint is not one of cost, but of time: within the same irrigation unit all fields must be drained, harvested and tilled for the next crop within a month. An alternative to seeking greater labour or machinery input to complete the work on irrigation units with large surface area would be to design a larger number of smaller irrigation units, so that planting dates of individual units could be more uniformly spread over the available growing period. On large perimeters, this would imply splitting individual farmer's holdings of, say, 1 ha into a series of small plots of perhaps 0.25ha distributed over four blocks capable of being irrigated (and drained) independently of one another. All four blocks would be managed by the same groupement, each of whose members would have access to plots in each block.

This system would essentially formalise existing practice, but would, however, have the advantage of offering an opportunity for progressive intensification by allowing farmers to double-crop their earlier-sown plots, even if they cannot double crop all of their area, using the existing availability of labour and machinery.

It may be argued that such a system already exists in the middle valley where villages have access to more than one PIV, and that no intensification of cropping has resulted. However, in the middle valley, more crop options are available than on the saline delta soils and questions that need to be studied in relation to double-cropping are the impact of mechanisation, particularly of tillage, and the *margins* (not only output) that farmers obtain by using irrigation for livestock fodder or for crops other than rice.

Equity in water distribution on large perimeters.

The evidence obtained in this study suggests that farmers are better at competing for resources as members of a group than as individuals competing against other members of the same group. If this is the case, then water distribution would be more equitable if the present system - simultaneous access to water by groups coupled with sequential access for individual group members - were replaced by a system of sequential access for groups coupled with simultaneous access for members within a given group. Aside from the infrastructure cost implications, such a system would require a greater managerial input on the 'main system' in order to switch water from one group to another. This could be the responsibility of farmers' organisations, possibly at "section" level. Inequity of water distribution between groups and between individual plots in such a system would be more clearly identified with the performance of specific elements of design, and could therefore present fewer risks for socially disadvantaged farmers than the present system.

State disengagement from irrigation maintenance

The absence of clear plans for the withdrawal of SAED from irrigation maintenance activities leaves open the question of what kind of organisations might replace it. Three principal maintenance areas can be identified: large pumping stations, diesel pumpsets, and canal systems. Maintenance work is an intermittant intensive activity, often carried out once a season. Although it is conceivable that farmers' irrigation organisations will develop the capability to carry out routine maintenance, such as servicing pumpsets, a need for specialist technical skills or very large labour/machinery use in some pump and canal maintenance tasks suggests an opening for "service enterprises" in irrigation maintenance, particularly on large perimeters.

Such enterprises could run repair workshops for pumps, operate earth-moving or dredging equipment, or employ gangs of labourers. These enterprises, which would be paid by farmers' organisations to carry out specific work, would need to be locally-distributed, particularly in order to undertake canal maintenance. This latter point implies the reverse of the privatisation of the SAED maintenance unit as a single large company.

Coordination of irrigation and design

The proliferation of cheap, but rudimentary, small-scale irrigation in the delta highlights a need for a body with an overall regulatory function in irrigation management. When situated on the periphery of large perimeters whose own drainage system has deteriorated, small perimeters whose construction excludes any provision for drainage must assuredly increase the risks of secondary salinisation of the saline delta soils. Avoidance of this risk requires both a regulatory body to enforce adequate drainage measures, and engineers with the necessary skills and experience to advise farmers' organisations on irrigation design. The plans for the withdrawal of SAED as yet have no concrete proposals on this last point. Moreover, since it is difficult to see how such regulatory functions could be carried out by a commercial enterprise, it is unlikely that the state disengagement from irrigation can ever be complete.

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1 Introduction

Il est bien connu que dans les pays en voie de développement l'approvisionnement des intrants et la commercialisation des produits recoltés des aménagements hydro-agricoles donnent souvent des problèmes. Par exemple, les intrants sont de mauvaise qualité ou ne sont pas disponibles au temps désiré, des pièces de réchange ou des matériaux tels que combustibles et ciment manquent, l'infrastructure est mauvaise ou les prix sont bas et instables.

Dans la conception des aménagements, l'aspect de l'utilisation et de la commercialisation des produits récoltés est le plus souvent ignoré. Le but de cette contribution est d'analyser à quelle mesure une approche de la perspective du marketing peut contribuer à l'amélioration de la conception viable des aménagements hydro-agricoles paysans et à l'adaption des périmètres déjà aménagés.

Dans cette communication on se concerne notamment du choix entre la production destinée à l'autoconsommation et la production destinée au marché, le choix de la spéculation, et le choix d'une stratégie de marketing. Deux études de cas seront décrit au point de vue de marketing; il s'agit des périmètres irrigués du riz et des jardins potager du projet Ile à Morphil dans la Vallée du fleuve Sénégal. Dans la dernière section on réfléchit sur les leçons qui peuvent être tirées de cettes études de cas pour la conception d'aménagements hydro-agricoles.
Cette contribution vise à stimuler la discussion sur ce sujet.

La conclusion de cette contribution est que la viabilité des systèmes d'irrigation à l'Ile à Morphil depend de la capacité des paysan(ne)s de vendre une partie des produits recoltés. Le marketing peut contribuer à la recherche sur les possibilités et les restrictions existant pour la production destinée au marché. Desormais, il n'implique pas des exiges spécifiques par rapport au plan des périmètres.

2 Vers une production destinée au marché.

2.1 Le choix entre l'autoconsommation et la commercialisation.

L'introduction d'une aménagement hydro-agricole a des conséquences importantes pour le "farming-system". Les paysan(ne)s ont besoin de l'argent afin de payer le gasoil, les pièces de rechange, les réparations et la maintenance des motopompes. Afin que le système soit rendable, il faut une méthode de l'agriculture plus intensive, avec l'utilisation d'engrais, des produits phytosanitaires et des semences améliorés. Cependant, tous ces produits doivent être payés. Le financement peut être tirée des revenus des activités agricoles et non-agricoles, des transfers de l'argent (des envoies par des migrants), et de la commercialisation d'une partie de la récolte.

La production pour le marché implique des risques diverses pour les paysan(ne)s. Le niveau des prix au marché est incertain et les "rates of return" des produits agricoles montrent une tendance baissante. Quand, par conséquent des raisons indiquées ci-dessus, le cycle de réproduction devient dépendant de la commercialisation des produits récoltés, les prix baissants et les récoltes temperées peuvent résulter en une situation où les paysan(ne)s ne sont pas capables à rembourser leur crédit de production, ce que peut initier une spirale de dette (Bernstein, 1979).
Au niveau de ménage, le changement vers une production partiellement destinée au marché peut fortifier les relations de pouvoir inégales. Malgré le fait que souvent les femmes contribuent considérablement à la production, ce sont le plus souvent les hommes qui obtiennent le pouvoir sur les revenus des ventes de la production. Dépendant des responsibilités des hommes, ils appliqueront les revenus en faveur du ménage ou pas. En cas que l'homme n'est pas le co-responsable de l'approvisionnement alimentaire, les conséquences négatives pour la sécurité alimentaire sont à craindre, surtout quand une

culture de rente est introduit au périmètre.

2.2 Les conditions pour une production destinée au marchè.

Au ébauchement d'une aménagement hydro-agricole, il faut se demander les questions suivantes par rapport à une production eventuelle pour le marché:

A. Quelle est la relation désirée entre la production pour l'autoconsommation et celle pour la vente? Qu'est-ce que veulent les paysans et paysannes eux-mêmes?

B. A quel égard la vente des produits au marché est nécessaire? Est-ce qu'il existe des alternatives pour financier les frais de production? Quelle est la sécurité de cettes sources monétaires alternatives à court et à longue terme? Est-ce que cettes sources monétaires sont accessibles pour tout le monde?

C. A quel égard la production pour le marché est-elle faisable?
Afin de répondre à cette question, on peut suivre une "checklist" comme suit.

I Quels sont les aspects forts et faibles des producteurs/-trices par rapport à:
   a. la connaissance et l'expérience de la culture,
   b. le degré de l'expérience et de l'organisation par rapport à la commercialisation des produits,
   c. La disponibilité de main-d'oeuvre et de capital

II Quelles sont les chances et les menaces qui proviennent de l'environnement, quant à:
   a. les besoins de consommateurs potentiels,
   b. les régions de production concurrents,
   c. les mésures et autres interventions gouvermentales,
   d. les développements dans le canal de distribution?

Remarque à C.: si la production pour le marché est faisable, dépend evidemment en plus du choix des spéculations et des marchés où on vend ses produits. Ainsi, il faut également ajouter deux autres questions (voir D.).

D. Quels produits ont des chances potentiels et quels sont les marchés eventuels à écouler ces produits?

E. A quel égard les producents sont capables d'appliquer les instruments de marketing (-produit-prix-distribution-promotion-) de cette façon, qu'ils peuvent obtenir un contingent de marchande avec leur produits sur les marchés désirés?

Le processus d'ébauchement devrai être dirigé par les réponses sur les questions énumerées ci-dessus.
La suite de ce paragraphe traite la question D, c'est à dire le choix des spéculations et de la stratégie de marketing, d'un point de vue de marketing.

2.3 Le choix des cultures

L'approche de marketing départ des besoins des consommateurs. On en peut distinguer deux situations dépendant de la destination des produits: l'autoconsommation ou la vente. En les deux cas il faut qu'une analyse de désirs des consommateurs dirige les décisions de l'aménagist et de l'agriculteur sur les cultures qui seront produites.

Les acteurs qui ont l'intention d'aménager un territoire ou un périmètre peuvent rencontrer quatre situations selon les conditions de la perspective du marketing et celle-ci des conditions physiques (Tableau 1).

On espère à atteindre la situation optimale (A) où les opportunités physiques coincident avec les opportunités pour les produits désirés par les consommateurs. La situation C où l'écologie est bien apte à la cultivation des certains produits mais où ces produits ne sont pas (encore) désirées par les consommateurs implique un risque. C'est difficile d'influencer les attitudes et les besoins des consommateurs telles qu'ils apprennent apprécier les (nouveaux) produits. Un tel changement prend souvent beaucoup de temps. Dans le cas B où les conditions de croissance ne sont pas favorables pour une certaine culture, mais au même temps le produit est bien désiré par les consommateurs, il faut que l'on étudie et compare les prix coûtant des cultures avec les prix au marché. Dans le situation D le projet n'est pas viable.

Tableau 1 Performance de l'aménagement hydro-agricole d'une perspective de marketing et de l'écologie

		La culture choisie sera-t-elle adapté optimal aux conditions physiques? Oui	Non
La culture est désirée par des consommateurs?	Oui	A Situation optimale	B Prix coûtant des produits peut être trop élevé
	Non	C Possibilité de changer les besoins des consommateurs?	D Projet pas viable

Par une analyse à base des critères mentionnés ci-dessus, les besoins des consommateurs et les conditions physiques, résultent quelques produits potentiels/promettants. Il faut chercher des possibilités d'écoulement sur les marchés différents. Cet aspect sera traité en 2.4.

2.4 Le choix de stratégie de marketing: la combinaison produit - marché

Les opportunités des paysans d'écouler les produits potentielles peuvent être clarifiés avec le matrix des stratégies de marketing d'Ansoff (Tableau 2).

Ansoff a proposé une stratégie de marketing pour les quatre combinaisons suivantes: un produit actuel ou nouveau, et un marché actuel ou nouveau (Tableau 2). La stratégie A est la moins dificile: on produit plus pour un marché bien connu. La stratégie D où on change de produit aussi bien que de marché, est la plus difficile à réaliser. La statégie C de cultiver des cultures traditionelles pour les marchés inconnues, et la stratégie B de cultiver les nouveaux produits pour le marché actuel, seront également dificile à réaliser. En général on recommende à considérer d'abord la stratégie A, après on considère la stratégie B ou C.

Tableau 2 Matrix avec les stratégies de marketing d'Ansoff

	Le produit actuel	Un produit nouveau
Le marché actuel	A Pénétration au marché actuel	B Développement des nouveaux produits
Un autre marché	C Développement d'un nouveau marché	D Diversification

Il y a des méthodes diverses pour faire un choix des marchés potentiels, notamment à base d'une analyse des marchés ou à base des critères mentionnées en 2.2: les objectifs des producteurs (A), l'analyse de la vigueur et la faiblesse des producteurs (BI), l'analyse des opportunités et des restrictions externes (BII), et une "analyse B/C". Souvent la distribution (l'infrastructure, les facilités de transport, la distance et les frais) constitue une restriction serieuse.

3 L'étude de cas: l'agriculture irriguée et le marché.

3.1 Le projet PIV Ile á Morphil, une introduction.

Le projet "PIV Ile á Morphil" est crée en 1977 sur la base d'une coopération étroite entre le Sénégal (MDR/SAED*) et les Pays Bas (DGIS, LUW). L'objective du projet était d'améliorer la sécurité alimentaire de la population locale.

Le projet est situé dans la Vallée du fleuve Sénégal. La région d'intervention englobe 29 villages. L'ethnie la plus importante est l'Halpulaar. L'agriculture traditionelle est dirigé vers l'autoconsommation. Les rendements de l'agriculture pluviale sont faibles (en moyenne 180 mm. précipitation par année) et les rendements de l'agriculture de décrue sont très aléatoires. La migration est la source la plus importante des revenues monétaires. On estime que 25% de la population est migré, dont 95% des hommes (Hadj, 1988/'89).

Les actions du projet "PIV Ile à Morphil" portent sur l'aménagement des périmètres irrigués villageois (PIV) destinés á la culture du riz et du mais. Ces périmètres ont une superficie moyenne de 20 ha. Les rendements obtenus avec la riziculture sont de l'ordre de 4 tonnes/hectare. L'intensité culturale est faible, de l'ordre de 0.8 à 0.9. Les exploitants sont organisés dans les groupements de 60 à 200 participants. Les groupements gèrent leurs périmètres eux-mêmes. (MDR/SAED/DGIS,1988)

Pendant la troisieme phase du projet (1985-1988) une autre objectif est ajouté, notamment la contribution du projet au développement rural integré. Pour cela les activités du projet sont étendues vers l'alphabétisation, l'introduction des fonds

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* Société d'Aménagement et d'Exploitation des terres du Delta du fleuve Sénégal et des vallées du fleuve Sénégal et de la Falème.

de roulement et la maraichage par les femmes.

Fin 1988 11 jardins, d'une superficie moyenne de 2 ha, sont realisés par le projet, le nombre de femmes qui y participent varie entre 80 et 326. Les femmes sont organisées en groupements par jardin. La plupart des jardins se composent de deux parties: une partie individuelle, irrigué par bassins où on remplie les arrosoirs, et une partie collective, irrigué par des canaux et/ou des raccords. La récolte de la partie collective est vendue locale pour alimenter la caisse commune du groupement. (Helsloot, 1988)

3.2 Le riz.

Ce paragraphe donne une description de la situation actuelle. A l'aide des questions posées dans le paragraphe 2.2, on répond à les besoins des producteurs de vendre une partie de leur récolte et la faisabilité et la nécessité de la production destinée au marché.

A La désirabilité de produire pour le marché.
La plupart des ménages qui cultivent du riz dans la zone d'intervention du projet, préfère de réserver leur riz pour l'autoconsommation.

B La nécessité de la vente des produits au marché.

Parce que l'objectif des paysans est la production du riz pour l'autoconsommation, la nécessité de la commercialisation de riz ce restreint au remboursement du crédit productif. Les frais de la campagne sont payés préférablement des autres revenus monétaires afin de réserver le riz pour la consommation. Le plus souvent ces frais sont remboursés avec l'argent des migrants. Pourtant les envois monétaires sont une source de révenues irrégulières et précaires, et pas tous les ménages se disposent de ces revenues migratoires. C'est pourquoi qu'une partie des ménages doit vendre leur paddy afin de payer leur frais de production. Pour cet objectif, 15% de la récolte dans la région d'intervention était vendu à la SAED en 1988.

C La viabilité de la production destiné au marché.
I Quels est la vigueur et la faiblesse des producteurs?

a. <u>L'expérience de la culture.</u>
Pourtant que le riz est une culture nouvelle dans la région et les paysans n'avaient aucune expérience ni avec la riziculture ni avec autres cultures irriguées, la riziculture ne pose pas beaucoup de problèmes. Un élément important dans ce développement est l'encadrement intensif par la SAED.

b. <u>L'expérience de marketing.</u>
Dans les marchés locaux on a toujours échangé les céréales traditionelles, comme le mil et le sorgho, contre les produits comme des poissons et du lait et de plus en plus contre l'argent. Aussi le riz est commercialisé sur ces canaux traditionnels. L'information du, et l'accès au, marché local n'était pas un problème. En plus il y a la possibilité de vendre la récolte de riz à la SAED, comme on verra plus tard.

c. <u>La main-d'oeuvre et le capital.</u>
La cultivation des céréales est par tradition l'affaire des hommes. La migration en masse des hommes de la région à provoqué un déficit de main-d'oeuvre masculin. Les femmes et les filles ont rempli cette pénurie de main-d'oeuvre.
Le capital pour le financement de la riziculture vient surtout de la migration et les envois migratoires. A défaut de possibilités d'inventissements plus productives, la population investisse de cette manière dans leur propre approvisionnement alimentaire.

II Quelles sont les chances et les menaces qui proviennent de l'environnement?

a. <u>Les besoins de consommateurs.</u>
La consommation de riz, aussi dans la Vallée du fleuve Sénégal de même que dans le Sénégal entier, s'augmente. La consommation

sénégalaise de riz par personne à augmenté avec 40 - 50% dans les dix années passées. Le riz est devenu un des plus importants de vivres de base. Dans la zone d'intervention en 1988 95% des ménages ont intégré le riz dans leur repas de midi (Martin 1987, Hadj 1988/89).

b. La concurrence.

La plupart de l'offre de riz en Sénégal provient d'importations (70 - 80%). A peu près deux-tiers du riz cultivé au Sénégal est l'origine de la Vallée du fleuve Sénégal (Hoogervorst, 1988). Le riz cultivé dans la Vallée du fleuve Sénégal doit faire une concurrence avec le riz importé. Le prix au niveau du marché mondial est tellement bas que la production locale ne peut pas être concurrent sans soutien gouvernemental (situation B du tableau 1).

c. L'intervention gouvernementale.

La subvention de riz provenant de la Vallée du fleuve Sénégal fait une partie des interventions gouvernementales dirigés vers une approvisionnement alimentaire nationale plus élévé. La CPSP*, qui s'occupe avec l'importation et le commerce de riz, finance la subvention avec les prélèvements sur le riz importé. Le prix au producteur pour le paddy, et les prix en gros et les prix au détail pour le riz sont fixés par le gouvernement. Le prix de riz dans tous les canaux de distribution est par conséquent stabil, ce que restreint les risques pour les paysan(ne)s.

Grâce à l'oppression de la population urbaine, le prix officiel au consommateur était baissé en avril 1988 de 160 à 130 FCFA le kilo de riz, tandis que le prix au marché mondial était augmenté. La CPSP à reçu moins de revenus venant de l'importation à cause de ce développement. En plus on espère une augmentation de l'offre de paddy dans les années prochaines, à cause de la production qui viendra des nouveaux périmètres irriqués sur une grand échelle dans la Vallée du fleuve. Ceci ne fera pas plausible que la CPSP peut maintenir

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* Caisse de Péréquation et de Stabilisation des Prix

au niveau actuel, sans appui externe, la subvention pour le riz cultivé au niveau local.

d. Le canal de distribution.

Dans les marchés locaux les producteurs vendent leur paddy directement aux consommateurs, sans intervention des intermédiaires. La SAED achète la récolte de paddy chez les paysans. La SAED organise elle-même le transport, la transformation du paddy en riz et la vente à la CPSP.
Par conséquent du "Structural Adjustment Program" le gouvernement Sénégalais a commencé en 1986 avec le désengagement de la SAED. La SAED a dû abandonner certaines activités, comme la distribution des intrants et la livraison des crédits. En matière de la commercialisation de paddy, la SAED a perdu sa position monopole depuis la libéralisation du marché céréalier en 1986. Il est incertain que les activités de la SAED seront réduits en plus.

L'allocation de la récolte de riz à Abdallah, un village dans la zone d'intervention, sert comme une illustration de la réalité locale. En 1987 un menage moyenne a récolté 675 kg du paddy (n=20). On a vendu en moyenne 110 kg (15%) par menage à la SAED et 160 kg (25%) au marché local; l'assakal* était de 40 kg (5%) et la rétribution du travail et le fermage se montaient à 40 kg (5%) en total. Donc, un ménage moyenne a consommé 325 kg du paddy ou presque 50% de la récolte. (Hadj, 1988/89)

On peut conclure que la possibilité de vendre une partie de la récolte de riz est une condition importante pour la viabilité de l'aménagement hydro-agricole. La production destiné au marché, au niveau désiré par les producteurs, est faisable dans la situation actuelle. A l'avenir il y aura des développements menacent du côté du gouvernement. En cas d'une continuation du désengagement de la SAED et la cession de la subvention de prix au producteur pour le riz et/ou une cession des prélèvements sur le riz importé, la production de riz dans les PIV's

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* Prélèvement en profit de l'Islam.

deviendra moins intéressante, surtout pour les ménages qui ne disposent pas des envoies migratoires. Pour couvrir les frais de production on est obligé de vendre déjà un tiers de la récolte dans la situation actuelle.

3.2 Les légumes des jardins des femmes.

Dans ce paragraphe on traite, analogue au cas d'étude de riz, les aspects du besoin, de la nécessité et de la faisabilité de la production destinée au marché. Ici, il s'agit également d'une description de la situation actuelle.

A La désirabilité de produire pour le marché.
En 1986 le project d'irrigation "Ile à Morphil" a commencé l'aménagement des jardins, sur la demande de quelques groupements de femmes. Les femmes voulaient cultiver des légumes pour l'autoconsommation mais aussi pour les vendre au marché, puisque la génération des revenus monetaires a une grande priorité pour les femmes.

B La nécessité de la vente des produits au marché.
La vente des légumes est nécessaire pour des femmes. D'une part pour rembourser les dettes, d'autre part pour renforcer leur position économique et agrandir leur autonomie. Afin de couvrir les frais d'une parcelle de 30 m2, cultivé la moitié de chou et la moitié d'oignons, 25% de la récolte (=30kg) doit être vendu à un prix de 100 FCF/kg. (Helsloot, 1988)

C La viabilité de la production destinée au marché.
I Quelle est la viqueur et la faiblesse des producentes?

a. <u>Expérience de la culture.</u>
Traditionellement les femmes cultivent des spéculations comme la patate douce, le tomate cerise et le niébé aux bords du fleuve Sénégal et son bras. Les légumes cultivés dans les jardins, notamment le chou et l'oignon, étaient nouveaux dans la région, donc les femmes n'y avaient aucune expérience. C'est pourquoi la qualité des légumes reste mediocre, le nombre des

spéculations cultivés limité et il n'y a pas une ètalement de la production, malgré l'encadrement maraichère de part du projet. Remarquons que les exiges de cultivation pour les légumes sont beaucoup plus haut que ceux pour le riz.

b. <u>L'expérience de marketing.</u>

Cette expérience se limite chez les femmes aux marchés villageois locaux.

c. <u>La main-d'oeuvre, le capital et le sol.</u>

A part du travail dans les jardins, les femmes ont des nombreuses autres activités, qui ont le plus souvent une priorité plus haut (par ex. le repiquage et la récolte du riz). Elles ne peuvent que difficilement diriger leur usage de temps vers les exiges de part du marché.

Le capital est une autre restriction , car la plupart des femmes ne dispose guère ou pas de propres sources monétaires. Une recherche de Helsloot (1988) montre que plus que la moitié des femmes paye leur contribution pour les jardins avec l'argent reçu des membres de la famille (dans 25-50% des cas par le mari). Seulement 30% des femmes avaient leurs propres revenus, surtout provenant du petit commerce.

II Quelles sont les chances et les menaces qui proviennent de l'environnement?

a. <u>Les besoins de consommateurs.</u>

Au Sénégal on mangeait environ 50 kg de légumes par personne par an en 1984, dont les spéculations les plus importants sont les choux, les pommes de terres et les oignons, et puis l'aubergine et le manioc. Pour les années à venir une croissance de la consommation des légumes est attendue. A l'Ile à Morphil la consommation des légumes est plus bas que la moyenne nationale, à cause de la pouvoir d'achat faible, la disponibilité et les habitudes alimentaires chez les "Halpulaar". Pendant l'hivernage (la saison de pluie) la consommation des légumes est presque nihil.

b. Concurrence.

Le "Niayes" est la région de production des légumes la plus importante au Sénégal. Elle est situé à la côte entre Dakar et St.Louis, ce que donne quelques avantages comparatives: le climat est favorable pour la production des spéculations de type "européen", puis la situation près des grands centres de population, une infrastructure bien développée et une longue tradition de maraichage.

c. L'intervention gouvermentale.

L'intervention par le gouvernement se borne à la commercialisation des pommes de terre et des oignons, les seuls produits qui sont importés en grandes quantités. Ces importations sont liées aux quota, et pendant la saison de production locale (Février-Août) les frontières sont fermés pour ces produits. Les quota ne sont livrés qu'aux commerçants qui achètent aussi des pommes de terre et des oignons locales.

d. Le canal de distribution.

L'infrastructure sur l'Ile à Morphil est mauvaise, les possibilités de transport sont faibles et il n'existe pas une circuit de commerce bien développée. Aux marchés sur l'Ile ou à côté du goudron, les femmes vendent leurs légumes directement aux consommateurs ou par l'intervention d'une collecteuse. Sur les marchés hebdomadaires à côté du goudron, les commerçants (bana-bana) amènent par taxi-brousse des légumes de l'origine de Niayes, qui sont achetés par les bana-bana aux marchés de gros à Dakar, Thies et St.Louis.

Pour ce cas aussi, nous pouvons conclure que pour la continuation des jardins et pour l'amélioration de la position des femmes, il est bien important d'avoir la possibilité de vendre une partie de la récolte. Actuellement, l'écoulement des légumes au marché est seulement réalisable en un degré limité. Les restrictions par rapport à la commercialisation se trouvent au niveau de la connaissance et l'experience de la culture aussi bien que de la commercialisation, au niveau de la main-

d'oeuvre, de la concurrence et de la distribution. Les exigences de qualité, la concurrence forte et la perissabilité des légumes ajoutent un handicap de plus à la commercialisation.
Cependant, au point de vue de marketing, le choix de cultiver des légumes n'est pas à recommander, mais il est recommandable au point de vue de la stratégie. La cultivation et la vente des légumes est traditionellement une tache des femmes. C'est la raison pourquoi les femmes peuvent décider elles-mêmes de quoi produire dans les jardins, et elles-ont en plus le pouvoir sur la vente et l'allocation des revenus. En contraire, dans la culture de riz, les hommes ont le pouvoir de la récolte.

Début 1988, après trois ans d'expérience, se trouve que, bien que les jardins étaient rentable, le niveau de commercialisation était toujours plus bas que le niveau désiré par les femmes. On estime que 25 % de la recolte était vendu au marché, la reste était utilisé pour l'autoconsommation (Helsloot, 1988).
Puisque il n'était pas tellement claire comment on pourrait augmenter la production pour la vente, une recherche était réalisé sur les possibilités d'écoulement des légumes provenant des jardins (Bergen & Warner, 1989), dont quelques résultats seront décrit ci-dessous.

D Quels sont les produits promettants et quels sont les marchés favorables?

Dans la recherche les marchés suivants étaient examinés:
1. les marchés dans les grands centres urbains, notamment à Dakar,
2. les marchés à côté du goudron dans la région
3. le marché européen,
4. quelques marchés mauritaniens.

ad 1. Sur les marchés dakarois, il y avait des possibilités pour les produits semi-conservable comme le gingembre, le piment et le maïs jaune. Ces produits sont approvisionnés du Guinée, du Guiné-Bissau, du Mali et de la Côte d'Ivoire; le niveau de prix est intéressant, et l'approvisionnement de l'étranger est irrégulier. Par une livraison garantie les femmes pourraient obtenir une clientèle fixe.

ad 2. Sur les marchés de l'Ile et à côté du goudron, l'offre des oignons et de l'ail en dehors de la saison (par une production hatif et le stockage) pourra concurrer avec les oignons et l'ail importés.

ad 3. Attendu que le marché européen exige une grande perfection en qualité et une livraison garantie, la production pour ce marché est actuellement pas faisable.

ad 4. Les marchés mauritaniens sont actuellement inaccesssibles à cause de la situation politique.

E A quel égard les producentes sont capables de obtenir un contingent de marchand par utilisation des instruments de marketing?

En général, le degré dans lequel les instruments de marketing, notamment le produit, le prix, la distribution et la promotion , sont dirigeables, dépend de la structure du marché et la volume de l'entreprise.

Le marché des légumes au Sénégal est un marché de concurrence parfaite. Ca veut dire pour les femmes qu'elles ne peuvent pas influencer le prix. Une analyse des frais de production, des frais de transport et des frais de commercialisation, doit montrer si les marges bénéficiaires des produits diverses seront suffisant.

Quant au produit, il faut l'adapter aux exiges des consommateurs, ou bien un groupe de but ("targetgroup") spécifique. Par exemple, le maïs jaune, mentionné dans le cas de marché de Dakar, est surtout consommés par les immigrants provenant de Guinée, Bénin et Portugal. Le maïs jaune est plus cher que le maïs général.

La distribution offre plus de possibilités pour les groupements de femmes bien organisées que pour des femmes individuelles. Par exemple, afin de transporter des produits de l'Ile à Dakar, il est possible de construire des points de collecte à côté du goudron, où les commerçants peuvent attraper à la fois les produits des villages différents.

En rapport avec la distribution, suit une idée de promotion: un des points de collecte, situé vers une gare des taxi-brousses, pourrait être installé comme point de vente, où on peut faire la promotion pour les produits de l'Ile à Morphil.

4 CONCLUSIONS.

Le but de cette communication était d'investiger à quelle mesure une approche de la perspective de marketing peut contribuer à l'amélioration de la conception viable des aménagements hydro-agricoles paysans.
A cet effet, on a analysé à quel égard la production destinée au marché joue une rôle par rapport aux périmètres irrigués villageois et par rapport aux jardins de femmes à l'Ile à Morphil, et puis à quel égard les productrices y éprouvent des restrictions.
Une conclusion remarquable est que la commercialisation des produits semble de jouer une rôle essentielle, bien que les périmètres de riz et les jardins potager étaient premièrement visé à la autoconsommation. Pour les deux cas le degré d'intégration de marché prouvaient d'être considérable. La viabilité, surtout en cas de périmètres de riz, depend à longue terme de la capacité des paysans de vendre une partie de la récolte, parce qu'ils ont besoin d'argent pour payer les intrants.
Si on veut ébaucher et implementer une aménagement hydro-agricole viable, où les intrants seront payé des revenus de produits récoltés, il faut d'abord se diriger vers les possibilités et les restrictions par rapport à la vente des produits au marché. Un "checklist", comme présenté dans cette communication, semble un instrument utile à découvrir ces restrictions et ces possibilités. En tout cas, en décrivant les deux études de cas, ce "checklist" prouvait d'être très utile.

Si le résultat de l'analyse des marchés et de la vigueur et la faiblesse des producteurs est que la faisabilité de la production pour le marché semble faible, on y peut tirer les conséquences suivantes.

* Quant à des aspects d'intrants, une possibilité peut être cherchée de diminuer les frais de production par limiter l'utilisation des intrants externes et tenir les frais de fonctionnement de la systeme d'irrigation à un niveau bas.
* Quant à des aspects de l'output, on peut opter pour des autres produits et des autres marchés, et/ou pour les possibilités d' éliminer des obstacles de commercialisation. Quelques exemples de 1ce dernier mentionné peuvent être les améliorations infrastructurelle et l'encadrement concernant les aspects de la culture, le marketing et l'organisation.
Les désirs des producteurs/-trices doivent être décisif par rapport au choix de ces options.

L'attention des études de cas sur les périmètres irrigués concernait principalement l'autoconsommation. Le problème qui on peut poser est comment financier les intrants nécessaires?

On peut conclure de cette communication qu'une étude appliquée pour un périmètre irrigué doit clarifier de quelles sources les frais de maintenance et des intrants seront financés. Il s'agit de "sustainability" du périmètre. S'il faut financier les frais concernants par les revenus venant de la vente des produits, une analyse des marchés est un excercice nécessaire de l'étude appliqué. Dans cette analyse il faut étudier les possibilités et les restrictions d'une production destinée au marché. L'analyse doit résulter dans quelques combinaisons des produits et des marchés qui semblent promettants, dont les producteurs peuvent choisir, de préférence après quelques expériments avec les produits aux marchés. Le résultat de cette analyse peut être, comme mentionné avant, que les frais attendus de la culture irriguée doivent être diminués afin d'obtenir un projet faisable. Les analyses du marché pareilles peuvent diriger l'ébauche, mais il n'y a pas des exiges spécifiques pour ce plan. Du point de vue du marketing une étude appliqué doit avoir une perspective étendu, et contient en même temps l'infrastructure physique et l'organisation de la commercialisation.

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SOMMAIRE

Des sources variées mentionnent des résultats essentiellement favorables à la réalisation et l'utilisation des périmètres irrigués villageois dans la vallée du Sénégal. Les résultats maigres, constatés en même temps dans les grands aménagements du delta, sont imputés par les planificateurs et les techniciens à l'absence d'une structure gestionnaire localement intégrée.

Le choix politique de réaliser des aménagements intermédiaires qui auront à joindre l'agrandissement de l'échelle et la production commerciale à l'organisation réussie habituelle des périmètres villageois, est fondé sur une image trop simple de la situation.

Beaucoup d'éléments des deux concepts hydro-agricoles sont divergents. C'est notamment l'orientation de la production, commercialisation versus auto-consommation, qui est un point qui attire trop peu d'attention. Aux villages où l'auto-alimentation (notamment le riz) n'est pas encore réalisée, la base est absente pour introduire les aménagements intermédiaires principalement orientés au marché.

1. INTRODUCTION

Le développement hydro-agricole est récent dans la vallée du Sénégal. Les dernières 15 années, un nombre impressionnant de périmètres villageois a été installé dont la superficie est estimée à 27.000 hectares environ en 1988 qui constituent le total des deux états riverains, le Sénégal et la Mauritanie (OMVS, 1988).

Les périmètres villageois sont situés dans des régions qui diffèrent pour leur population, leur topographie, leur climat et, par conséquent, pour leur système de production traditionnel. L'intérêt des formes agricoles traditionnelles c.-à-d. la culture de décrue et l'agriculture pluviale est très différent par région.

C'est pourquoi le succès de l'irrigation villageoise dans la vallée du Sénégal ne repose pas sur une histoire sociale et physique pareille. Ceci amène que beaucoup d'expériences acquises au cours du développement hydro-agricole dans la vallée du fleuve Sénégal, s'appliquent dans un domaine plus large, dans celui des recherches et de l'exécution.

L'agriculture irriguéefait partie du système de production. Tandis que dans la moyenne vallée, la culture de décrue a une importance traditionnelle et, dans la haute vallée la production sous pluie, on trouve partout des activités comme l'élevage, la pêche et le commerce. Le travail de migration, saisonnier ou (semi-)permanent, est une source importante de revenu et explique en même temps l'absence temporaire ou permanente d'une partie considérable de la population active masculine. Les manques de la propre production de céréales sont comblés, autant que possible, par des achats.

Les caractéristiques de production des périmètres villageois sont traitées ailleurs (Diemer, Fall et Huibers, 1989). Souvent, on cultive le riz bien que d'autres céréales se généralisent de plus en plus. Les récoltes, au premier abord, sont destinées à l'auto-alimentation. Le développement rapide était possible en outre grâce à la production réduite d'autres activités agricoles causée par la série d'années de pluies très faibles. L'irrigation a pu compenser certaines pénuries d'aliments. Un trait caractéristique des périmètres villageois est le financement des moyens de production qui puise dans des ressources externes acquises, en grande partie, grâce au travail de migration (Diemer et Van der Laan, 1987).

Pour les exploitants, l'irrigation n'est pas toujours prioritaire étant donné l'achat nécessaire d'intrants coûteux et le schéma strict de culture qui est parfois difficilement intégrable dans d'autres activités. Cependant, (après des années de sécheresse relative), ce schéma joue un rôle important, dans de nombreux villages, à la production de céréales (Table 1). Dans quelques villages non-maures sur la rive droite du fleuve Sénégal, l'agriculture en irriguée satisfait jusqu'à 90% environ des besoins de céréales.

Table 1: Intérêt exprimé en pourcentage de la production et des besoins de plusieurs systèmes de culture

Village	Année	Part production de céréales				Part besoin de céréales				
		jeeri	walo	falo	irr.	jeeri	walo	falo	irr.	Total
Boki	1983	-	32	-	68	-	6	-	13	19
NGawlé	1983	-	1	1	98	-	1	1	64	66
Kaskas	1986	-	91	9	-	-	79	8	-	87
Dungel	1986	-	30	31	39					
Barangol	1986	-	46	4	50					
Bakel G.	1985	78	-	-	22	55	-	-	12	67
M'Leiga	1986	-	8	-	92	-	8		85	93
Medina G.	1986	-	10	-	90	-	10		92	102

Source: ADRAO - Projet Gestion de l'eau

Le développement hydro-agricole dans la vallée du fleuve Sénégal est soumis à une forte pression politique. La planification agricole nationale sénégalaise part de l'extension de la superficie du riz irrigué de 3.500 ha par an au delta et dans la vallée du fleuve Sénégal. Tandis que les grands aménagements hydro-agricoles du riz, installés jusqu'ici au delta (13.000 ha), réalisent une récolte insuffisante par hectare, cette production est de 20% au moins plus élevée dans la plupart des périmètres villageois (Freud, 1988; OMVS, 1986). La production favorable des aménagements villageois n'a qu'une influence marginale sur le marché national étant donné le taux bas (< 10%) de commercialisation (ENDA, 1986).

C'est également au niveau politique et de planification hydro-agricole que l'on voit le succès des périmètres villageois. A ce niveau on explique la différence entre les petits aménagements dans la vallée et les grands du delta par les différences de la structure organisationnelle des deux conceptions hydro-agricoles. Les grands aménagements du delta sont gérés par des structures imposées par le gouvernement, tandis que l'organisation et la gestion des périmètres villageois sont fortement liées à la structure politique et organisationnelle locale et traditionnelle. Les exploitants du delta, en général, sont des migrants qui se trouvent confrontés à l'agriculture irriguée comme leur seul moyen d'existance.

Au sein du gouvernement, la situation esquissée a mené à l'adaption logique, au premier abord, de la planification hydro-agricole. Cette vision vise la combinaison de la capacité organisationnelle locale avec l'agrandissement de l'échelle, ce dernier facteur étant nécessaire pour l'extension rapide de la superficie irriguée et pour agrandir la production à commercialiser. Ceci a mené à la notion d'aménagements intermédiaires à installer dans la moyenne et haute vallée du fleuve Sénégal qui, dans la vision gouvernementale, devraient remplacer, à terme, les périmètres villageois. Il serait possible de trouver des terrains appropriés dans les plaines d'inondation (les soi-disant cuvettes de décrue), actuellement utilisées pour la culture de décrue; ces plaines pourraient perdre leur utilité traditionnelle à cause des conditions climatologiques défavorables et de la régulation du débit du fleuve sous l'influence du barrage de Manantali, construit sur le cours supérieur.

Dans la pratique, les points de départ des aménagements intermédiaires sont interprétés de façon simple. Ceux-ci, principalement, sont définis à la base de leur superficie totale, 100-500 ha, où la division en secteurs plus ou moins indépendants et couvrant entre 50 et 60 hectares, permettra aux exploitants de former des groupes sociaux homogènes. La répartition indépendante de l'eau par secteur devra garantir une gestion de l'eau autonome par le groupe d'exploitants.

2. ETUDE DE CAS DE LA VALLEE DU SENEGAL

Au cours de la période 1983-1989, l'ADRAO (Association pour le Développement de la Riziculture en Afrique de l'Ouest) a étudié la gestion de l'eau des aménagements hydro-agricoles dans la vallée du Sénégal, en collaboration avec le département de l'irrigation de l'Université agronomique de Wageningen. Après une phase préliminaire de ce projet de recherche (U.A./ADRAO, 1985) pendant laquelle, principalement, l'organisation des périmètres irrigués villageois était examinée, la recherche s'est étendue pendant la deuxième phase du projet (1985-1989) pour regarder de plus près quelques aspects du développement des aménagements intermédiaires.

2.1 Conceptions hydro-agricoles existantes

La conception du périmètre irrigué villageois est de loin le plus connu dans la vallée du fleuve Sénégal. L'organisation de ces aménagements, et notamment la gestion de l'eau, est discutée en détail ailleurs (Huibers, Fall et Samb, 1988; Diemer et Van der Laan, 1987). Le plus souvent, les aménagements villageois n'occupent qu'une superficie totale réduite (20 ha), mais parfois aussi, ils sont groupés en unités de 100 hectares ou plus (Pété, Moudery). Voici quelques éléments les plus caractéristiques de leur conception:

- proximité du village
- participation de tous les intéressés
- petites parcelles
- gestion par le groupe d'exploitants
- peu ou pas de production commerciale
- construction peu coûteuse (sans plannage).

En dehors, de plus en plus des aménagements plus grands sont installés. Toutefois, la caractéristique de la "production commerciale" qui est à la base de la conception intermédiaire, ne s'applique pas toujours. Dans les cas où il est question d'attributions modestes par exploitant, et (par conséquent) d'une orientation de la production sur l'auto-alimentation, il vaut mieux caractériser ces aménagements comme des aménagements villageois agrandis. Les aménagements qui visent des parcelles plus grandes, la mécanisation et la production commerciale satisfont mieux aux points de départ de la conception intermédiaire.

L'exemple de l'ITALIMPIANTI est élaboré ici. Il s'agit de la construction et de l'encadrement d'une vingtaine d'aménagements répartis sur le Sénégal et la Mauritanie à la hauteur de Podor. Chaque aménagement a une superficie de 50 ha (42 ha de riz, 1 ha de pépinière, 7 ha de polycultures) et est géré par le groupe d'exploitants. L'installation de pompage alimente le système de canaux à pente nulle d'où les rizières bien égalisées à la superficie de 0,84 ha sont irriguées au moyen de siphons ou tuyaux souterrains. Le canal n'a qu'un seul ouvrage: un déversoir d'urgence, et il a en même temps la fonction de retenue à une capacité d'environ 3.500 m^3. Ceci permet de maintenir le niveau de l'eau stable ce qui est nécessaire pour l'irrigation du siphon. Un avantage complémentaire est que l'irrigation proprement dite utilise les réserves d'eau et qu'elle dépendra donc moins directement du fonctionnement de la pompe. Ce procédé simplifie l'organisation de l'irrigation.

Dans l'option des planificateurs, ces aménagements indiqués "IT" ont une fonction commerciale à part de l'auto-alimentation. La culture de deux récoltes de riz par an sur des parcelles de 0,84 ha est facilitée aussi par l'introduction de la mécanisation. Dans cette vue, il est nécessaire que les exploitants soient complètement disponibles et qu'ils soient censés abandonner leurs petits champs dans les périmètres villageois.

Les frais de production sont à payer complètement par les utilisateurs et à régler à la récolte. Selon les calculs du projet, la culture dans ces aménagements réalisera une valeur de production nette de 297.000 FCFA par exploitant à la récolte brute de 4,6 t/ha par saison (Table 2).

2.2. L'utilisation des "IT"

L'utilisation des différents "IT" est diverse jusq'ici. D'abord, l'histoire des groupes d'exploitants d'aménagements n'est pas identique. Les expériences de l'irrigation, la superficie déjà disponible dans les périmètres villageois et l'intérêt de l'irrigation à l'intérieur des autres activités sont, sûrement dans les premières saisons, des raisons importantes des différences de la compétence et de la motivation des exploitants.

Table 2: Résultats d'exploitation d'une parcelle d'un aménagement intermédiaire "IT" (en FCFA) 1)

Superficie	Récolte	Valeur production	Frais d'exploitation 2)	Valeur nette
2 x 0,84 ha	4,6 t/ha	656.800	359.800	297.000 3)

1) 50 FCFA = 1 FF
2) sans amortissement de l'aménagement
3) dont 153.000 pour la consommation directe (famille 7 personnes)

Source: Italimpianti (1987)

Quelques aménagements sont très récents ce qui signifie que l'encadrement du projet est intense, un encadrement qui impose le schéma de culture et qui fournit l'assistance aux intrants, aux réparations et à l'entretien. Le renouvellement des appareils n'est pas encore nécessaire.

Attribution des parcelles

Le projet a stipulé que les parcelles devaient être attribuées entièrement aux chefs de famille qui pouvaient démontrer qu'ils disposaient d'une certaine quantité de main-d'oeuvre, en prohibitant l'attribution aux plus petits ménages (foyrés). D'ailleurs, l'attribution était laissée aux autorités locales. Plusieurs villages ont fait prévaloir leurs propres règles dans cette attribution. A Donaye (village haalpulaar) l'attribution se fait réellement aux familles. Dans quelques cas, deux petites familles étaient jointes pour entrer en ligne de compte pour recevoir une parcelle. Dans ces derniers cas, une division de la parcelle a eu lieu à la fin de la première saison de culture pour résoudre les problèmes mutuels. Ailleurs aussi, les Haalpulaar ont attribué des parcelles aux familles pour arriver à une répartition juste des parcelles disponibles. Ceci s'est passé par exemple dans la partie de l'aménagement de Dar-el-Barka (Mauritanie) utilisée par les Haalpulaar. Pour les Maures cultivant l'autre moitié de cet aménagement, cette solution est impossible étant donné la différence de leur structure sociale. Les parcelles y ont été divisées pour fournir un petit champ à tous les ménages intéressés. A Diatar, village haalpulaar, l'attribution s'est faite au niveau des ménages. Le grand nombre de d'intéressés a nécessité la division en quatre de toutes les parcelles.

La répartition des parcelle provient de l'historique logique. Outre la forte tendance vers l'égalité lors de l'attribution de terres, les paysans veulent répartir aussi les risques. On préfère la culture d'un certain nombre de petites parcelles dans de différents aménagements à celle d'une seule grande parcelle à l'intérieur de la nouvelle conception "IT". On n'était pas disposé à abandonner l'exploitation des aménagements villageois en faveur des "IT".

Le développement des aménagements intermédiaires a quelques implications dans le domaine des droits fonciers. Traditionnellement, les 'propriétaires fonciers' (**jom leydi**) ont l'habitude de libérer des terres pourvu qu'elles soient favorables au village entier. Le développement des périmètres villageois a provoqué peu de problèmes à ce sujet parce que les terres nécessaires n'avaient que peu ou pas de valeur d'utilisation alternative. La situation est différente dans les cas des aménagements intermédiaires qui amènent, en outre, beaucoup d'investissements. L'exclusion de migrants (à Donaye) a soulevé de fortes protestations, tandis qu'à Diatar les jom leydi se sont indemnisés par l'attribution de parcelles doubles, au grand déplaisir de la jeune génération.

utilisation des "IT"

Dans tous les cas, la conception technique a pu garantir la disponibilité suffisante de l'eau. Toutes les parcelles ont reçu suffisamment d'eau à temps, malgré les différences parfois considérables des besoins en eau. L'opération simple du système d'irrigation et la certitude de la disponibilité suffisante de l'eau ont fait que le nombre de conflits de distribution d'eau était minimal. C'est pourquoi il n'était presque pas nécessaire aux paysans individuels de rester présents à l'irrigation; des économies considérables du travail en sont le résultat. L'irrigation simultanée d'une superficie de 10 hectares, dans la pratique, pouvait être exécutée sans aucun problème par 3 ou 4 personnes y compris l'opérateur de la pompe. Cette distribution techniquement correcte décharge l'organisation des exploitants.

En général, il se trouve que la quantité de travail consacré par parcelle des "IT" est plus basse, dans la pratique, que planifiée. Cela ne s'explique qu'en partie du besoin faible de main-d'oeuvre pour l'irrigation. Les économies de la main-d'oeuvre des "IT" est nécessaire aussi pour pouvoir cultiver les petits champs aux périmètres villageois, une activité qui n'était pas prévue dans la conception "IT". Dans la plupart des cas étudiés, il s'est révélé que la part des enfants dans la production des "IT" était beaucoup plus petite que le projet avait prévu (table 3). A Dal-el-Barka, où une partie des parcelles a été attribuée aux femmes, il se trouve que la part du travail faite par les jeunes filles est plus grande, mais une partie assez importante de la main-d'oeuvre nécessaire a été engagée. Donaye IT-3, pendant la première saison de l'exploitation, a investi le plus dans la main-d'oeuvre, Donaye IT-1 (ne plus encadré) a laissé tomber le repiquage et, de ce fait, a besoin de moins de main-d'oeuvre. Diatar IT-1, dont les parcelles ont été divisées en quatre, a eu remarquablement peu de main-d'oeuvre. L'aménagement est situé le plus près du village, mais il se trouve qu'il est peu prioritaire aux exploitants. Les économies de la main-d'oeuvre s'exprime surtout dans le temps très réduit consacré aux activités non fixes comme le désherbage (17% du temps consacré, contrairement à 38% ailleurs).

Table 3: Répartition de la main-d'oeuvre utilisée des catégories de personnes (%) et total des heures travaillées par hectare

	Périmètre type	Donaye IT-1	Donaye IT-3	Diatar IT-1	Dar-el-Barka IT
hommes	40	55	53	56	46
femmes	30	42	32	32	11
garçons	30	3	11	9	)
jeunes filles	-	-	4	3	)29
petits enfants	-	-	-	-	)
...	-	-	-	-	14
Total heures/ha	621	391	531	379	?

<u>Source</u>: Visscher (1989); Samb (1989)

récolte et frais de production

Les récoltes des différents "IT" s'élèvent à environ 4 t/ha pendant la saison des pluies. Pour la contre-saison, cette valeur est plus basse dans la plupart des cas. Ce sont des récoltes très maigres étant donné la première utilisation de la terre et une disponibilité quasi parfaite de l'eau. La présence de quelques maladies, probablement insuffisamment combattues à cause de la mauvaise disponibilité de pesticides, a contribué à la récolte moyenne plus faible qu'attendue. L'écart limité du schéma de culture pourrait avoir eu une certaine influence aussi.

Pourtant, les récoltes par parcelle sont fortement reliées à la quantité de travail consacré et la motivation de l'exploitant en question. La répartition des récoltes sur les 50 parcelles de Donaye IT-1 présente une grande déviation standard de la récolte moyenne qui ne semble pas expliquable des différences de qualité des champs. Il se trouve que les parcelles aux récoltes les plus élevées sont exploitées par des paysans motivés disposant de suffisamment de main-d'oeuvre, le contraire s'imposant aux parcelles aux récoltes les plus basses.

Les frais de production (sans main-d'oeuvre) sont de 214.000 FCFA/ha dans les "IT", plus que le double d'un hectare d'un périmètre villageois. Cette différence est provoquée par les frais de mécanisation. Les frais de l'amortissement de l'infrastructure ne sont pas compris dans les deux cas.

Un niveau acceptable de la production nette des "IT" ne pourra être atteint que par une superficie assez grande par exploitant. A la production de 4 t/ha et au prix de 85 FCFA par kg de paddy, une parcelle standard de 0,84 ha rapporte dans les "IT" un profit net de 106.000 FCFA (1245 kg de paddy = 16,5 sacs) par exploitant. La division des parcelles en quatre (0,21 ha) réduit la récolte nette à un peu plus de 4 sacs par exploitant. Dans un périmètre villageois, cette superficie, au même niveau de production, aurait rapporté presque 8 sacs de paddy net. A la récolte brute de moins de 4 t/ha, ces chiffres s'écartent davantage. Vu les frais de la mécanisation, la tendance à la division des parcelles a des conséquences désastreuses pour la motivation des exploitants et donc pour la faisabilité de la conception intermédiaire.

3. DISCUSSION

Les aménagements intermédiaires "IT" constituent une innovation par rapport à d'autres concepts hydro-agricoles dans la vallée du Sénégal.
Outre les aménagements bien installés et leur gestion simple, l'emplacement semble être bon aussi. Etant donné ses précipitations très basses, la région de Podor a peu d'autres possibilités de production. Du point de vue topographique, on a pu utiliser des sites très appropriés aidé par la superficie limitée des aménagements. Le point de départ étant une agriculture intensive dans laquelle une partie importante de la production sera à commercialiser pour compenser les frais de production et pour acquérir des revenus est typique. Ici on se fonde sur la double riziculture des exploitations de 0,84 ha. D'ailleurs, un champ de 0,14 ha a été réservé pour les cultures non rizicoles garantissant la diversification de la production. Du point de vue technique, ces aménagements sont très flexibles pour l'aspect de la distribution de l'eau et leur irrigation demande très peu de main-d'oeuvre. Il y a peu de raisons pour soulever des conflits ce qui favorise l'irrigation juste.

La conception "IT", par contre, comporte un certain nombre d'éléments impératifs comme la double culture. La forme choisie demande l'inondation permanente des canaux en rehaussement. Pour cette raison, il est nécessaire de pomper de l'eau, hors de la saison de culture aussi, pour éviter le tarissement et les fissures. On a fait des erreurs pendant de l'intégration d'une nouvelle forme d'irrigation à l'intérieur de la société socio-économique. La conception "IT" se fonde sur la supposition que les exploitants cherchent à obtenir le rendement maximal. Bien que les documents du projet signalent l'importance pour les paysans de la sécurité de leur production alimentaire, on ne se rend pas compte du fait que cette sécurité se combine difficilement avec la conception technique "IT" qui vise l'intensification de la production. L'agriculture dans la vallée du Sénégal est au stade où les paysans cherchent la diversification de leur production. L'agriculture n'est pas vue comme la génération de revenus, mais comme la garantie de la production d'aliments élémentaires. Trop peu d'attention est attirée au fait que les paysans utilisent leur environnement pour survivre et qu'ils ne sentent pas le besoin de le maîtriser (ENDA, 1986).

Dans la stratégie des paysans s'intègrent l'attribution traditionnelle de parcelles, la solidarité des exploitants et l'attribution de la main-d'oeuvre disponible à un certain nombre d'activités économiques différentes. L'utilisation réellement constatée des "IT" qui se caractérise par la division des parcelles et par la culture peu intensive, s'explique par ces principes.

Pour arriver à des aménagements intermédiaires viables, il faudra satisfaire à plusieurs conditions. Outre les exigences techniques visant l'efficacité du travail, la disponibilité garantie de l'eau et les frais réduits d'entretien, il faudra avoir la certitude que les exploitations peuvent être cultivées, de façon intensive, en unités non-divisées. Ceci pose des conditions à l'attribution de parcelles. Pour obtenir la production plus intensive proposée, il n'est possible d'attribuer les parcelles qu'aux paysans qui disposent de suffisamment de temps, de connaissances et de motivation. Ceci exclut ceux pour qui l'agriculture irriguée a seulement la fonction de l'auto-alimentation et qui génèrent d'autres activités leur revenu additionnel nécessaire . Cette exclusion n'est possible que si l'on satisfait réellement à la condition que chaque intéressé dispose déjà (ailleurs) d'une superficie irrigable qui suffit à faire la production de base nécessaire. Nous renvoyons à la table 1 déjà présentée pour préciser que les exemples y cités, à l'exclusion du village de Medina, ne couvrent absolument pas le besoin de consommation de céréales (à Medina seulement pour une partie des exploitants).

L'extension de la superficie irriguée sera d'abord destinée à obtenir, de façon peu risquée, un niveau plus élevé d'auto-alimentation, dans le cas aussi où le gouvernement part d'une autre optique pour étendre la superficie irriguée.

Au choix (principalement politique) de stimuler la production commerciale du riz dans la vallée du Sénégal, il faudra tenir compte de cette réalité, malgré la constatation que très peu ou pas d'emplacements appropriés sont disponibles pour l'extension ultérieure de la superficie des périmètres villageois.

Pour l'élaboration plus détaillée de cette problématique, il est possible de donner trois options:

1. Amélioration des périmètres villageois existants

Beaucoup d'aménagements villageois se caractérisent par des défauts techniques causant, dans des cas extrêmes, l'abandon partiel ou complet des aménagements (Huibers et Speelman, 1989). Dans presque tous les cas, l'irrigation demande plus de travail que strictement nécessaire et elle réduit la superficie à cultiver par exploitant. Une meilleure installation et la réhabilitation des aménagements existants pourront améliorer les possibilités de production des aménagements villageois. Cette amélioration peut viser, en même temps, l'augmentation de l'intensité de culture, qui demande moins de superficie pour obtenir la production de base désirée.

2. Adapter le concept actuellement très strict du périmètre villageois

Il faudra envisager d'atténuer les conditions qui sont à la base de la conception d'un périmètre villageois. De cette façon, des terrains villageois additonnels pourront être utilisés. Les frais de construction de ces aménagements seront plus élevés mais ils resteront toujours beaucoup plus bas que ceux des aménagements intermédiaires.

3. Installation d'aménagements combinés

Il est possible de considérer à entamer l'installation d'aménagements qui laissent l'espace à la production commerciale sur de grands champs à côté d'une production auto-alimentaire sur un plus grand nombre de parcelles plus petites. L'attribution d'une grande parcelle (commerciale) ou d'une petite (auto-alimentation) se fait en fonction de la situation et des besoins des exploitants individuels.

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1. INTRODUCTION.

Le Burkina Faso comme les autres pays du Sahel éprouve d'énormes difficultés pour la réalisation de sa politique d'autosuffisance alimentaire à cause des aléas climatiques rendant souvent précaire la situation alimentaire.

Pour lutter contre cette situation, l'une des solutions vers laquelle les autorités s'orientent de plus en plus est la sécurisation de la production agricole par les aménagements hydro-agricoles et leur mise en valeur.

Mais le Burkina Faso ne bénéficie pas d'une longue tradition en agriculture irriguée comme les pays asiatiques et le pays ne possède pas beaucoup de cours d'eau permanents. Les ressources en eau sont surtout concentrées dans les régions Ouest du pays où la pluviométrie est abondante (env. 950 mm par an).

Sur un potentiel irrigable évalué à 160.000 ha, seulement 14.000 ha sont aménagés dont 8.000 ha avec maîtrise totale de l'eau. Ce faible potentiel réalisé est insuffisamment valorisé a cause:

1. D'une absence d'approche prenant en compte la participation des utilisateurs et les structures au sein desquelles une telle participation est possible afin de parvenir à une pleine maîtrise de l'aménagement qui demeure un outil de production "nouveau" et complexe pour le paysan sahélien.

2. La non prise en compte des aspects sociaux, environnementaux et institutionnels pouvant influencer sur le développement et l'avenir de l'aménagement hydro-agricole.

2. BREF HISTORIQUE DE L'AMENAGEMENT ET DE LA SITUATION INSTITUTIONNELLE ET TECHNIQUE.

Les travaux de base du réseau hydraulique ont débuté en 1969 grâce à une coopération taïwannaise. Les cent premiers hectares aménagés furent mis en exploitation en 1970. En 1974, la mission taïwannaise a été remplacée par celle de la République Populaire de Chine qui a poursuivi les travaux de l'aménagement jusqu'en 1976 où il a été transféré à l'Etat Voltaïque à l'époque.

Le système d'encadrement a été rapproché et de style "militariste" ayant favorisé rapidement de bonnes connaissances de la riziculture chez les paysans.

Les superficies totales aménagées s'élèvent à 1.260 ha dont 1.045 ha sont cultivés en double culture de riz. Ce périmètre constitue pour l'instant le plus grand périmètre rizicole à double culture.

Le débit d'étiage de la rivière Kou qui alimente le périmètre est de 3,3 m3/s en période normale.

Dès 1980, le périmètre a bénéficié d'un financement de la Banque Ouest Africaine de Développement (BOAD) destiné à promovoir la culture attélée et l'élévage en tant qu'activité économique complementaire. Un premier financement néerlandais destiné à la réhabilitation du réseau hydraulique très dégradé est intervenu.

La forme d'exploitation retenue dès le départ est la coopérative, installée en 1970 sur base d'un choix plutôt bureaucratique que de l'approche de systèmes permettant ou favorisant la naissance d'une coopérative maîtrisable et entretenable par les paysans.

906 familles venues principalement des régions dont les conditions agroclimatiques sont défavorables à la promotion d'une agriculture intensive ont été retenues pour l'exploitation du périmètre. Chaque famille à qui il a été attribué 1 ha; a apporté quatre membres actifs.

Durant des différentes interventions sous forme d'assistance, l'organisation des paysans et leur formation en vue de leur responsabilisation réelle dans la gestion technique et financière de l'aménagement et de leur coopérative n'ont pas été considérées comme objectifs prioritaires.

Ainsi,à la veille de la 2è phase de financement néerlandais (1984-1989) la situation s'est fortement déterminée sur le plan de la production, du réseau, de la gestion de la coopérative, des relations sociales et de partenariat et de la démographie.

* Sur le plan de la production rizicole.

Les rendements moyens des quatre premières années de la mise en exploitation du périmètre ont atteint 6,5 tonnes de riz paddy à l'hectare.

Ces rendements ont chuté en 1977 à 3,1 tonnes/ha et 2,75 tonnes/ha en 1982.

Les causes essentielles sont:

- La pratique de la monoculture prolongée sans apport de matière organique appropriée,

- L'acidification des sols,

- Le non respect du calendrier agricole,

- Le mauvais drainage,

- Le non respect des doses d'engrais recommandées par les services d'encadrement et de la recherche,

- Instauration de système d'exploitation féodale des parcelles: pratique de metayage.

* Sur le plan hydraulique.

L'ensemble du réseau d'irrigation (11 km de canal d'amenée, 11 km de canal principal, 85 km de canaux secondaires et tertiaires, tous bétonnés, et 99 km de drains non bétonnés) a été maintenu dans un état de dégradation progressif lié à une mauvaise gestion de l'eau et à un manque d'entretien. Le système de drainage n'était pas efficient à cause d'erreurs de conception.

* Sur le plan de la gestion de la coopérative et les relations sociales.

Une absence de gestion transparente de la coopérative assurée par un agent cadre de l'Etat, disposant de tout pouvoir de décision en connivence avec quelques membres du conseil d'administration et délégués villageois en fonction des intérêts individuels.

En plus:

- La base financière de la coopérative était très faible et destabilisée par de multiples détournements de fonds,

- La méconnaissance du contenu des statuts et le non respect du règlement intérieur,

- L'absence d'esprit coopératif lié au manque de formation coopérative,

- Le fonctionnement d'une assemblée générale constituée par des délégés villageois élus sur des bases d'intérêts, d'appartenance ethnique et politique. En même temps les conflits entre les paysans étaient alimentés et entretenus de l'extérieur par des querelles politiques et régionalistes.

Ce contexte socio-politique a favorisé l'émergence d'un groupe d'agriculteurs commerçants ayant un pouvoir de décision très influent sur le fonctionnement de l'institution coopérative mise en place (commercialisation parallèle du riz, pratique de l'usure à taux élevé).

La femme, quoiqu'elle contribue pour 30 % aux activités de production agricole est maintenue dans une position marginale, sans statut et sans plans d'action à caractère économique. Elle n'a pas accès à la terre sur le périmètre.

Au niveau de certaines familles, il s'est développé une pauvreté relative ayant pour conséquence la malnutrition et le mauvais état de santé.

Les paysans regroupés au sein de la coopérative ont acquis le comportement d'être des assistés.

* Sur le plan démographique.

On assiste à un taux démographique galopant atteignant 4 % et à l'affluence de migrants autour de la zone aménagée engendrant le développement de types de rapports socio-économiques et culturels divers.

* <u>Au niveau des relations avec les partenaires extérieurs</u>.

La faiblesse voir le manque de relations fonctionnelles sur base de partenariat a nettement fait défaut, faisant de l'aménagement une zone laissée à elle-même et subissant des caprices d'un ensemble de facteurs exogènes.

Ainsi, le problème d'écoulement de la production du riz a longtemps constitué une préoccupation permanente des paysans pratiquant la riziculture sur le périmètre. Ceci par manque d'une politique cohérente et dynamique sur le plan national dans le domaine de l'organisation et de la commercialisation des productions céréalières.

Les structures de l'Etat créées pour assurer la collecte n'ont pas pu jouer efficacement leur rôle faute de moyens physiques et financiers, de personnel compétent et d'organisation adaptée. Les importations du riz dont les quantités ont connu une augmentation rapide d'une année à l'autre (de 15.000 tonnes en 1980, les importations du riz ont atteint 60.000 tonnes en 1984, soit un taux d'augmentation de 300% en 4 ans) ont contribué à défavoriser la promotion de la culture du riz.

Par ailleurs, l'intervention de la structure de recherche pour appuyer la production rizicole du périmètre est demeurée quasi inexistante. Ainsi, aucun programme de recherche d'accompagnement et d'études des systèmes de production n'a été initié afin de mieux analyser les contraintes majeures liées à la production et proposer des solutions d'amélioration en conséquence.

Par manque d'une politique nationale en matière de vulgarisation agricole, les structures du Ministère du Développement Rural, chargées à l'époque de l'organisation, de l'animation et de l'encadrement technique des producteurs n'a pu définir une approche spécifique et adaptée pour permettre la transmission des connaissances techniques aux riziculteurs du périmètre.

Les relations développées entre la zone et ces structures de l'Etat ont été plutôt technicistes et n'ont pratiquement fonctionné que sur la base d'une certaine préoccupation liée au fonctionnement de la structure étatique qu'à l'intérêt réel de la zone dans une situation de blocage et de dégénérescence sur le plan technique, socio-économique et institutionnel.

<u>3. LA STRATEGIE D'INTERVENTION DU PROJET (1984-1989)</u>.

Elle a été définie à partir du diagnostic de la situation de la zone à la veille de la deuxième phase du projet. Elle consiste principalement à promouvoir des actions susceptibles de créer et développer des transformations qualitatives sur le plan agro-socio-économique et institutionnel afin de faire de la zone aménagée un espace économique viable.

Elle est axée sur deux concepts essentiels:

1. L'amélioration et la consolidation de l'appareil de production,

2. La redynamisation de la coopérative pour réaliser l'auto-gestion par les paysans.

4. L'AMELIORATION ET LA CONSOLIDATION DE L'APPAREIL DE PRODUCTION.

L'appareil de production comprend l'aménagement et le système de cultures qui y sont pratiquées. Son état de dégradation général a nécessité la définition et la mise en oeuvre d'un ensemble de mesures afin de faire de la zone aménagée un espace économique viable.

4.1. La réhabilitation de l'infrastructure hydraulique.

L'ensemble de l'ancien réseau d'irrigation a été entièrement modernisé par le projet. Les travaux de réhabilitation ont été accompagnés par la mise à jour d'un dossier technique qui faisait défaut au démarrage du projet. La gestion technique du périmètre se butait à cette insuffisance notoire héritée de l'assistance chinoise. C'est ainsi qu'il était difficile de contrôler le débit dérivé dans les canaux et les parcelles en tête des quartiers hydrauliques étaient mieux arrosées que celles en aval. Cela s'était traduit par un gaspillage d'eau et l'inondation de parcelles.

Des adaptions opérées sur le réseau ont permis la mise en place d'un système de gestion efficace et simplifié. Ainsi le niveau a chaque prise secondaire est contrôlé par un seuil dans le canal primaire et dans les canaux secondaires pour les tertiaires.

Ces seuils garantissent un débit constant à chaque ouverture des vannes. Des modules à masques sont installés au niveau des tertiaires afin de mieux rationaliser l'irrigation au niveau des parcelles de cultures. Une étude détaillée de l'infiltration de l'eau dans les différents blocs pour permettre la répartition correcte d'eau sur le périmètre a été effectuée. La répartition actuelle de l'eau a considérablement réduit le problème d'eau précédemment connu au niveau des blocs secondaires et tertiaires.

Le système d'irrigation est renforcé par l'application des tours d'eau pour la répartition d'eau dans les blocs tertiaires au cas où des problèmes de débit se posent notamment au cours de la période sèche. Le tour d'eau est basé sur trois principes:

* un débit constant au niveau des blocs tertiaires,

* une durée bien déterminée pour l'irrigation au niveau des paysans (4 heures par paysan),

* l'application stricte du tour d'eau au niveau de tous les paysans d'un même bloc tertiaire sous la supervision et le contrôle de responsables paysans.

Pour garantir une répartition équitable de l'eau en période de crise, le projet a démarré l'installation des modules à double masque de 60 l/s modulable par portion de 5 l/s.

Afin de stimuler la responsabilisation des paysans au fonctionnement du nouveau système d'irrigation, une organisation de ces derniers a été conçue suivant les blocs secondaires et tertiaires de distribution d'eau.

Ainsi 101 représentants ont été choisis par les paysans au niveau tertiaire. La répartition des paysans au niveau des blocs secondaires a été également établie sur base d'élection: 10 paysans choisis et constituent le conseil d'eau.

Les principales tâches exécutées par <u>les représentants tertiaires</u> portent sur:

- la gestion des tours d'eau au niveau des quaternaires,
- organisation de l'entretien du réseau,
- la transmission de l'information issue du conseil d'eau et vice-verca.

<u>Les représentants des blocs secondaires</u> contrôlent l'exécution de la répartition d'eau et les tours d'eau:

* contrôlent l'exécution des travaux d'entretien du réseau,
* organisent des réunions avec les représentants tertiaires avec l'appui des techniciens du projet,
* proposent des sanctions (amendes) à l'endroit des paysans indisciplinés.

Au cours de l'année 1988, le montant des amendes payées par des paysans en infraction s'est élevé à 90.000 FCFA soit U$ 257 environ.

Au niveau du conseil d'administration (voyez l'organisgramme de la coopérative) deux coordinateurs sont les correspondants du service hydraulique du projet.

La formation dispensée en direction de ces représentants paysans en matière de gestion d'eau et d'entretien a été insuffisante et cela complique la compréhension de multiples questions d'ordre technique.

<u>4.2. L'amélioration de la production agricole</u>.

La baisse des rendements enregistrée au cours de la période ante-projet constitue une sonnette d'alarme pour des mesures de correction à entreprendre pour sécuriser et garantir la production.

Quatre axes principaux ont nécessité une concentration des efforts du projet en vue d'améliorer la production agricole:

- le redressement de la fertilité des sols,
- la mise en fonctionnement du système Recherche-Développement,
- la responsabilisation des paysans aux actions de pilotage de la production,
- l'amélioration de la commercialisation.

4.2.1 Le redressement de la fertilité des sols.

Une analyse chimique des sols a mis en évidence que bon nombre de parcelles avaient un pH 3,5 à 4 avec manifestation du phénomène bronzing (libération du fer).

Une sensibilisation des paysans appuyée par des visites sur les parcelles atteintes par le phénomène de bronzing a permis d'accelérer la mise en exécution d'un programme d'amendement calcaire. Ainsi, 249 ha ont pu être amendés sur 364; soit 68 %.

4.2.2. La mise en fonctionnement du système Recherche-Développement.

Le manque de ce volet n'a pas permis de bénéficier efficacement de l'appui des structures de la recherche ou d'institutions partenaires. Pour combler un tel vide, un programme recherche-développement a été défini en concertation avec la structure de la recherche et axée sur les contraintes majeures relevées au niveau de la zone aménagée:

* amélioration variétables,
* protection phytosanitaire,
* mécanisation adaptée,
* système de cultures,
* production de semences.

Ainsi le programme d'amélioration à partir des essais expérimentaux et de prévulgarisation en milieu paysans appuyés par le système de démonstration a permis de mettre à la disposition du paysan de variétés de riz qualitativement performantes sur le plan de la résistance aux maladies et dont les qualités organoleptiques sont très appréciées.

La protection phytosanitaire a été renforcée grâce à la mise en fonctionnement d'un système de surveillance sanitaire et d'intervention sur seuil. Le travail de surveillance a été confiée à des paysans pilotes 20 paysans dont 2 par bloc d'irrigation élus par leurs camarades et qui ont reçu une formation de base sur les principales maladies et les insectes ravageurs.

Ces derniers sont appuyés par les techniciens de la Direction et le personnel spécialiste de la structure de recherche. La généralisation du système qui constitue une nouvelle approche a été appliquée sur le périmètre en 1988.

Le système consiste à n'appliquer les traitements que si les niveaux d'attaque par les ravageurs observés hebdomadairemant atteignent:

- 5 % de coeurs morts au cours de la phase végétative,
- 1 % de pannicules blanches pendant la phase reproductive.

L'évaluation a mis en évidence la satisfaction des paysans sur l'application de la méthode et un gain d'économie pour les paysans (FCFA 30.000 à 40.000 soit US 114 à l'hectare) et la coopérative. Ceci quant à la réduction de quantité de produits à commander et la réduction des risques de pollution et d'intoxication donc une meilleure préservation de l'environnement.

* <u>La mécanisation adaptée aux conditions de la zone</u>.

Il s'agit de l'expérimentation de matériel permettant d'effectuer les travaux sur le périmètre et les cultures sèches. Ainsi, 100 charrues et 100 herses Rumptstad acceptées par les paysans après démonstration ont été introduites.

* <u>L'introduction d'un système de cultures</u>.

Des expérimentations conduites avec les services de la recherche ont déterminé l'établissement d'un programme d'introduction de cultures dites intercalaires: blé, maïs, niébé et tomate pour la campagne de contre saison.

Ceci pour répondre à deux questions:

1. reduire le problème d'eau en saison sèche (insuffisance débit et prélèvement excessif d'autres utilisateurs en amont de l'aménagement),

2. Tenir compte de certaines cultures pratiquées par les paysans en zone sèche.

Le programme concerne 245 ha de terres très perméables. En 1988 45 ha ont été cultivés en blé (rendement 2,5 tonnes/ha) et maïs (rendement 4 tonnes par ha).

<u>4.2.3. La responsabilisation des paysans</u>.

Une structuration similaire à celle des représentants paysans chargés de la gestion d'eau a été instaurée sur la base des tertiaires et blocs secondaires d'irrigation ainsi:

- les représentants tertiaires agricole (101 paysans),
- le conseil agricole (10 paysans),
- la coordination d'eau (2 paysans).

Les deux coordinateurs agricoles avec leurs homologues coordinateurs d'eau sont des membres du nouveau conseil d'administration.

L'essentiel des activités assumées par ces paysans hiérarchisés:

* le suivi de la campagne de production,
* le contrôle du respect du calendrier agricole,
* le contrôle de l'utilisation des variétés conseillées;
* le contrôle du respect des traitements conseillés,
* la transmission des informations de manière interactive.

Cette structuration a fonctionné avec difficultés liées notamment à:

- la non maîtrise de la programmation des activités de contrôle,
- l'insuffisance de l'appui des techniciens du projet,
- à la non disponibilité des représentants paysans pendant la campagne hivernale (travaux sur les rizières et cultures sur les terres hautes).

* La mise en oeuvre du dispositif: système d'irrigation-recherche-développement.

La mise en oeuvre de l'ensemble du dispositif a permis :

1) de relever les rendements à 5,5 tonnes/ha par campagne de culture. Beaucoup de paysans réalisent 6 tonnes/ha.

2) d'améliorer le revenu des paysans.
Le compte d'exploitation analysé en 1988 met en évidence le niveau de revenu tiré par les paysans, (au prix de vente = 85 FCFA/kg = 0,24 dollars) un rendement de:

- 4.000 kg/ha donne un revenu de 496.217 FCFa soit US 1.418,
- 5.000 kg/ha le revenu est de 666.217 FCFA ou 1.903 dollars,
- 6.000 kg/ha le revenu est de 836.217 FCFA ou US 2.389.

4.2.4. L'amélioration de la commercialisation.

L'implication de structures étatiques tel que la C.G.P. et la CNCA [1]) a résolu le problème de collecte du riz par un système de préfinancement. Cette intervention a mis en retraite les commerçants spéculateurs.

Ainsi les quantités de riz paddy commercialisées sur le périmètre durant la phase du projet atteint 27000 tonnes soit 63% des productions totales.

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[1]. C.G.P.: Caisse Générale Péréquation ayant la monopole d'importation du riz;
C.N.C.A.: Caisse Nationale de Crédit Agricole.

4.2.5. Les contraintes liées à l'appareil de production.

4.2.5.1. La faible utilisation de la matière agricole.

Le diagnostic de la situation fait par le projet revèle que deux tiers des paysans soit 735 doivent être équipés en 348 paires de boeufs de traits, 305 charrues et 128 herses (type Rumptstad notamment).

4.2.5.2. La faible utilisation de la matière organique.

Malgré les efforts de sensibilisation, la matière organique est faiblement utilisée sur le pèrimètre. Dix pour-cent des 1.103 paysans appliquent la matière organique. La quantité de travail que requiert la préparation du compost et la lenteur de la dégradation de la matière organique constituent le facteur limitant. La solution est d'arriver à la mise en expérimentation et à vulgariser un procédé de transformation rapide de la paille du riz en compost.

4.2.5.3. La position de la femme dans le système de production.

La femme quoiqu'elle contribue pour 30% aux travaux agricole est dans une position encore marginalisée:

* pas d'accès à la parcelle irriguée donc à la coopérative,
* n'a pas bénéficié d'une formation technique en matière de production agricole,
* aucune stratégie claire n'a été définie par le projet afin de permettre l'exécution d'activités concrétes susceptibles de promouvoir économiquement le statut de la femme.

4.2.5.4. La position des jeunes.

La question de distribution des revenus à l'intérieur des ménages et les conflits de génération exercés sur le périmètre engendrent de nouveaux comportements de jeunes, et leur exode, reduisent ainsi la taille de la main-d'oeuvre familiale dans certaines familles. Comment arriver à résoudre une telle situation somme toute complexe.

4.2.5.5. Le problème de malnutrition.

Malgré l'amélioration du revenu des paysans, le taux de malnutrition des enfants est assez élevé. Selon les resultats acquis sur le périmètre brachial 38 % des enfants de 10 à 24 mois et 13 % des enfants de 2 à 5 ans sont malnutris.

Des actions de sensibilisation pour la lutte contre la malnutrition ont été menées: p.e. par les comités de quartiers. Mais le resultat est encore très faible. Le recensement d'enfants malnutris a été effectué; un programme d'activités de leur suivi et de prevention d'éventuels cas restent à élaborer et à mettre en exécution.

4.2.5.6. Les cultures pratiquées sur les terres hors périmètre.

Différentes études menées dans la zone du périmètre montrant que les paysans disposent de 2,5 - 3 ha de cultures traditionnelles. Tout se passe comme si l'exploitant acceptait l'intégration du système de culture irriguée dans un système de production, mais cela avec certaine prudence.

La question fondamentale qui se pose est comment arriver à une combinaison complète culture irriguée-cultures traditionnelles comme éléments composants de l'exploition familiale sans créer trop de déséquilibre entre superficies en cultures traditionnelles et surfaces irriguées.

Le niveau d'équipement des paysans reste le facteur conditionnant le plein emploi des terres sous irrigation et hors périmètre.

4.2.5.7. Problème d'entretien de l'élèvage.

L'apport de l'élévage sous forme de force de travail et de fumier et en contribue à l'amélioration de la productivité du travail et de la production.

L'inexistance de culture fourragère sur le périmètre reduit la couverture des besoins en énergie nécessaire pour les boeufs de labour.

5. LA REDYNAMISATION DE LA COOPERATIVE.

Le contexte socio-politique auquel était confrontée la coopérative a maintenu cette dernière dans une situation de léthargie et de blocage. Les conflits sociaux ont paralysé la vie associative de la coopérative, lui imprimant une dimension politique très prèjudiciaire. Un plan de redressement de la situation socio-politique a été préparé et mis en exécution en juillet 1986 avec l'appui des autorités et comprenant :

- le recensement "commando" de tous les exploitants ayant abusé de leur pouvoir vis à vis de la coopérative et de ses membres,

- la dissolution du conseil d'administration et son remplacement par un comité populaire de gestion provisoire,

- l'installation de comité de défense de la révolution,

- la préparation d'élection de représentants de la coopérative.

5.1. Le fonctionnement de la nouvelle coopérative.

L'autogestion de la coopérative par ses membres constitue l'objectif principal du projet. L'atteinte de cet objet fait appel aux concepts :

* d'organisation,
* de formation,
* de gestion et finances,

* de relation avec les partenaires.

5.1.1. L'organisation de la coopérative.

L'approche adoptée par le projet est de susciter la participation active de la majorité des paysans à la vie de la coopérative et de l'aménagement. Le nombre élevé des coopérateurs 1.103 requiert un type d'organisation adapté favorisant la libre expression des membres. Une structuration à deux niveaux a été mise en place.

Niveau 1: Cadre non professionnel.

Constitué par la présentation des paysans au niveau tertiaires et secondaires d'irrigation et assument des tâches d'organisation, de suivi et d'information dans le domaine agricole et irrigation.

Cette organisation est la suivante :

- représentants paysans tertiaire d'eau et agricole (202 paysans),
- conseil d'eau et agricole (20 paysans),
- les coordinateurs d'eau et agricole (4 paysans),
- les responsables de section (7 paysans).

Niveau 2: Administration.

L'administration est assurée par le conseil d'administration recemment mis en place.

Le gestionnaire de la coopérative, cadre de niveau universitaire exerce les tâches quotidiennes de gestion, de supervision des agents placés sous son contrôle:

* agent chargé de la comptabilité,
* responsables paysans au niveau de section et chargés de l'approvisionnement et crédit,
* le suivi phytosanitaire,
* la commercialisation,
* les activités non agricole,
* la gestion du matériel agricole,
* la multiplication des semences.

N.B.: Les difficultés liées au fonctionnement de cette structuration sont signalées en pages précédentes.

5.1.2. La formation des paysans.

La formation s'est située à deux volets :

- l'alphabétisation comme moyen de responsabilisation des paysans à la gestion de la coopérative et de l'aménagement,

- la formation coopérative pour développer l'esprit cooperatif et renforcer la solidarité de la vie associative.

Le résultat acquit a été très faible. Ainsi 15% des paysans membres ont été alphabétisés en français ou en langue nationale. 165 paysans sont formés en coopération. Ce faible résultat est principalement lié à plusieurs facteurs:

- insuffisance de sensibilisation des paysans,
- problème d'organisation de la formation par le service technique,
- faible compétence de certains agents d'encadrement.

Ce groupe de paysans ayant acquis le savoir est favorisé par le rôle qu'ils peuvent jouer sur le plan de certaines décisions au sein de la coopérative. Il a été observé que c'est à l'intérieur de ce même groupe que sont renouvelés les responsables paysans. Il y a donc un certain risque de monopolisation des acquis de la formation si celle-ci ne touche pas le grand nombre des exploitants membres de la coopérative.

5.1.3. La gestion et la situation financière de la coopérative.

5.1.3.1. La gestion de la coopérative.

Au cours de la période avant le projet, le problème de transparence de la gestion a largement fait defaut. Au cours de l'exécution du projet des actions ont été menées pour améliorer la situation mais sans que l'objectif principal soit réellement atteint.

Il s'agit:

- de la séparation de la comptabilité de la coopérative avec celle du projet,

- de l'appui du projet à la coopérative sous forme d'assistance comptable par un cabinet de la place,

- du recyclage du personnel de la comptabilité du projet,

- de la formation comptable des responsables paysans au niveau de l'administration de la coopérative: conseil d'administration représenté par le comité de gestion, conseil d'eau et agricole, responsables paysans de section, bureau eau et agricole, comptables villageois, soit 42 paysans formés.

Par manque d'approche pédagogique et de compétence en matière de gestion et comptabilité simplifié nécessaire pour la coopérative, la formation dispensée par le cabinet comptable n'a pas répondu aux attentes.

La conséquence est que les documents comptables sont difficilement compréhensibles par les paysans donc non accessibles, quoique les opérations de décaissement et de co-signature sont respectivement effectives par le trésorier et le président de la coopérative en relation avec le gestionnaire;

Au niveau de l'exécution du budget; des faiblesses sont déjà observées et portent sur:

- le manque de rigueur dans la gestion du budget,
- le manque de planification des activités,
- l'octroi de crédits divers notamment sociaux aux membres de la coopérative.

Ainsi les prêts sociaux (baptèmme, mariage, funérailles) accordés aux paysans au cours des deux dernières années atteignent 7.377.375 FCFA soit US 21.078 environ.

Un comité de contrôle composé de paysans élus a été récemment mis en place au sein de la coopérative afin de vérifier et contrôler de manière périodique les mouvements des opérations financières: caisse, banque, etc.

Ce comité n'est pas suffisamment opérationel, par manque de formation appropriée. Cette situation ne permet pas aux paysans de participer efficacement et démocratiquement à la gestion de leur coopérative, le savoir et le savoir faire en matière de comptabilité-gestion étant monopolisé par le cadre professionnel de la coopérative, les comptables, le gestionnaire, le caissier et l'archiviste.

L'élément qui convient d'être signalé est la vigilance de plus en plus accrue que les membres du conseil d'administration constitué par de jeunes paysans dynamiques déploient dans le suivi des grosses dépenses à effectuer.

<u>5.1.3.2. La situation financière de la coopérative</u>.

La situation finacière de la coopérative s'est améliorée au cours du projet. Cette situation est dûe principalement à des subventions reçues du projet, de l'Etat et de l'amélioration du niveau de la production.

Ainsi le bilan 1988 présente un solde positif de 91.762.623 FCFA soit US 250 million environ. La situation comptable au 31 mars 1989, signale un solde créditeur de 15.458.605 FCFA, soit US 44.167 environ.

Malgré cette physionomie satisfaisante, la situation financière de la coopérative est fragile et doit être consolidée afin de réaliser pleinement l'auto-gestion de la coopérative. Il s'agit notamment d'améliorer et de renforcer les aspects financiers liés à la viabilisation économique de la coopérative et de l'aménagement.

Le niveau des redevances pendant la phase avant projet était dérisoire 12.000 FCFA par an par hectare ou US 34. Ce qui ne peut répondre au besoin de fonctionnement de la coopérative et de l'entretien de la coopérative.

Au cours du projet, le niveau de redevance par paysan a été relevé et atteint 30.000 FCFA soit US 85. Une étude menée par le projet détermine le niveau de redevance annuelles par paysan à 120.000 FCFA soit US 342 pour garantir le fonctionnement de la coopérative et la réhabilitation (fond de réhabilitation) du périmètre dans 15 ans. Cette idée a été acceptée par l'Assemblée générale des paysans qui propose l'application progressive d'un taux de redevances.

6. PERSPECTIVE ET AVENIR DE LA COOPERATIVE.

La pleine réalisation de l'auto-gestion de la coopérative sous entend la réalisation des multiples questions soulevées et dont les solutions n'ont été que partielles ou n'ont pas été abordées.

Ces questions sont relatives à:

1. L'intensification de la formation de l'ensemble des paysans dans le domaine de l'alphabétisation, la coopération et la comptabilité gestion simplifiée tout en accordant une attention particulière aux groupes les plus hiérarchisés et permettre ainsi une gestion plus participative et démocratique de la coopérative.

2. La consolidation de la situation financière de la coopérative par des mesures de rigueur de gestion et l'instauration de redevances à taux normal permettant la constitution d'un fond de réhabilitation du périmètre.

3. Le transfert effectif des compétences existentes au sein du projet pendant la troisième phase d'exécution.

4. La mise en valeur d'un réseau de concertation permanente d'échange avec les structures partenaires.

5. La poursuite et le renforcement des actions de recherche-développement et l'introduction des systèmes de cultures.

6. La mise en oeuvre d'un programme d'activités concrètes en faveur de la femme et favorisant son accès à la terre et son adhésion à la coopérative et cela sur la base d'étude socio-économique (en cours de réalisation).

7. L'équipement des paysans en matériel agricole et boeuf de trait.

8. La mise en place d'une caisse d'épargne et de crédit sur la base d'étude de faisabilité déjà executée par la Société de Développement Internation de Desjardin (SDID) et qui implique la population de la zone. Ce qui contribuera à éteindre le système de prêts sociaux accordés par la coopérative à ses membres.

9. La stimulation de la coopérative à un esprit d'ouverture et de concertation avec le reste de la population afin de promouvoir une prise de conscience collective pour la réalisation d'un développement intégré.

10. L'amélioration de la situation nutritionnelle des enfants par la réalisation concrète de mesures de lutte contre la malnutrition.

11. L'intégration des jeunes à la coopérative par leur accès à la terre.

12. La définition du statut foncier des parcelles exploitées par les paysans par la mise à jour de textes officiels en la matière afin de garantir la sécurisation de l'appareil de production et de la résidence du coopérateur.

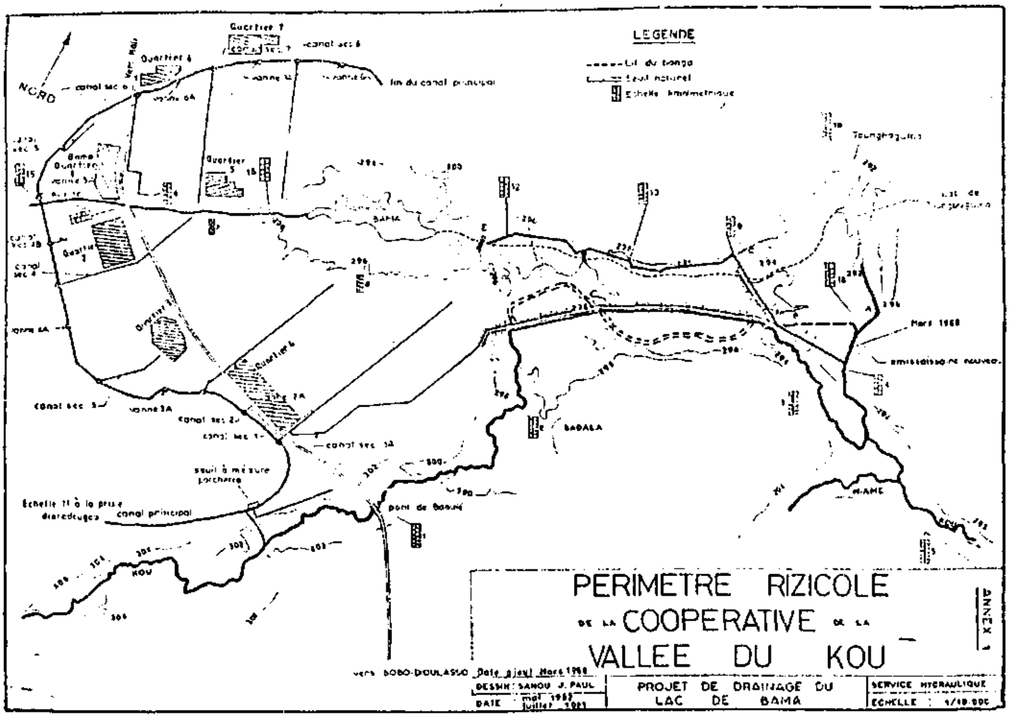
7. CONCLUSION.

L'aménagement hydro-agricole constitue un outil de production complexe pour le paysan sahélien. La seule voie de réussite et de viabilisation de cet outil est la responsabilisation des paysans dans la gestion technique et financière.

Cette participation ne peut être effective que par la promotion d'une organsiation paysanne dotée de la formation adaptée permettant de promouvoir un développement harmonieux et durable pour les membres de la zone aménagée.

La réussite de l'appareil de production implique par ailleurs l'appui des structures ou d'institutions partenaires sur la base des contraintes majeures mises en évidence.

ANNEXE I


LEGENDE
NORD
BAMA
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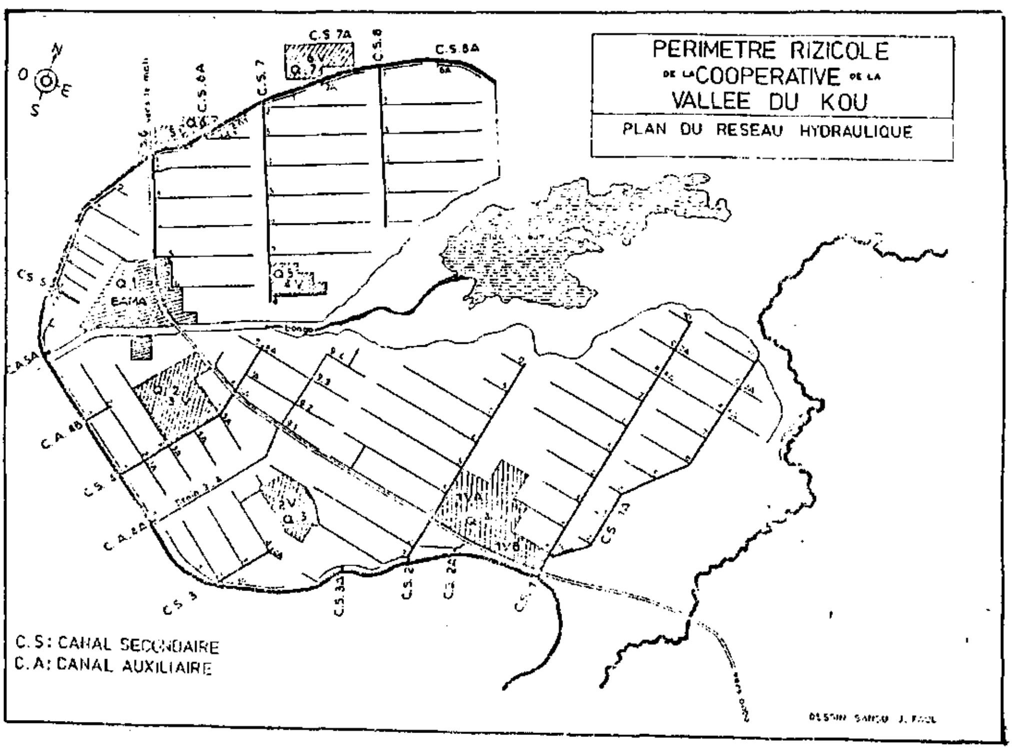
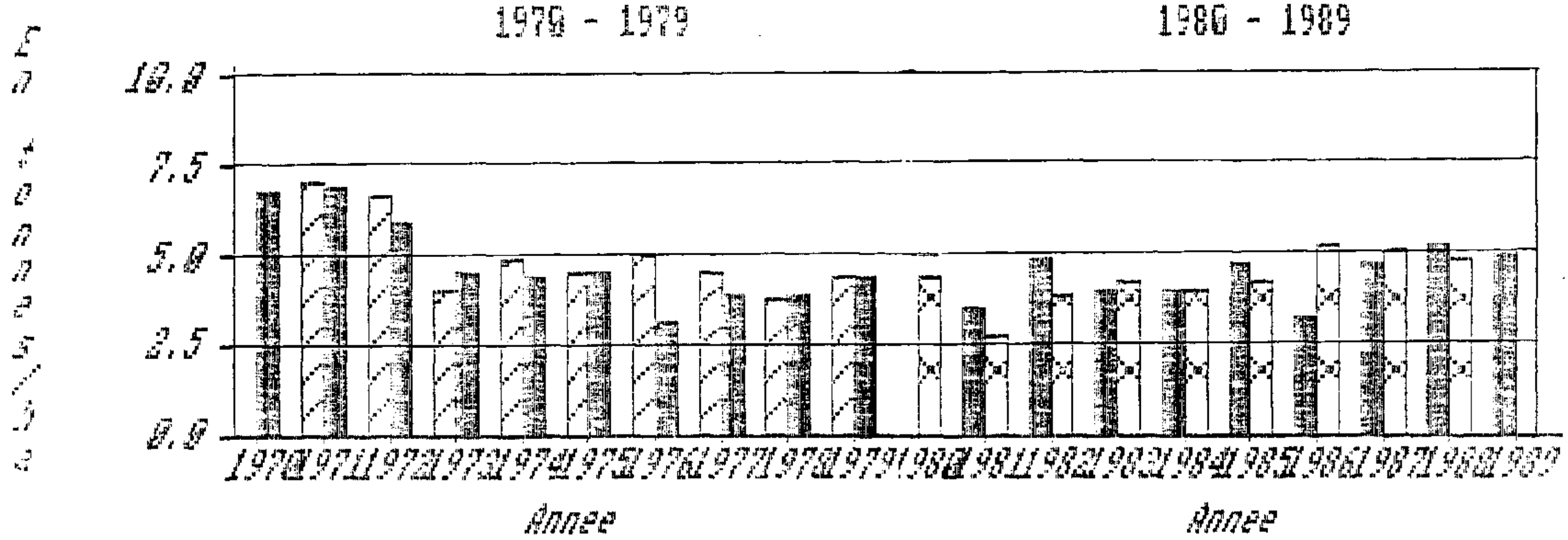
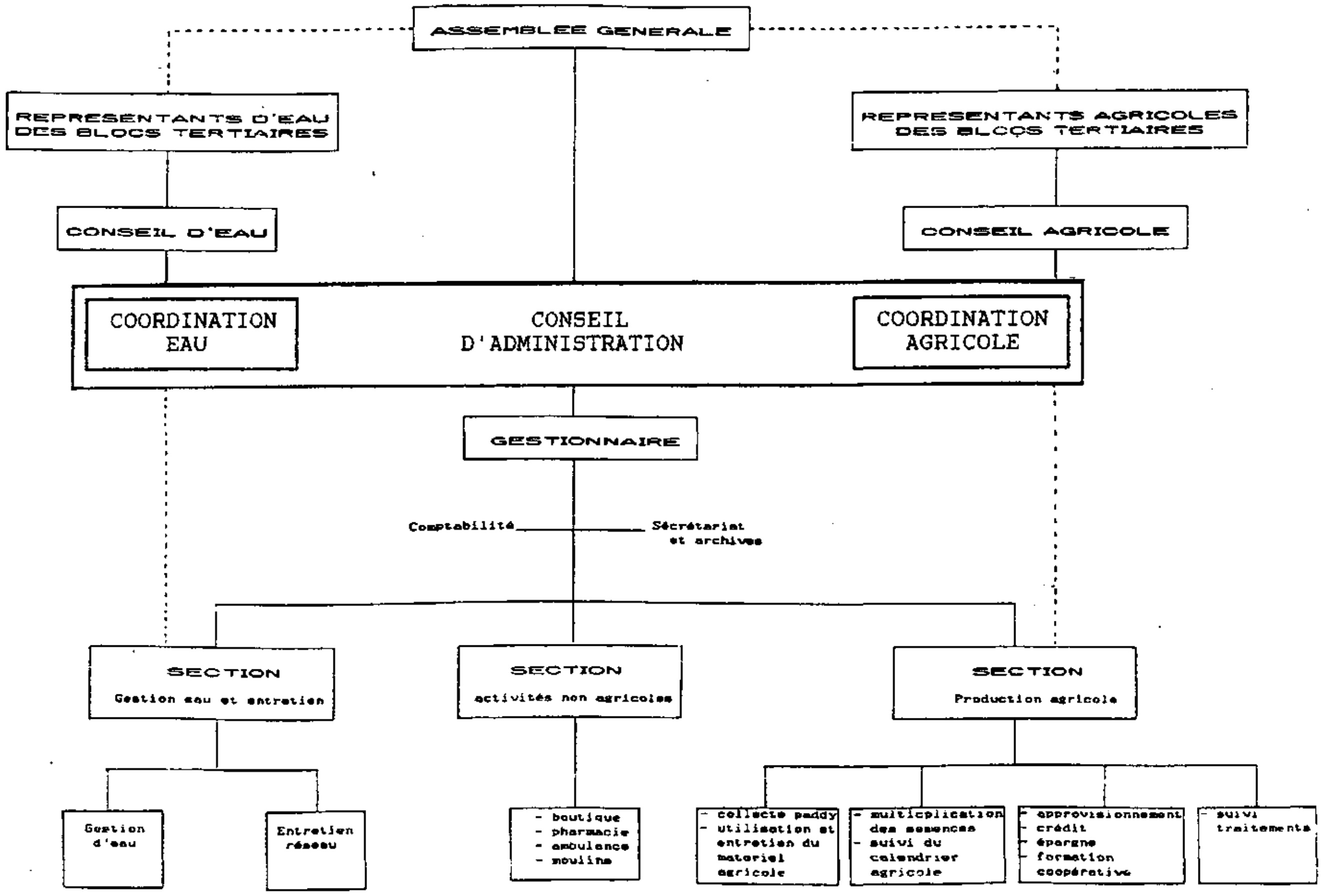
KOU
PERIMETRE RIZICOLE
DE LA COOPERATIVE DE LA
VALLEE DU KOU
ANNEXE 1
PROJET DE DRAINAGE DU
LAC DE BAMA
SERVICE HYDRAULIQUE


PERIMETRE RIZICOLE
DE LA COOPERATIVE DE LA
VALLEE DU KOU
PLAN DU RESEAU HYDRAULIQUE
BAMA
C.S 7A
C.S 8A
C.S 3
C.S 2
C.S 1
C.S: CANAL SECONDAIRE
C.A: CANAL AUXILIAIRE

LES RENDEMENTS



ORGANIGRAMME DE LA COOPERATIVE DES EXPLOITANTS DU PERIMETRE RIZICOLE VALLEE DU KOU



ANNEXE III

1. SUMMARY

This paper discusses some experiences encountered in Zimbabwe regarding the design of farmer managed irrigation systems. Efforts have been made to involve farmers in launching the National Farmers Irrigation Fund (NFIF) programme in which farmers meet the costs for infield infrastructural development, operation and maintenance. Farmers have participated in various ways in the process of planning, design and implementation of projects. Initially, formal and informal discussions are held through which the farmers's willingness to irrigate is assessed. Farmers are given a chance to express their opinions about the crops they want to irrigate, the methods of irrigation they prefer. Farmers are also physically involved by providing labour for some activities like fencing, trench digging, pipe laying, refilling trenches, bush clearance and canal construction.

On the other hand government through the Department of Agricultural Technical and Extension Services (Agritex) provides engineers and extension officers who assess irrigation potential, hold discussions with farmers on alternative irrigation methods and cropping patterns. As much effort as possible is put into consultations with farmers and the majority agree on the course of action implemented.

It has been observed that participation by farmers through discussions has provided some psychological involvement that shapes the farmers' attitudes and prepare them for the hard work

involved in irrigation. The farmers' physical involvement has built in them a feeling of belonging and responsibility for the scheme.

The Irrigation Engineers have, through farmer involvement, worked out design alternatives that suit the farmers's needs and expectations. When the designs are finally put on the ground the observations made so far have shown that the farmers become very responsive to the management procedures introduced. Because of the two way communication between farmers and engineers/extension officers in the process of developing farmer managed irrigation schemes, a lot of problems and misunderstanding that affect scheme management are minimized.

2. INTRODUCTION

It is becoming increasingly the trend that small-holder irrigation development, being concerned with people and not just the land, water and money requires a human approach. This human approach, in the context of this paper, refers to maximum farmer involvement in every possible way throughout the planning, design and implementation phases.

Many projects in Zimbabwe have been established with very little prior involvement by the beneficiaries. These projects are managed by a structured government organization on behalf of the settled small-holders. This approach gives rise to numerous problems that are a result of lack of commitment and responsibilities by the farmers. Farmers look at the irrigation scheme as belonging to government in which case their commitment is very superficial. Lack of farmer participation has been documented as one of the major contributory factors to poor performance (Bagadion 1986, Canewatte 1988, IMMI 1986). Involving farmers is an approach that has been tried in many third world countries and has proved promising and appropriate. Perhaps the question that has to be asked is: How and when to involve farmers?

However, this paper will specifically discuss the following issues under Zimbabwean conditions:

i) Activities in which farmers and government can get involved at some stages of the project cycle i.e. planning, design and implementation.

ii) Factors that facilitate the mobilization of farmers and enhance maximum farmer involvement in developing "their"project.

iii) Some advantages and disadvantages of involving farmers.

iv) The benefits for involving farmers.

3. BACKGROUND INFORMATION ON SMALL-HOLDER IRRIGATION SCHEMES IN ZIMBABWE

Some 74 small-holder schemes were established by government in communal areas between 1912 and 1980. These range in size from 2 to 400 ha. More schemes have been built after independence in 1980 and today small-holder schemes cover about 5 500 ha or 4% of the total irrigated area in Zimbabwe. In 1988 only 54 schemes were operational i.e. operating all or part of the command area. Various factors have contributed to the non-operational status of the 22 schemes which have been abandoned. These range from non-availability of spare parts for diesel engines, silted dams, the security situation in some parts of the country and general disatisfaction by the irrigators.

The maintenance charges currently applicable range from Z$145/ha/year for schemes with an assured water supply and growing two crops in one year to Z$30/ha/year in all sand abstration schemes.* An investigation done by government through a study carried out by consultants has shown that in the 1985/86 financial year, total operation and maintenance costs on the small-holder schemes overaged Z$780 per irrigated hectare. Therefore the present irrigation fee of Z$145/ha/year covers 19% of the average operation and maintenance costs. This is indicative of the level of government subsidy requirements in running the small-holder schemes.

* 1989 : One US dollar is equivalent to 2.25 Zimbabwe dollars.

Subsidies for investment in irrigation schemes are a one off item which can be increased or decreased depending on availability of government funds. Subsidies of the operation and maintenance (O and M) costs of irrigation schemes are on-going commitments which increase with inflation. Government is committed to increasing the pace of irrigation development on one hand and is also committed to reducing subsidies on the other. Since farmers are not able to pay for all the capital costs for irrigation development, subsidies for scheme investment will continue to be needed. But the costs of O amd M cannot be subsidised forever. This highlights the necessity for handing some of the financial responsibilities to the farmers; and this has to cover a greater part if not all the O and M costs. Therefore a funding procedure had to be developed which removes the financial commitment on O and M costs by government.

4. THE NATIONAL FARM IRRIGATION FUND (NFIF)

In view of the high development costs and the inevitable government subsidies to sustain the schemes, a new funding approach was introduced by forming the NFIF in 1985. This is a revolving fund administered by the Agricultural Finance Corporation (AFC). The fund is designed in such a way that farmers have a role to play by meeting part of the capital investment costs and all the O and M costs. The provisions of the fund under small-holder development are as follows:

a) Government provides a grant for head works i.e. from source to field edge under the Irrigation Support Fund (ISF).

b) Farmers borrow for infield infrastructural development for new projects under the NFIF.

c) The scheme has got to be financially viable to be eligible for funding under the NFIF.

d) Farmers should organize themselves into groups and borrow as a group - individual borrowing is not encouraged.

e) The interest rate for the money borrowed is 9.75% payable over 10 years. (This rate of interest is lower than the usual rate of 13% under normal AFC programmes).

f) The farmers should grow some crops marketed through statutory bodies like the Grain Marketing Board, so that AFC should make a stop order arrangement and recover their money on a regular basis.

g) Payment should be effected soon after the first crop i.e. no grace period is granted for either interest or repayments of capital.

5. EXPERIENCES ENCOUNTERED IN LAUNCHING THE NFIF PROGRAMME

Initially farmers were not keen to embark on the programme. For at least two years no scheme was implemented under the NFIF programme. This could be attributed mainly to the following reasons.

i) Irrigation is a new style of life to most communal area farmers and with the condition of group borrowing they can not trust each other when put in a situation they owe large sums of money as a group. Group borrowing is a new concept to the farmers. A lot of farmers need some time to organise themselves and fully understand the provisions of the fund because group borrowing means a lot to their families in cases of sudden death, for example.

ii) The majority of existing small-holder schemes have been fully funded by government including more than 80% of the O and M costs. The introduction of the NFIF is contradictory in a way to the precedent already set. It is not easy to convince farmers to borrow money under the NFIF yet the existing schemes are fully funded by government grants.

iii) The lack of a grace period and the commitment to grow crops marketed through statutory bodies, are some of the factors that make the fund less attractive on first hearing.

However, despite the above constraints, to date (October 1989) the Irrigation Division of Agritex has planned and designed 22 schemes, 10 of which are fully operational. These are fully operated and managed by the farmers. The Irrigation Division under the NFIF programme is responsible for identifying irrigation potential, planning, designing and implementation of irrigation projects for the small-holder farmers. In view of the experiences encountered in launching the NFIF programme, the Irrigation Division adopted the approach in which farmers participated as much as possible in all activities of developing the project. This approach is described below as follows:

After having identified the water resources and irrigable area in a given district, a series of farmer meeting are arranged to discuss with farmers as openly as possible the identified irrigation potential in their area. Advantages of irrigated agriculture are explained to them i.e. the benefits. In some cases field trips are arranged to visit existing schemes and let the farmers see for themselves and discuss with other fellow farmers and share experiences.

The provisions of the NFIF programme are explained to the farmers. Cropping programmes and marketing outlets for the produce are determined in consultation with the farmers. If farmers' crop choices are not agronomically feasible in terms of rotations and disease control, further discussions are held to make the farmers appreciate the inappropriateness of their choices.

The hard work involved in irrigation is discussed i.e. at least two crops per year, carrying out the irrigation proper, weeding, maintenance of the infrastructure, operating equipment and managing themselves in activities that require communal effort. The levels of financial and labour requirements are mentioned in general.

After several meetings with farmers to discuss the above aspects, they are given time to digest and discuss among themselves.

Further meetings are then scheduled to assess the genuine interest and commitment by the farmers. Farmers, with the assistance from extension staff, draft a constitution and bye-laws that would guide the members in handling the day-to-day affairs of the project. An irrigation management committee is formed, members of which are voted in by the farmers. This committee will be a representative body for the farmers. The major positions are: Chairperson, Secretary and Treasurer. All the bye-laws and disciplinary measures will be enforced by the Committee. The willing farmers would show their commitment and acceptance by putting their signatures on paper.

Once the farmers have committed themselves the engineers from the Irrigation Division start on the topo-surveys and detailed soil survey and analysis. Detailed designs for infield works with bill of quantities for alternative irrigation systems are prepared. The alternative designs are explained to the farmers i.e. the advantages and disadvantages of each in terms of method of operation, capital cost, (which farmers have to borrow under the NFIF programme), replacement costs, operational costs and management requirements. The alternative designs usually include drag-hose, semi-portable sprinkler system and where possible a surface irrigation option. Designs are made in such a way that they accommodate the farmers expectations as much as possible. For example with a cooperative approach irrigation takes place in a block system whereby all sprinklers are located in one block of land at a time. Although this increasesthe number of lateral lines or hydrants in comparison with the drag-hose and semi-portable systemsit allows the farmer to irrigate one crop efficiently. With individual plots under a sprinkler drag-hose system each farmer has his/her own equipment for which he/she is responsible. Each plot receives the same volume of water regardless of its location within the irrigated area. With surface options farmers have the choice of one individual plot for all crops along one field canal or having one crop grown together with other farmers along one field canal - in a block farm - but still maintaining small individual plots.

small individual plots.

The reasons for choosing a particular design alternative by farmers can be many and include capital and operation costs, previous experience with certain systems of irrigation, whether equipment is shared or not. The drag hose system is very popular with most farmers because they prefer to own and use their own equipment in the field without sharing.

When the most appropriate design is finally chosen by the farmers, their physical involvement is called upon. They provide labour for fencing the scheme and bush clearance. They dig trenches for piping if need be and provide labour for canal construction.

Such discussions with the farmers are important for shaping their attitudes through which they develop a feeling of belonging and possessiveness for the project. Because farmers will have contributed by giving their opinion in the process of developing the irrigation they feel they are an important part of the process of developing the irrigation scheme. This is consolidated further by the financial commitment and the provision of labour for some activities during implementation.

On the other hand, government provides the engineers who identify the irrigation potential and initiate the project. The engineers plan the project to detailed designs, supervise contruction and make the necessary tendering procedures. Through the extension staff farmers get advice and training on record keeping, water management, agronomy and general operational procedures of the equipment. Farmers are further advised on marketing and procurement of agricultural inputs.

The provision of unskilled labour by the farmers teaches the farmers how to carry out construction works which in turn will help them when repair and maintenance works have to be carried out. For example farmers have already been able to repair PVC and A/C pipes during the first seasons of operation in the Mutoko schemes.

A comparison between Insukamini Irrigation Scheme (designed without involving farmers) and Tagarika Irrigation scheme (designed under the NFIF programme) can demonstrate the difference. Insukamini was designed as if it were a commercial farm subdivided into one hectare plots. It was designed for monoculture with farmers sharing sprinkler laterals. Farmers have started growing crops that were not included in the design. The crop water requirements under the "farmers'" cropping programme is different from what the equipment can supply. Problems are encountered in scheduling irrigation for people sharing equipment and growing three different crops in a given plot. If farmers were involved in the planning process their wishes to grow more than one crop at a time and to have their own equipment would have been included in the design.

At Tagarika Irrigation Scheme farmers are growing crops they want, they own their infield equipment and because they have been party to the development of the project farmers are more responsible in handling equipment and more responsive to extension advice given them.

When the scheme is finally implemented farmers are trained in running the pump house, irrigation cycles and scheduling. During the first season efforts are made to visit the scheme on a daily basis by extension staff; to give technical advice on irrigation, agronomy and organizational issues such as acquisition of inputs and disposal of produce to market. The yields obtained during the first year of operation are encouraging: maize up to 8 tonnes/ha, potatoes up to 20 tonnes/ha, onion 30 tonnes/ha, cabbage 40 tonnes/ha.

These farmer participatory approaches have been applied at 22 different schemes involving some 484 families. Ten of the schemes have been constructed in which some 240 families are engaged in irrigated farming. The observations made in these schemes are encouraging. These are given below as follows:

i) The level of farmer commitment and responsibility is fairly high. This is evidenced by the fact that all the irrigators do not have any outstanding debts.

ii) All the equipment and infrastructure have been operated and maintained reasonably well by the farmers.

iii) Farmers have been able to make minor repairs on their own on broken pipes, leaking canals and hydrants.

6. FACTORS THAT FACILITATE THE MOBILIZATION OF FARMERS AND ENHANCE MAXIMUM PARTICIPATION IN DEVELOPING THEIR PROJECT

The foregoing discussion has highlighted that a two way communication between farmers and government professional officers is an important pre-requisite. The farmers have to be convinced of the importance of their participation. This was put forward to the farmers by expressing the importance of their involvement so that what ever scheme is finally implemented they understand and appreciate why certain decisions were taken.

The irrigators have to get motivated to participate and the incentives for participation have to be visible, tangible and achievable. These were achieved by taking farmers to existing schemes to appreciate the benefits that can be accrued from irrigation. After seeing what other farmers can do and achieve, the farmers in the new project got motivated and gained confidence in their new venture.

Problems do emerge where close integration of technical, and institutional activities is lacking. The irrigation system should be developed simultaneously with the management capabilities and organizational skills among the irrigators. Farmer involvement in the planning, design and construction activities enhances the farmers' understanding of how the scheme would operate. Furthermore, farmer participation in making decisions and carrying out certain tasks is the basis for building group solidarity and imparting technical and social skills that will make the group activities effective in the long run.

Farmers can be easily motivated by looking forward to some benefits in various forms that can be accrued from the project.

Motivation of government personnel is always a neglected issue. Government personnel should be motivated enough to be wholeheartedly committed in promoting farmer participation. The question is: How can government personnel be made accountable for effective farmer involvement? What incentives are available for government personnel? This is an area where government can play a significant role.

7. CONCLUSIONS

Government has started on the right course of action through which grants and subsidies are reduced by placing financial responsibility into the hands of farmers. The question is: Can the farmers sustain the system when wholly handed over to them? What does the future hold for these newly developed farmer managed irrigation systems? This is only the beginning, all the parties concerned are still in a learning situation and what has transpired so far is promising and encouraging. A monitoring and evaluation programme to look into these schemes as they grow has been set up. Some close observations through the Monitoring and Evaluation unit will generate information that will be useful in developing future schemes. Problems and costraints that affect farmer managed systems will be highlighted and their causes identified. The good aspects of the systems that should be maintained and replicated in other locations will be noted.

However, the following observations encountered in this Zimbabwean case are worth highlighting.

i) Organising people is not easy because the process, in this Zimbabwean case, involves changing the people's culture, habits and values. Irrigation is a new style of life which seeks to evolve people's lives from subsistence agriculture to cash-cropping. This calls for maximum commitment from all parties concerned. Farmer participation does not involve only physical engagement, it also has a lot to do with the psychology of the farmers, their attitudes, and level of motivation. Furthermore, the parties involved should be highly motivated.

ii) The cooperative approach by way of sharing equipment has not proved popular in the NFIF programme. Farmers do like individual responsibility for using and replacing infield equipment. The accountability inherent in the drag hose system, designed such that sharing of infield equipment is eliminated, encourages farmers to use equipment more carefully. This can only be decided by the farmers themselves after discussing alternative designs with them.

iii) On schemes that have been implemented so far, there is some evidence to show that farmer participation through the provision of information on their needs and expectations enables the designer to do the following.

a) Produce a design that can accommodate the farmers needs and requirements in terms of crops, ownership of equipment, labour availability, operational procedures such as irrigating at night etc.

b) Produce a desigh that when finally put on the ground can be operated and maintained by farmers with minimum supervision.

These are some of the contributory factors to management problems and poor scheme performance if they are not clarified with the farmers during the planning and design stages.

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SUMMARY

This paper is an attempt to highlight some strategies in formulating a positive relation between technical and organisational choices in improvement programmes of Traditional irrigation. Traditional irrigation as described in the paper express the existence of early irrigation practice in Tanzania. "Irrigation has been practiced in Tanzania as far back as history can trace. The now defunct, elaborate canal system.... was built during the pre-European days".(1)

It is emphasised that formulation of plans for improvement of traditional irrigation should consider the various essential means of achieving the goal of sustainable irrigated agriculture. Organisation and management issues are thus recognised as the first step before making a choice of alternative technical designs. The involvement of farmer groups at all stages is considered significant. Basically, it is pressumed that the local situation will govern the defining of project organisational structure and alternatives for technical designs. The generalised conclusions are only meant for traditional irrigation in Tanzania.

INTRODUCTION

Perhaps, the most difficult task in designing a framework for a farmer-oriented irrigation scheme is how to reconcile the relevant technical and organisational choices. In most cases, the importance of such reconciliation is hardly realised until the problems of operation and management are encountered

It is true that very often, the government wish to reduce its participation in operation and management of irrigation schemes. Unfortunately, this government wish has not been fulfilled as irrigation schemes are growing weaker, dependent, and the investment returns are disappointing. In the case of

Tanzania, one of the reasons for such a situation is the fact that the government has never succeeded in formulating an irrigation programme which logically reconciles the different interrelated aspects of irrigation development - technical and organizational. As a result, the efforts of the government in irrigation development since the early 1930s have been a failure. Government assistance had ranged from providing cement to furrow groups for construction of intakes and main canals to replace the local ones.

In this paper I shall try to illustrate how the "Traditional Irrigation Improvement Programme" attempted to reconcile the different aspects in improvement of some of the surviving traditional irrigation systems in the country.

HISTORY

The traditional irrigation improvement programme was preceeded by an inventory study. The major tasks of the inventory study included the identifiction of social economic characteristics of the local communities, management requirements and eventually, formulation of a programme which reconciles the technical and organisational aspects of irrigation improvement. The study came out with a proposal for an "integrated approach" Programme.

THE PROBLEM

Although no exact data are available, it is estimated that even after fifty years of government involvement in development of medium scale irrigation, 79% of the irrigated land is still traditional(2). However, production of crops in traditional irrigation areas has continued to fall due to newly emerging technical, environmental and organisational problems. Among others, there are two main causes of the Problem, namely, rapid population growth and technological limitations. The two causes are illustrated in fig. 1 and 2 on the next page.

Figure 1: Rapid Population Growth

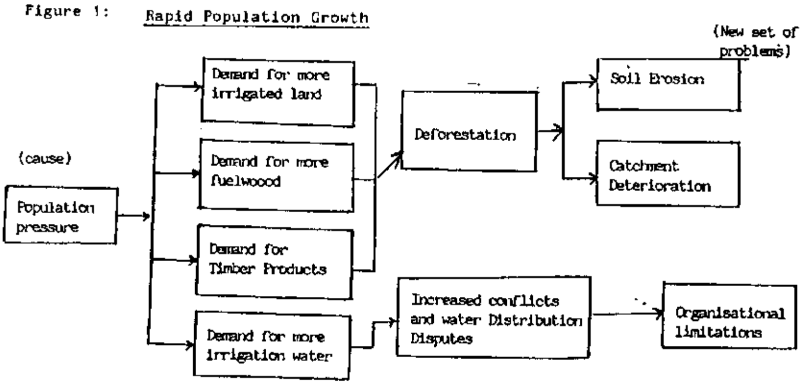
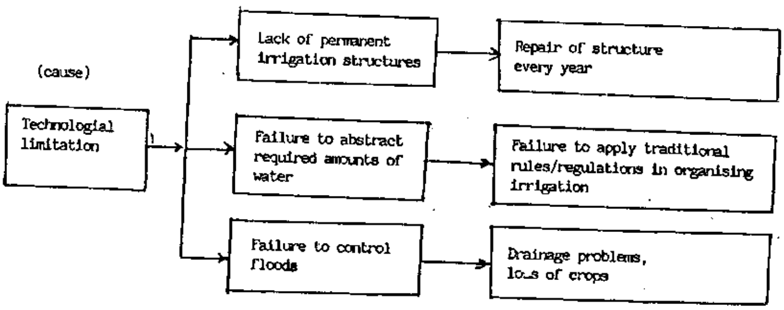


Figure 2: Technological limitations



Based on the analysis of these problem illustrations, the proposed programme envisaged a combination of social organisation, environmental protection and irrigation engineering as the most appropriate approach.

INTEGRATED APPROACH

Integrated approach as suggested here implies that the final goal of the programme can be achieved through the interraction of the related aspects (fig. 3). The integrated approach is found useful in overcoming the difficulties of coordinating the different aspects of irrigation improvement e.g. it can assist solving problems ranging from socio-economic conditions of the farmers to their technical and physical/environmental inhibitions.
The idea of integrated approach was a logical conclusion of the inventory study. The study had drawn the following main conclusions:

a) Irrigation tradition has existed in some parts of Tanzania for hundred of years. At present, a substantial amounnt of irrigated crops in Tanzania is still produced by the traditional irrigated areas.

b) Because of numerous socio-economic and physical/environmental changes the traditional irrigation knowledge/organisation needs to be technically supported.

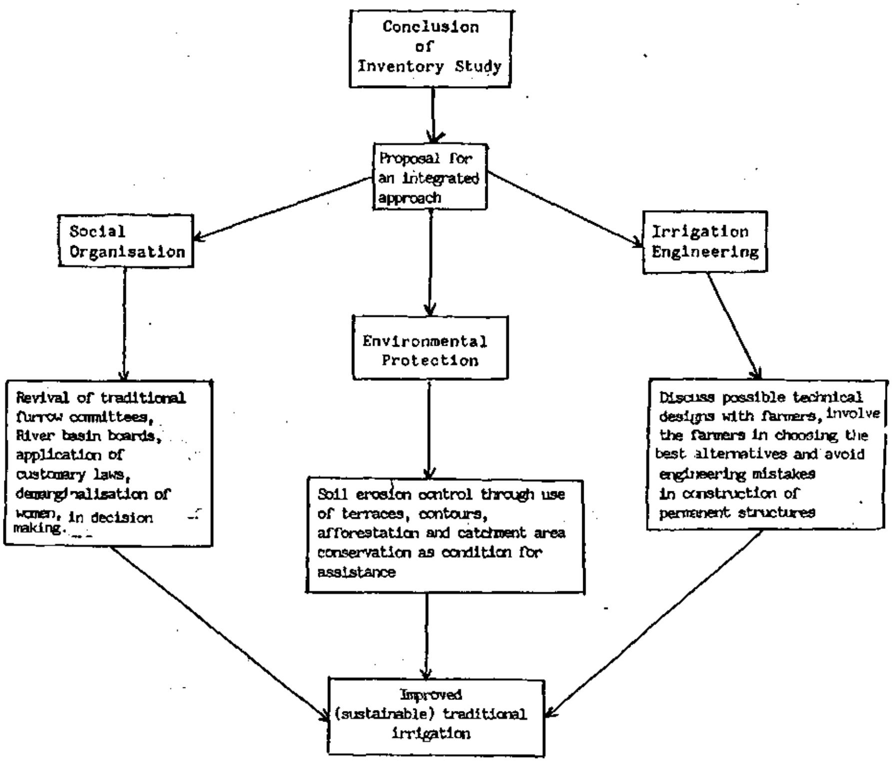
c) A meaningful develoment in organising irrigation in Tanzania can be achieved if the existing traditions are put into consideration and if due attention is paid to the surviving areas of traditional irrigation. In such areas, it is much easier to introduce a programme as the farmers already know the benefits and can be organised.

d) In order to improve traditional irrigation, an integrated approach is desirable. This will have to combine improvement of irrigation structures, protection of catchment areas and soil erosion control, and re-establishment of organised farmer groups.

e) In order to fulfil objective (d) above, it is essential to revive the traditional furrow committees and form river basin boards. This should be done at the village/project levels.

The three major components of this sequence of logical conclusions are thus social organisation, environmental protection and irrigation engineering itself.
A brief illustration of facts established is illustrated in fig. 3.

Figure 3: Integrated Approach



SOCIAL ORGANISATION

"...... The poor performance of irrigation schemes is not only a consequence of technical deficiencies in the design of irrigation systems ..... but many of the problems stem from weaknesses in the organisation and management of the schemes".(5)
Social organisation in an irrigation community is of primary importance. Traditionally, there were several Socio-economic rules that enabled the organisation, control and maintenance of traditional irrigation schemes. In most of Tanzanias hydraulic societies, construction of individual irrigation furrow was associated with clans. Organisation of water distribution differed from society to society - but mainly based on either a council of elders or a water manager. These performed their duties as an honorary task. Maintenance of irrigation systems was also organised such that members felt obliged to clean their furrows and repair the headworks once every year or sometimes twice a year.

When disputes or conflicts occured, they were traditionally solved through the customary rules of penalties or fines after deciding who was right or wrong. The rules differed from one community to another.

However, the traditional social organisation of irrigation as here described had drastically changed and the different forms of water control are vanishing. Even though, in Tanzania, there are still modified social systems based on the customary laws of the people which are effective. This means that, some elements of the traditional rules can be adapted into the Programme. Under the 1975 Ujamaa Village Act all villages in Tanzania are registered and have "Village governments", which have a 25 member Village Development Council(VDC). The 1984 Local Government Authority Act allow establishment of a special village council

(Baraza la Usuluhishi) which can solve disputes and conflicts other than criminal cases. Thus, disputes on water distribution can be solved at that level.
Remnants of the traditional organisation is also found in the Mobilisation of people's participation in communal work (e.g. "Mtharagambo" in the case of Pare Mountains). Here the customary rules of penalty are applied for those who fail to participate in communal work.

It is no wonder, therefore that the initial task of our Programme upon selection of project villages is purely organisational. First, the traditions of having furrow committees, river basin co-operation and strengthening the self-help spirit are revived. As a modification of the tradition, formal agreements are signed between the district and the project villages. In these agreements the duties of both parties are specified. Because of the increasing number of female headed families and changing role of women, the programme motivates women groups and insists on their involvement in the decision making bodies. Thus, along with commencement of programme activities, a socio-economic research with emphasis on the role of women is conducted. The position of deprived group and demarginalization of women is therefore clearly looked into from the outset.

ENVIRONMENTAL PROTECTION

Volume one of the inventory study made the following remarks:
".....The evergrowing demand for land and fuelwood, combined with the extension of furrow systems resulted in deforestation and drying up of rivers and springs........ With the continuous deforestation and absences of an effective government programme, the water and land situation in the traditional irrigation areas has deteriorated......"(6)

The study further remarked:
"To assist local irrigation in such a situation also calls for an attention on the environmental concerns........any programme

to improve irrigation must therefore assist also the protection of water catchment."(7)

The problems of catchment area conservation was not an issue in the past. For many years, natural forests remained untouched because of various reasons. Forests were sometimes associated with local myths (e.g. sacred forests) and people feared entering them. People also feared forests because of dangerous wild animals. Cultivated lands were smaller, fuelwood demand was less and timber products were rarely used. All these factors contributed to protect natural forests and catchment areas and thus most rivers maintained their regular flows.

During the last two decades, a rapid population growth took place in the traditional irrigation areas. This led to the extension of furrow systems, cultivated land, and more wood was exploited for fuel, timber, and other building requirements. Consequently, deforestation took place. The end result was severe soil erosion, and a drastic decline in irrigation water supply. The flow of water over bare hillsides also led to increased rates of sedimantation in the lowland systems and more engineering problems to the existing local structures.

The traditional irrigation improvement Programme considers environmental protection as an important technical problem which needs to be solved within the framework of the proposed social organisation in an irrigation community. The activities of soil erosion control (terracing, contouring, ridging, etc.) and catchment area conservation (afforestation) are therefore also organised on the same basis as those of irrigation itself.

A meaningful programme to improve traditional irrigation also requires a reconciliation between the measures to protect catchments and their social implications on the lives of the people. For this reason, it is more logical to solve the environmental related problems as a second step after social organisation in formulating an improvement programme.

IRRIGATION ENGINEERING

The traditional irrigation technology included various solutions for diverting water, overflow/spillway structures, irrigated terraces, aquaducts or divetions to cross gullies and night storage reservoirs. In areas with stones and boulders, the structures were more permanent.

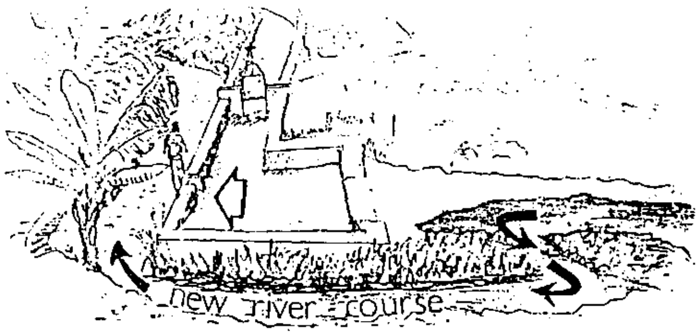
The extension of irrigation furrows in recent years has led to a series of new technical problems. Because of population pressure, people have also shifted from the mountains to the plains. Construction of intakes is more problematic in the plains and salinity and alkalinity problems are emerging. The first major task before embarking on technical designs was to explore, in collaboration with farmer groups, all the possible technical options. In the case of Hingilili river basin, the technical tasks were identified as: a) Construction of permanent intakes for the water control, b) Protection of mountain furrow, reduce the erosion hazard and increase water use efficiency, c) construction of Mariranga intake after thoroughly discussing the design with the farmers.

In the case of Mariranga intake, excavation of a floodway, as discussed by furrow members from four villages, is assumed to be necessary. The organisation of self-help during the survey of floodway provided valuable information about the expectations and interests of the participating groups in shaping the project designs.

The design of the intake will be based on both technical and socio-economic data. Contribution of the farmers during the construction of the intake include collection of stones, excavation work and other labour requirements within the ability of the farmers.

The programme bears in mind that technical intervation in traditional irrigation is a risk. The number of collapsed intake structures in Tanzania due to ill-designs or bad construction work are numerous(8). Because of ill-structures, rivers can change course and this can be disastrous to traditional irrigation like in the case of Miegeo Project, Lushoto (fig. 4)

Figure 4: Risk of assistance



It is therefore important for the Programme to ensure the provision of technically adequate designs as one of the factors determinant in establishing a sustainable irrigation project.

CONCLUSION

The best opportunity for reconciling organizational and technical choices for a small holder irrigation scheme should be found right at the time of formulating the programme. The choices will definately depend on the irrigation form in question and its local context.

There are probably various strategies under different geographical circumstances. In the case of Tanzania, there was a need to carry out an inventory study and appraise the best approach for improvement of the indigeneous local systems. The assesment of environmental and socio-economic impacts are essentially taken as an integral part of the designing process.

The first step in choosing project village is based on the answers to questions such as: Is it possible to organise the farmer groups at the local level? How? What is the level of the farmers previous experience in organising irrigated agriculture? What is the degree of social cohesion within the farming community? What is the degree of women demarginalisation in decision making and what is the degree of their traditional involvement in irrigation agriculture?

From the answers, alternatives for environmental protection and technical choices are explored. These should not contradict the social structure. A participatory approach is essential in making improvement designs. The basic idea is that farmers must also play a role in the execution work and be responsible for management and maintenance.

Therefore, no technical improvement work is commenced until its design choice is agreed upon by a meeting of the farmers group. By providing self-help labour, farmers are made to participate in the actual execution of technical work.

FOOTNOTES

(1) FAO: "Water Development planning and soils aspects of irrigation Development." Report to the Government of Tanzania. Rome, 1969 (pg. 9)

(2) Mrema, G.C. "Development of samll holder irrigation in Tanzania: Problems and prospects". Paper presented at the African Regional Symposium, University of Zimbabwe, Harare.(1985)

(3) Rapid population growth as it affects irrigation is also mentioned by irrigation and drainage paper, no. 40, Rome, 1982, pg. 1 (titled, Organisation, operation and maintenance of irrigation schemes).

(4) The FAO paper described in footnote (3) above also mentions (pg. 1), the importance of adequate technical choices in designing good projects. Technical limitations can lead to a series of problems.

(5) Ibid (pg. 1)

(6) Burra R, and K. van den Heuvel: Traditional Irrigation in Tanzania. Vol. I, SNV-Dar es Salaam, 1989. (pg. iii - iv)

(7) Ibid (pg. 90)

(8) Ibid (pg. 74)

1. Introduction

Modern (ie 20th century) attempts at irrigation development in sub-Saharan Africa have met with numerous difficulties and setbacks (Adams and Grove,1984; Carter,1989b; ILRI,1985; Underhill,1984). In many cases irrigation schemes have proved to be unsustainable precisely because their design has failed to include and involve the intended users. Recent emphases on farmer participation in planning, design and construction, and farmer-management of completed schemes, are the result of a learning experience which has been largely at the expense of small farmers. In some cases the change in emphasis has been forced by shortages of funds and competence within national implementing authorities, and a fundamental change of approach may be yet to come.

As new approaches to irrigation development have begun to emerge it has become increasingly evident that there are major shortfalls in understanding, competence and skills at all levels. Politicians and planners are often woefully ignorant of the issues involved in irrigation development, and hence their policies (such as exist) are weak or inappropriate. Engineers and other professional and technical personnel often lack practical competence, and they still too often prefer to impose schemes on intended "beneficiaries", rather than involve them in dialogue. Farmers in turn may be experts in survival and in the management of scarce and uncertain resources, but the management of irrigation water and participation in many previously unnecessary kinds of group action may be quite new to them.

The panacea to these sorts of shortfalls in understanding, competence and skills has seemed obvious : training. Donors and recipient organisations alike have eagerly adopted training as a necessary and desirable component of development projects, often without thinking through all the implications fully. And yet the planning, delivery and utilisation of training have not been without their problems. As with most instant "fixes" training is an inadequate solution to the sustainability problem; as with all irrigation developments, a great number of things need to be right simultaneously to achieve success. Training is just one, albeit an important one, of these many components of sustainable irrigation development.

This paper puts forward two theses on training in the context of sustainable irrigation development. The first is that the role, objectives and nature of training as an external support to development have been misunderstood. Training has sometimes been misused, inadequately planned, or poorly delivered, and it has therefore been ineffective. This however need not be so. Guidelines can be given to improve training performance and results, and this paper attempts to do so.

The second thesis of the paper is that there is much room for improvement in training methods themselves. Conventional methods of training, especially techniques of agricultural extension applied in the irrigation context, are unimaginative. Irrigation training at all levels could be improved by the adoption and adaptation of techniques used in other fields, such as community health and organisational management. Moreover, just as development itself is becoming more of a participative process, so too training must become less didactic and more of a process of dialogue.

This paper arises from a wide range of experience of the authors in irrigation development in sub-Saharan Africa and Asia. The authors are convinced not only of the importance of high quality training, but also of the necessity to consider training as part of the design process. Scheme design, project design, and indeed national policy design all need to include training in order to ensure the sustainability of the developments which are proposed.

2. The Context, Role, and Delivery of Irrigation Training

Context

If the design of irrigation project hardware (source works, canals, pumps) or software (community-authority dialogue, farmers' organisations) is inadequate, then training added on as an afterthought will be of little value. To be effective training must also be set in the context of the right irrigation development policies, effectively managed irrigation authorities, and adequate funding for scheme implementation.

The first of these, irrigation development policy, is a neglected but crucial issue. Few countries in sub-Saharan Africa have a clearly enunciated policy for irrigation development, far less an explicit strategy for realising that policy. Policies such as exist tend to be framed in very general terms, omitting any detailed appraisal criteria by which proposals can be judged. Although this state of affairs is in part a reflection on Governments' weakness in this area, it is in many cases also a problem caused by the influential but uncoordinated power of donor organisations. The pressure on Governments to accept donor funding without questioning too much the project design should not be underestimated. There is clearly a need for training of policy makers and planners, both in Government and in donor agencies (see section 7 below); and until policies become more clearly and realistically formulated, training at lower levels will have limited impact.

The second necessary context for effective training is good management within the implementing authority. Lack of staff supervision, poor motivation or morale, and inadequate control procedures and documentation all lead to a situation of organisational ineffectiveness. Training alone cannot solve this type of problem, although management training in particular can certainly have a role here.

If the right policies and good management are necessary, then adequate funding and physical resources (offices, vehicles, field equipment) for project implementation are equally vital. The case study (see section 8) describes a situation in which, until recently, funds and equipment for scheme implementation have been virtually non-existent. No amount of training can address this situation, and indeed the usefulness of training is likely to be very limited if trainees then have no opportunities to practise their new skills and knowledge.

Role

What then can training hope to achieve in the context of sustainable irrigation development? So far we have emphasised the constraints to the effectiveness of training, so what then is its role?

Training is the transfer of knowledge and skills. Traditionally this has been seen as a one-way process, from trainer to trainee; in its extreme it has sometimes been limited to the passing on of very specific practical skills. Neither of these last two ideas are helpful in the present context. Training here must be a process of dialogue, and it must emphasise not just the transfer of specific skills, but also the capacity to think and to solve problems. Seen this way training can have important roles in assisting policy making, in upgrading the competence of technical and professional staff, and in communicating skills and knowledge to farmers. Carried out effectively training is an enabling and empowering process which can enrich both trainer and trainee.

Delivery

The delivery of irrigation training at all levels in relation to sub-Saharan Africa is very open to criticism. Some of the weaknesses of both in-country and overseas courses, and also in-service training provision, have been highlighted by one of the authors (Carter,1989a) elsewhere. Three main issues are emphasised here.

Firstly international as well as in-country courses in irrigation (usually for professional and technical staff), while often emphasising the development of problem-solving and design capabilities, frequently encounter a major obstacle. This is that trainees from the Region have rarely, either in their previous education or professionally, had the opportunity or indeed the requirement put upon them to make judgments and decisions. The acquisition of an independent, problem-solving mentality takes time, and it requires much practice, including learning through mistakes.

Secondly in-service training in irrigation is frequently unstructured and weak. There are few opportunities for relevant training and experience, except through donor-funded, project-related (and therefore short-term) training courses or other ad hoc programmes. Few countries in the Region have structured training programmes for designated staff categories, so that it is largely a matter of chance as to what experience and training an individual staff member receives.

Thirdly, although most donor-funded irrigation projects include an element for training, this training is often poorly planned and uncoordinated with the activities of other projects. Moreover, the amount of preparatory work and planning needed to mount an effective training course is often grossly under-estimated.

3. Guidelines for Effective Training

Training is often perceived as a "soft" science, lacking rigorous methodologies, and easy to carry out. This is far from the truth. Unless training is planned and structured carefully, it will lack effectiveness. An assessment of training needs should be followed by a formulation of clear objectives which are susceptible to later evaluation. Appropriate training methods should be selected to match the identified objectives, and suitable written, visual or other materials prepared. The effectiveness of training should be evaluated, not only in the usual way through questionnaires, but also through more objective testing of trainees' abilities.

Training for sustainable irrigation development should stress problem solving. This demands not only a mastery of techniques, but also, and more importantly, experience and judgment in the selection of techniques appropriate to a particular situation. No two irrigation schemes are exactly alike, and so every situation is new. Technical and professional level staff especially must be able to think independently and in a rigorous and logical fashion. However this principle applies also in farmer training. A communication of understanding, and not merely of technique, is essential if training is to have a truly enabling role.

Irrigation training must be practical, involving doing, and not just seeing or hearing; the temptation to avoid field work and practical exercises is strong, but it must be resisted.

Irrigation training must be integrative. It should bridge gaps between technical disciplines (eg agronomy and engineering; engineering and environment; water management and public health; farm mechanisation and scheme design), as well as between the technical and managerial issues involved in farmer management of irrigation schemes.

4. Who to Train

It will be evident from what has been said so far that training has a role at all levels of irrigation programme and project design.

Firstly, and most obviously, the end users and direct "beneficiaries" of irrigation schemes, namely farmers and rural communities, require training to assist them to take an active and informed part in the development of their land and water.

Secondly, there is a need to train technicians and professional staff. The agencies directly involved with the implementation of irrigation projects, whether Government or non-Governmental, need structured training programmes addressing both technical and non-technical (management, socio-cultural and economic) issues.

Thirdly there is a need to train policy makers. In the formulation of irrigation development policy and strategy, Governments and donors should engage in dialogue with engineers, researchers and others with experience in alternative approaches to irrigation. Experience should be transferred and policy and strategy formulated through this sort of training partnership of planners and subject specialists.

In the three following sections the objectives and appropriate methods for training these three groups are considered.

5. Farmer Training

Objectives

Training of farmers and rural communities should be part of the process of enabling and strengthening farmer participation in irrigation development. The establishment and training of water user groups is often a key element in achieving sustainable farmer managed irrigation schemes

(Smout,1986). However, it is important to stress that training should not be mis-used as a substitute for true participation. Training should not be seen as a tool to fit farmers for what is otherwise an imposed project.

Four distinct objectives can be identified in training farmers for sustainable irrigation development. Firstly training should be used to raise awareness during the planning/feasibility stage of projects. Farmers who are familiar only with rainfed cultivation or unsophisticated "traditional" irrigation methods may be quite unaware of both the potential, and also the possible problems, which more formal or technically sophisticated irrigation may bring. They are unlikely to have much knowledge of the range of options which are open to them in technical and organisational aspects (nor of the options which may be closed because of particular local physical, social or economic conditions).

Secondly, most forms of irrigation development require, or at least benefit from, cooperation in activities such as channel maintenance, water allocation, and input acquisition. Farmer training should therefore be used to mobilise such group activity.

Thirdly, training is needed to transfer the skills needed for such group activities (for example group decision making, simple book-keeping).

Fourthly, individual farmers can benefit from training in aspects of farming which are specific to irrigation, such as field-level water management and pump maintenance, as well as more general farm management skills such as record keeping and farm finance.

Methods

Training of farmers, perhaps more than any other group, must be highly practical, field-based and participative. Arguably the major difficulty with agricultural extension in this Region is the shortage of suitably qualified, experienced, motivated and resourced field level extension agents. Although irrigation extension suffers the same difficulties as the rainfed sector, at least it has the potential advantages of more distinct geographical boundaries, and, usually, higher levels of investment in training.

Demonstrations of irrigated crops and cropping systems, water management methods, and farmer organisations can be powerful, especially if carried out on real farms rather than under unrealistic research station conditions.

Much depends on the rapport built up between the extension agent and the farmer or farmer group, and training methods may range from formal meetings or structured courses to informal and ad hoc contacts and activities.

Because of the limited experience and knowledge of many extension agents, it is important that they are supported by a strong research/extension service which can supply regular, relevant, simple messages (for instance via a T & V type system) together with visual and written materials.

Since farmer training or extension is so closely bound up with the process of mobilising and enabling farmers' participation in scheme development and implementation, it is appropriate to seek innovative training techniques from other developmental fields. The emphasis on community participation is perhaps strongest in community health and primary health care; in this field a whole range of novel and interesting training methods are used, including song, dance, drama, and role-play (Werner and Bower,1982). So far little appears to have been done to adapt and adopt these methods for use in irrigation extension. The authors are just beginning work in this area at the present time, with international funding.

6. Professional and Technical Level Training

Background

The welcome new emphasis on farmer participation and management in irrigation development requires a fundamental re-orientation of attitude among professional and technical staff, particularly in Governmental agencies. The radical nature of this attitude change should not be under-estimated. Until very recently the approach and attitude fostered, deliberately or unwittingly, by technical education and the work environment was a top-down, expert one. The engineer, the technician (even the lowly extension agent) was the expert who, through the benefits of education, knew what was good for the "illiterate" peasant farmers.

Now while this attitude still persists in too many irrigation authorities, it is gradually being eroded and replaced by a more enlightened approach. This approach is one which is people-centred in its approach to development, and participative in its orientation to problem-solving. Robert Chambers (1989) usefully makes the distinction between the "Transfer-of-Technology" approach (the expert or top-down attitude) and the "Farmer-first" way. He talks further of the desirable attitudes of the professional being HUMILITY, a willingness to make ERRORS, and an openness to LEARN, so leading to PROGRESS (note the mnemonic HELP). Professional and technical training in irrigation should reinforce this farmer-centred approach, rather than the unhelpful traditional attitudes.

Carefully planned, tightly structured, participative training of professional and technical staff can not only result in significant improvements in competence and performance, but can also greatly boost morale and motivation (Burton,1986; Burton et al,1987).

All that has been said so far relates most particularly to Governmental and other "technology-based" agencies. Many non-Governmental development organisations already have a well developed community-centred attitude, while the weaknesses of their staff may be greater in the area of technical competence. Clearly the training priorities of these groups are very different. Because of their complementary expertise a far higher degree of professional contact between Government irrigation agencies and NGOs is desirable.

Objectives

Against this background the objectives of training at these levels should be to :

- instill an awareness, sensitivity and sympathy towards other value systems, cultures and forms of practical and technical knowledge (indigenous technical knowledge)
- enable technical staff to communicate effectively with rural people, including explaining technical issues in language understandable by farmers
- achieve mastery of technical and engineering skills and problem solving.

Methods

Training of technical and professional staff can be conveniently divided into general educational courses (often international) of long or short duration, and in-service training.

Training courses, whether leading to a formal qualification (such as a Masters degree) or not, should emphasise principles and problem solving approaches. If they do not encourage, and indeed require, trainees to think independently, then they fail to meet the needs. Integrating mechanisms such as group design projects, and simulations and games, should be used alongside conventional methods of transferring skills and knowledge. Practical field work should be prominent, as well training in management and communication skills. Links between educational institutions in "first" and "third" world countries should be fostered, with the aim of strengthening the training institutions of the Region.

In-service training should include close, structured, and documented supervision by a senior engineer or other specialist, field attachments, networking and exchange of experience even at junior levels, and professional or technical recognition through national institutions (not only for engineers, but other disciplines too). Short courses undertaken in-service (usually in-country) should be accompanied by procedural manuals which lay down the current guidelines and working methods of the national irrigation policy. In-service training should be coordinated, monitored, and in part implemented by experienced trainers working alongside the full-time scientific and engineering staff.

7. Training the Policy Makers

Background

Some of the reasons for including policy makers in irrigation training programmes have already been mentioned. National Governments tend to be weak in three main areas in relation to irrigation development. Firstly they often fail to appreciate the complexity of the issues involved. To a lay person irrigation appears to be a simple matter of applying water to land; the complexity of social, legal, technical, economic and environmental aspects are easily missed, and so irrigation development policies tend to be simplistic or over-general.

Secondly Governments in the Region often have difficulty in formulating and holding to firm policies in the face of pressures from many and varied donors and lending agencies, each with their different approaches and priorities.

Thirdly, and especially in the multi-discipline of irrigation development, Governments find it difficult to effectively coordinate the efforts of the various Ministries, Parastatals and NGOs involved.

Funding agencies too often lack deep understanding of the issues involved in irrigation development policy, and they suffer from excessive pressures to spend or lend without asking too many questions.

Objectives

The aims therefore of training these policy makers and planners are threefold :

- to communicate an understanding of the complex issues involved in smallholder irrigation development in the Region
- to encourage and enable planners to learn from experience in a non-threatening atmosphere
- to assist in the formulation of sound irrigation development policy and the strategies necessary to realise that policy.

Methods

Training in this area must use methods which above all are participative and brief. Short presentations of issues, using powerful visual aids such as video, followed by discussion; or field visits and well planned site meetings; are likely to be most effective.

8. Case Study : Tanzania

Irrigation development in Tanzania has been supported for many years by a multitude of international and bilateral donors. Only in the last three years however (since 1986) has there been any real effort to coordinate and standardise the approaches of the various organisations involved, and to develop a coherent irrigation policy. The main vehicle for this work is the project "Institutional Support for Irrigation Development", a project funded by UNDP and implemented through FAO technical assistance. Two of the authors (Carter and Burton) have acted as consultants to the project.

The main activities of the project include :

- preparation of a national strategy for irrigation development
- coordination of Government and non-Governmental agencies involved in irrigation development, including through the introduction of standard planning, design and construction manuals
- strengthening the capacity of the Irrigation Division to implement irrigation projects (through organisational reform, equipment provision, and training)
- strengthening the capacity of the Irrigation Division to provide operational support to irrigation schemes (through development of agronomic packages, and through training).

The project is relevant to the present context both because of the likely direction of future irrigation policy, which will stress small-scale, low input, farmer-managed schemes, and also because of the importance given to training within the context of a wider institution building project.

In relation to training the ultimate aim of the project is to introduce a structured staff development plan for the entire irrigation service of Government. This will include assistance to in-country irrigation training institutions, as well as a comprehensive in-service training programme for all staff. The remainder of this brief study includes a summary of the methodology used to plan and structure irrigation training, as well as interim conclusions and recommendations. It is believed that elements of the proposed future training activities could be used as models elsewhere in the Region.

The main stages in the development of training plans have been as follows :

- the evaluation of all existing in-country irrigation training including both that conducted by educational institutions as well as in-service training
- the collection of data on the training and experience of all irrigation staff
- the identification of all irrigation staff categories and their relationships within the (proposed new) organisational structures
- the preparation of outline job descriptions for all staff categories, together with recommendations for pre-service education and in-service training
- the identification of all recommended training not currently available in-country
- establishment of the terms of reference, staff composition, and physical facilities necessary for a manpower development unit within the Irrigation Division.

The main outcome of the work so far has been a proposal for the establishment of a unit within the Government irrigation service which would take responsibility for the coordination and implementation of all irrigation training. The terms of reference of such a unit would include the management of all in-service training (including both supervised work experience and short courses), and provision of selective assistance to in-country irrigation training institutions. The aim of such a unit would not be to duplicate existing irrigation training provision, but rather to strengthen and supplement what is already in place.

Among the proposed activities of such a unit would be the establishment of regular short course programmes using procedural manuals developed elsewhere within the institutional support project; the maintenance of databases on training opportunities and on staff experience; the introduction of formal professional and technical recognition, and the encouragement of in-country professional and technical institutions; and assistance to existing training institutions through provision of resources and staff training.

The project as described is attempting to design training into national irrigation programmes and projects in a structured and integrated way. It is setting training within a context of policy development, management overhaul, and resource provision, and it is addressing training needs in a rigorous and rational manner. At the level of national irrigation development programmes it is including training as an important element of design. Structures are also being put in place for the inclusion of training (especially of farmers) as a component of individual scheme design.

9. Conclusions

Training is an essential component of irrigation development strategy, and it is required in different forms at all levels from farmers to policy makers.

It is essential that training needs are assessed in the early stages of project or programme planning, so that training is designed into new irrigation projects and individual schemes.

Training is a rigorous discipline which should be undertaken by, or in close collaboration with, experienced trainers. It needs to be carefully planned, have clear, testable purposes, be practical, and emphasise problem solving rather than the blind application of technique.

Training methods should be constantly improving through cross-fertilisation of ideas with other disciplines. Imaginative techniques such as the use of simulations, games, role-playing, drama, song and dance should be used alongside conventional methods and modern audio-visual aids.

Finally training is only one of many necessary external supports to irrigation development; training will only be effective if it is delivered in the context of sound policies, good organisational management and adequate funding for irrigation project implementation.

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IRRIGATED AGRICULTURE AND SOCIAL CHANGE IN NORTH MALI

A method for integrating socal variables in irrigation design

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THEME 4: DESIGNING AS AN INTERACTIVE PROCESS

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THEME 4: DESIGNING AS AN INTERACTIVE PROCESS

1. Introduction

The definition of 'Designing' which we will use during the workshop is the following: "Making of an image of something which has to be realized in the future". This design process starts as soon as the idea for a project is generated and it continues to exist during the entire project cycle. This means that not only designers are involved in the design process, but other actors, such as hydrologists, sociologists, agronomists, farmers and civil servants, as well. A designer can be considered to be someone who tries to balance options with regard to the technical elements, on the one hand with the physical constraints, and on the other hand with the conditions of the farming system (theme 1), the local community (theme 2), and the external context (theme 3). This process of balancing results in a proposal for the design of (a part of) the irrigation system.

In this theme we focus on the way information is exchanged and the way negotiations are carried on to come to decisions on the design. We depart from the idea that interaction between the various actors is at the root of this process. Hence the title of this theme: "Designing as an interactive process". Here the designing process has been defined as follows: "The sum of all activities in the field of technical considerations, interaction and decision-making, which lead to the creation of a proposal for the physical system". We will also enter into the way the designing process is integrated in the project cycle as a whole.

In the second paragraph the project cycle and its various phases will be treated. The third section will deal with the connection of the designing process with the project cycle. Three components of the designing process - technical design, interaction and the decision making - will be discussed. The way in which these 3 components are related to one another and to the project cycle is indicated in figure 1.

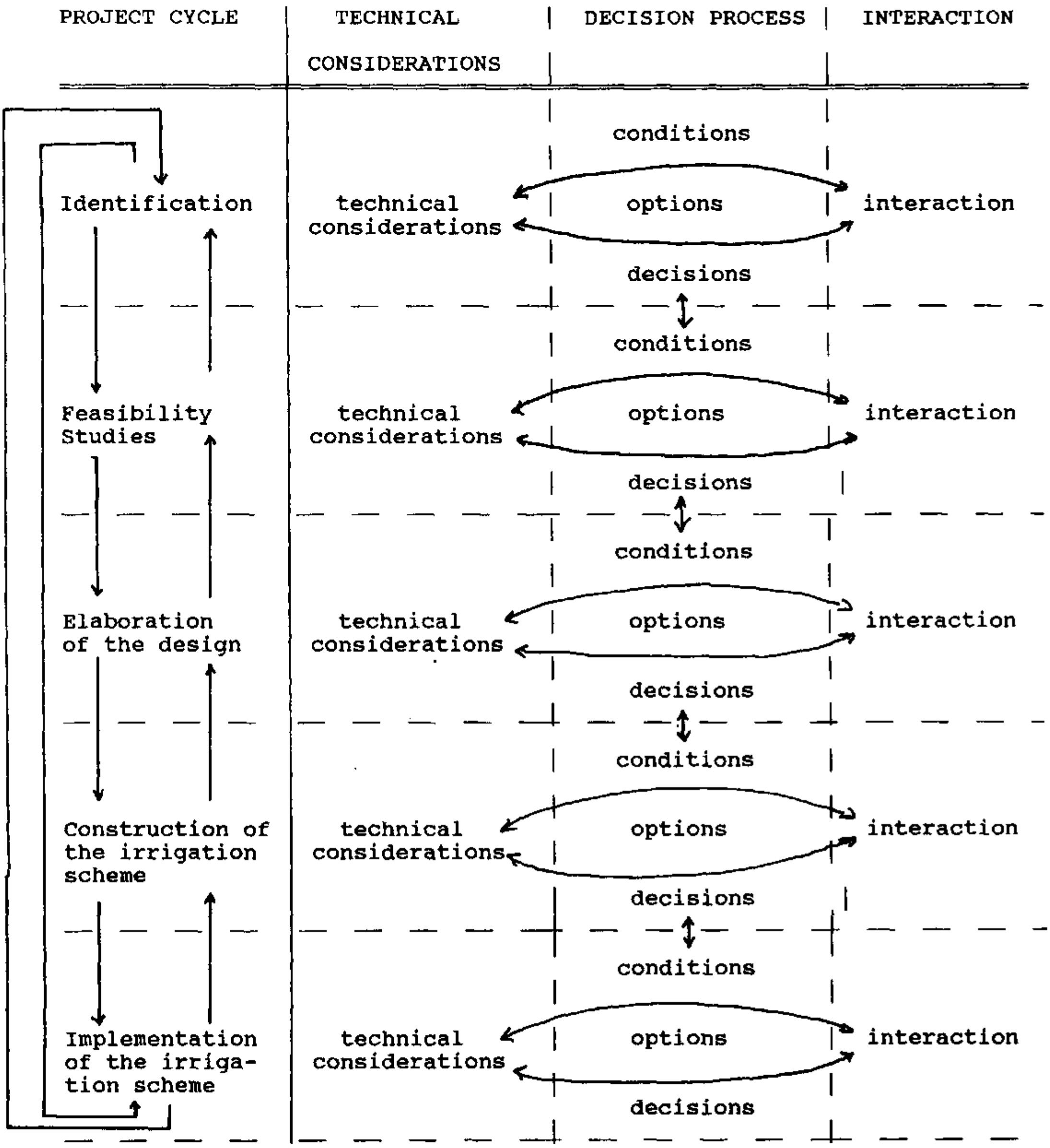

Figure 1.: The design process related to the project cycle.

2. The project cycle[1]

'Project cycle' refers to the various phases into which the realization of a project is often divided, based on the kinds of activities executed. We divide the project cycle into the following phases:

1) Identification
2) (Feasability) studies
3) Elaboration of the design
4) Construction of the irrigation scheme
5) Implementation of the irrigation scheme

The prevailing perception of projects is that the various phases involve different objectives and different actors. Usually only certain actors are involved in the project cycle from the beginning. When new actors enter the project cycle in later phases, new data and new views become available. This can effect decisions which have been made at earlier phases. It is this division of the project cycle into phases carried out by different specialists that makes it difficult to tune the physicaldesign to the actual situation and thus threatens sustainability.

Erroneaously the third phase of the project cycle is often considered to be synonymous with the actual making of the design. Though the activities, the objectives and possibly the actors involved in the designing process change as the project cycle progresses, the activity of designing is always relevant. Decisions or considerations on the physical system will be made in each phase.

The first stage of the cycle entails considerations of a more general nature, while later phases usually get into more

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[1] Although we depart from a different classification the description of the various stages has partly been borrowed from an unpublished essay by Engel, P., e.a.: Development phasing, the temporal progress of project involvement in small-scale irrigation schemes.

little relations to design questions. If such studies are made, the design is often realized in a separate substudy. Consequently, linking and integrating of the various substudies often becomes difficult and this causes problems in the course of the following phases of the cycle. If interaction between the specialists who carry out these studies, and the farmers is given a more central place in the designing process, and is aimed at the concerted formulation of conditions which are involved in the design, the preliminary research phase can be more useful. It should be stressed that interaction with farmers during the following phases often provides new and important information. It is important therefor to find ways to incorporate continuous study and feedback into the project cycle as a whole.

Elaboration of the design

The main operation of this phase is the translation of the various conditions in a proposal for the physical system. This proposal is discussed by different actors and adapted, if necessary. The actors concerned have to make decisions on the specific design elements.

Construction of the irrigation scheme

This phase focuses on the construction of the physical and sometimes on the organization. The construction phase is often not considered to be part of the designing process. However, many adjustments to the formerly proposed design may be required during this phase. Some reasons are worth mentioning. First of all the surveys may have overlooked important information which forces the designers to readjust the design. Secondly, information which could not (easily) be obtained for the surveys - e.g. with regard to conflicts between certain groups - may emerge during the construction process. Thirdly, the construction process is in many cases the first opportunity for farmers to gain an overview of the scheme which is under construction. At this stage they provide information and ideas which were overlooked previously. If something has gone wrong in the decision process of the previous stages, non-cooperation of certain groups of farmers or technical problems which were initially overlooked or played down, may occur at this phase. In such cases it is important to return to the roots of the problems and to discuss them first. Though this operation may take much time it is important, because it makes a parallel development of the physical system and of the organizational structure possible. This phase is completed when the scheme is taken into use.

Implementation and development towards self-management

At this stage the scheme is tested, so to speak, and the possible errors are remedied in a continous dialogue of project personell and farmers. Sometimes changes in the layout of the scheme appear to be necessary. The farmers often try to get as much help and material support as possible from the project. This can cause a situation in which the project stays involved (sometimes even more and more) in the running of the scheme. Consequently the development towards self-management stagnates, unless the project's involvement in the scheme is cut back actively. All actors must make sure that the farmers are organized well enough to run their schemes autonomously and to exert enough collective influence on external actors in order to secure the technical support and advice they need. The transition to self-management is only realized if the project is no longer structurally involved in the scheme concerned and if this scheme continues to function on a reasonable level.

3. The designing process

In the foregoing the designing process has been defined as a continuous process which covers all phases of the project cycle. Three components can be distinguished:
- Technical considerations: adjustment of physical design options and formulations of various design conditions.
- Interaction: examination of these considerations for

compatibility with the perceptions of the actors and extension of information.

- Design decisions on the basis of the other two components.

Usually the first two components, on the left side of the figure (technical considerations and the decision making), are stressed as far as designing is concerned. Designing is considered to deal with technical considerations, which results in a proposal for the physical system.

During the workshop the interaction component will be emphasized, because interaction makes it possible to link the technical considerations to the context and to the users. A better integration of this component may be a contribution to the creation of sustainable farmer-managed irrigation schemes.

On the one hand we discern technical considerations and on the other hand we distinguish interaction. Both aspects affect the decision process. None of them is a straightforward argumentation from problem to solution. They are iterative processes, just like the entire designing process itself.

As far as interaction is concerned the confrontation of the views and the interests of various actors can lead to the repetition of a phase - e.g. an engineer who has been provided with new information steps back to discuss new solutions with the farmers.

Though we tried to schematize the designing process, this schedule may certainly not be used as a rigid manual. If new information becomes available it has to be inserted, even if the iteration has to be picked up at a different stage.

3.1 Technical considerations

Through technical considerations the design elements which have been mentioned in the introduction on designing are geared for one another in order to form a technically consistent scheme,

which must answer to the 'internal logic' or 'physical laws' of technical design. This operation is mainly carried out by the engineer at his desk. Here a discipline is involved which principally takes place in the engineer's mind.
Decisions which are made with regard to a specific design element also are influenced by the interaction. Consequently, it may sometimes be necessary to adjust technical considerations and to look for new alternative options.
It may take repeated trials to decide on a set of coherent options that will lead to a final decision via renewed interaction and technical considerations.

The 'technical' considerations which are required for correct designs can be improved. To this end the presuppositions with which the engineers enter the technical considerations have to be made explicit and to be tested against the relations which are mentioned in themes 1 to 3.

3.2 Interaction

The introductions of the preceding three themes indicate that various actors may be involved in the *formulation of conditions* which regard the use of the plot and of the irrigation system. They also state that interaction between the actors is required for the formulation of these conditions. For one thing this interaction is an information exchange process, for another it is also a negotiation process on decisions to be made.

All actors which are involved in the designing process can directly or indirectly be classified into two global categories. The first category covers the farmers/users. The second category covers all external actors (see theme 3). Within these categories various kinds of subdivisions can be made. The farming population, for example, includes local leaders, farming communities, men and women, different categories or groups of farmers, etc. The external actors can be classified into: experts, such as designers, sociologists, hydrologists, etc.; civil servants and politicians; local traders and private companies.

The various actors have their own standards and values as well as their own economic activities, social relations and positions. During the designing process these aspects will play a role as these determine the interests of the actors. These interests will correspond in some cases, but they will differ or even be opposed to one another in other cases. During the designing process confrontations or maybe even conflicts will be caused by different of opposed interests. One problem is the way to deal with all these different actors and their interests during the designing process. At various phases of the designing process attention has to be paid to **who** (what actors) is involved in **what** (phase or activities) during the interaction, and **under what conditions**.

Part of the answer to the question "**who** or what actors are involved during the design process", is that the farmers and the designer have to play a central role in the process of designing farmer-managed systems. Yet, other actors, such as civil servants, politicians and local traders may not and cannot be ignored.

The question "**in what** (phase or activities) the various actors are involved" in the designing process is linked to the question "at what phase of the designing process" and the question "in which stage of the decision process". Is it in the formulation of conditions, in the elaboration and discussion of options or in the taking of the final decisions itself?

Under what conditions the various actors are involved in the designing process can be described in a number of characteristics:

1) initiative: Who takes the initiative to realize a certain interaction.
2) motive: What is the actor's motive for the interaction (what are his interests).
3) form: In what form a certain interaction takes place.

Are the actors involved in the designing process on an individual basis or as members/representatives of a certain group, is it in a formal meeting or an informal consultation, etc.

4) duration: How often and how long the actors are involved in the designing process.
5) influence: How much influence an actor can exert on the designing process. May his opinion be the only one or can he take binding decisions.

3.3 The decision process

Decisions and their reconsideration are a permanent component within the designing process. Via options conditions can be transformed into decisions, which can serve as a condition for the next step of the process.

Through the use of preconditions designers and planners try to limit the range of design options for each design element and eventually make the design decision. Interaction which is related to the context (the three other themes) creates "farming system oriented", "social structure oriented" and "external relations oriented" preconditions, whereas technical considerations create "physically oriented" preconditions. In the beginning of every stage of the project cycle all four elements have to be regarded as equally relevant to sustainable design. Ranking and combining of conditions must be carried out during negotiative interactions between actors involved.
This process of the transformation of conditions via options into design decisions on the basis of technical considerations on the one hand and interaction on the other hand can be repeated at every phase of the project cycle. In the further course of the cycle the decisions will become more concrete and more detailed. Not all decisions with regard to all design elements have to be reviewed at all stages. This depends on the specific context, the nature of the information and the results of the interaction with all actors.

4. Possible discussion topics for theme 4

During the Workshop discussions within theme 4 will focus on the interaction aspect of the designing process. On the basis of as many concrete experiences of the participants as possible we will try to formulate answers to questions, such as:

- What elements are essential for effective interaction ?
- Which are the possibilities and the limitations of organizing interaction within the designing process of the irrigation system ?
- What does an interactive designing process demand from the actors and what consequences does this have for the tasks, the roles and the education of the designers ?

The above introduction aims at the conceptualization of the designing process. During the Workshop it has to be interpreted on the basis of our practical experiences.

THE INTERACTION BETWEEN USERS AND DESIGNER IN THE DESIGN PROCESS OF VILLAGE IRRIGATION SYSTEMS ON THE ISLAND OF ILE A MORPHIL, IN NORTH SENEGAL

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Contents

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1 INTRODUCTION

In this paper a description is given of the process of the development of small-scale village irrigation schemes on Ile à Morphil, an island in the middle reach of the Senegal River. The account is based on my personal experience as a designer and technical supervisor in this region in the period of January 1986 to April 1989.

The objective of this paper is:
1 to contribute to the discussion about the possibilities and limitations of interaction between farmers and designers in relation to design.
2 to show that the design process should be seen from a wider perspective than simply making a technical drawing on a contour map and the relevant calculations.
3 to stimulate the discussion about the task, role and training of designers/irrigation engineers.

In this paper it is described how the Ile à Morphil project actually dealt with the procedure of consultation between the users of the scheme and the design team -designers, surveyors, masons, bulldozer drivers, and incidental other project workers such as extension agents or agronomists-, and how these consultations may lead to different design options than those initially planned.

The area of intervention of the Ile à Morphil project, the subject of this case study, is situated in North Senegal in the department of Podor. The project is based in the village of Cascas.
The project is part of the SAED (Société d'Aménagement et d'Exploitation des Terres du Delta du Fleuve Sénégal). It started at the end of 1977 in reaction to the long dry spell in the early seventies when rainfall and floods were reduced to almost zero, with the result that the existing types of agriculture did not offer any security of subsistence any more. Pressure was exerted by the local population, the Senegalese

government, and donors to initiate projects that tried to offer more structural assistance instead of food aid. In this context the small-scale irrigation project of Ile à Morphil financed by the Dutch government was also formulated. Its main activity was the implementation of village irrigation schemes (PIV: périmètre irrigué villageois) for particularly the production of rice.

The small PIVs are characterized by:

- A small size of about 20 ha . The irrigation is determined by the capacity of a motor-driven pump, the type of soil, the site available, and the crop to be irrigated (rice),
- A users' group consisting of a large number of participants, given the principle of allowing the whole village to participate, the consequence of which is a small plotsize ranging from 0.08 up to 0.40 ha.
- The geographical situation: along the banks of the river or a tributary, with a conveyance canal of a limited length.
- A site lying on a relatively high area, to avoid the construction of dikes of a considerable dimension.
- A location close to a village.
- Simple constructions and equipment: a pump on a floating raft, earth canals and simple brick works.
- The implementation in which the future users participate to a large extent.
- Group management.

(Université Agronomique, Wageningen, 1988)

An example of the standard concept of a PIV is given in Figure 1.

2 DEVELOPMENT IN THE DESIGN PROCESS

Although the basic principles of the technical concept of the PIVs hardly changed in the course of the project, changes did occur in the design process. In the first few years priority was given to quantity partly because of the formulation of the project as emergency relief: to provide as many people as possible with a small area of irrigated land in the fastest and cheapest way.

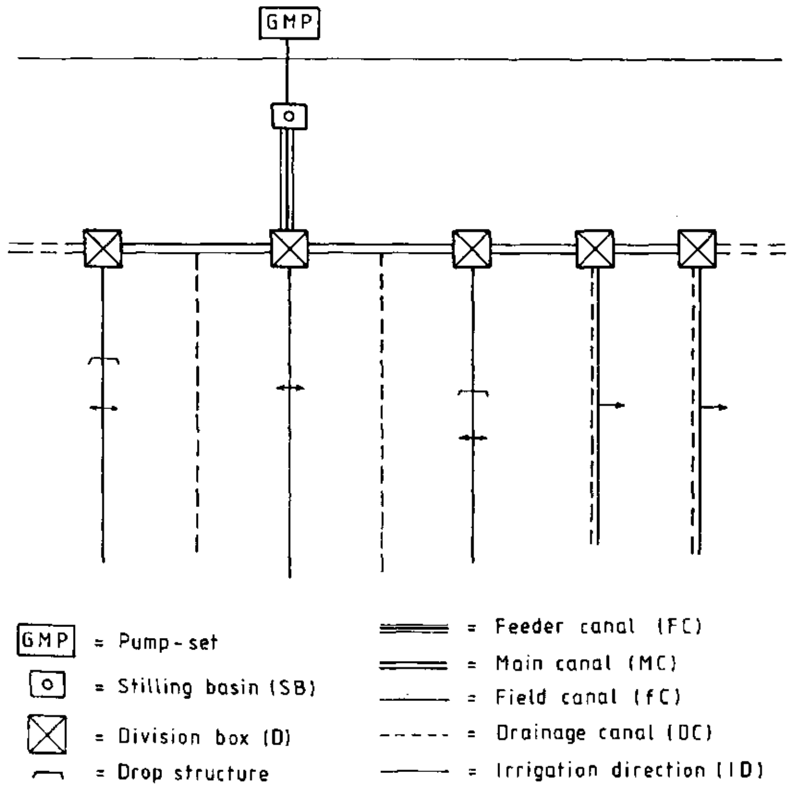


Figure 1: Basic Lay-out of a Village Irrigation Scheme

Throughout the years there was a field of tension between the criteria of quality and quantity as regards the area to be irrigated. From the government and the donor there was a continual pressure on quantity (in hectares), while the project put more emphasis on quality. The latter was based on the experience gained from the schemes implemented in the first phase (Versteylen, 1983).

As regards the criterion of quality, up to 1986 specific attention was paid to the technical aspects of the schemes. The surveying work was considerably expanded and improved.
More attention was paid to the selection of sites in terms of type of soil. Construction works were improved and machines were brought in to assist with the earth-moving. From 1986 onwards an attempt was also made to pay conscious attention to the quality of the structural process of scheme implementation. This because it appeared from preceding phases that in spite of an improvement of the technical quality, some villages still had problems using their schemes, or that in an exceptional case, e.g., because of discord between two factions in the village, the farmers abandoned them altogether.

In an attempt to avoid problems of this kind we have tried to incorporate consultation with the users in the framework of the design process, and to base the physical layout on their contribution as well. The communication with the farmers took another turn and some steps were added to the design process:
- Discussions with the future users during the preparation of a specific scheme in order to make an inventory of their ideas concerning the design and the future organization,
- excursions to other schemes,
- presentation and discussion of some alternative designs, and
- a guarantee on the technical quality after the first growing season if adaptations prove to be necessary.

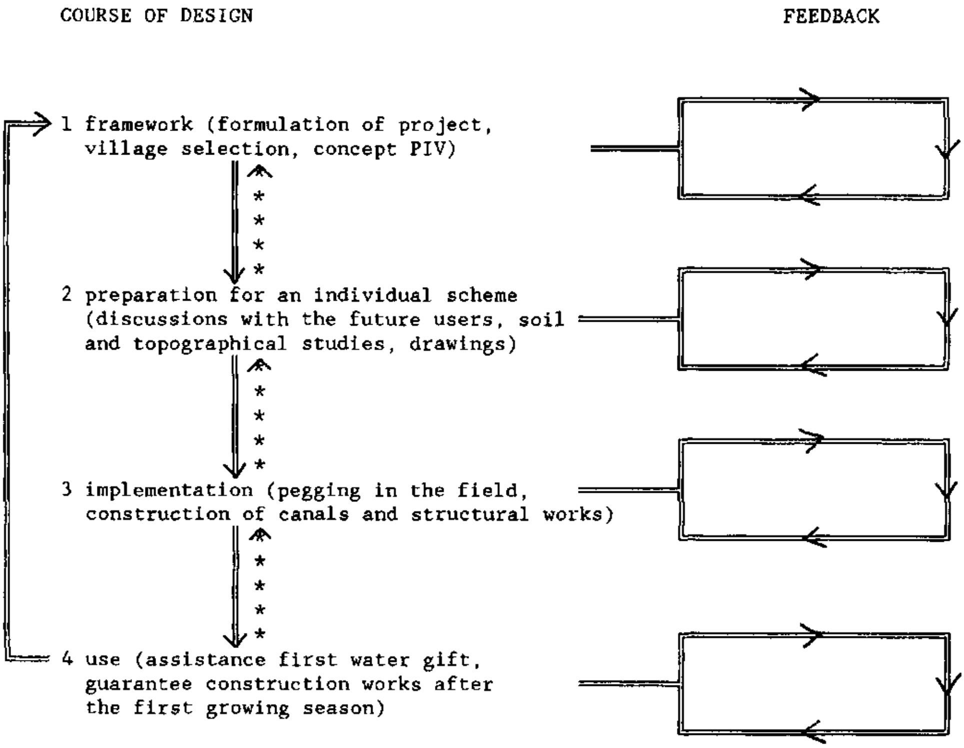
The area put under irrigation remained the same as in the preceding years, i.e., 200 ha per year.

Figure 2 represents the process of designing in diagram form. Two levels can be distinguished:

- the whole project, stages 1 up to 4, takes place at project level,
- within which stages 2 up to 4 take place at village (scheme) level.

The feedback of experiences at village level may result in a change in the concept for the project as a whole. For instance, the gradual increase in the number of PIVs per village with laps in between the periods of implementation - yet always on request-shifted to only one period of implementation per village in which all the remaining possibilities for rice-PIVs were dealt with.

Figure 2: the process of designing



It is a process in which new data become available continually which have to be incorporated in the design. Constant feedback takes place within and between the different stages. The process of designing thus consists of several iterative processes and is, as a whole, an iterative process itself too in the sense that preceding designs polish the methodology to be applied in the designs of future schemes.

It should be stressed that a process of designing may be represented in a diagram, but this does not mean that this diagram can be rigorously applied. Incorporation in the design should take place according to the moment the feedback occurs and new information becomes available, even if this does not fit in with the stage of the process reached at that very moment.

In fact, during the project period of twelve years development of technology took place with regard to both technical aspects and the structural aspects of process. In Chapter 3 particularly the development of the structural aspects of process during the different stages in the design process is dealt with.

3 EXPERIENCES WITH THE DIFFERENT STAGES IN THE DESIGN PROCESS

3.1. Request and preparation of a new scheme

3.1.1 Introduction

During this stage information should be collected concerning the selection of the site, the integration with any existing PIVs, ideas of users on the layout, and any specific starting-points for the design that deviate from the standard concept. Moreover, a work schedule is made.
The periods of preparation differ widely per specific situation. Preparatory stages up to two years do occur during which the designer/the project can play a catalyzing role, but the group sets the pace.

3.1.2 Request

The implementation of a new scheme takes place at the request of a a users' group, which is formally organized in a 'Section Villageoise' or a 'Groupement d'Interet Economique'. Together with the request the group must submit an allocation of a site by the 'Communauté Rural', and a list of participants.
The project is not formally involved in this. Being an outsider, however, the designer may play a useful role in the process of coming to a request on account of his experience with similar irrigation schemes that were constructed before, and his prolonged involvement in the villages.

> An irrigation scheme brings about a drastic change in a society. This society has a history of its own. The existing relations will be projected on the discussions concerning the scheme. In villages where there is a considerable friction between the different factions, the discussions and decision-making will be effected by this discord, irrespective of its relevance to the development of the scheme. One faction will ,by definition, take an opposite stand to the other faction , and neither will compromise. This often happens even if each faction itself is convinced of the importance of a scheme, be it a separate or a collective one.
> A proposal of an outsider may sometimes be accepted without one faction losing face with regard to another. An outsider can formulate compromising proposals concerning the realization of a scheme to everybody's satisfaction without the separate factions having to declare themselves openly against one another.
> This is particularly relevant in situations where there is a general agreement regarding a scheme, but where not everybody happens to be on speaking terms owing to conflicts concerning completely different affairs.

The compilation of a list of participants is left to the users' group. The result is that the aim to parcel out a minimal area of 40 are (one are is 100 m 2) per user, which is, according to various appraisal missions, the bare minimum for subsistence, is mostly not reached. In a village the criterion of allowing everybody to participate, has first priority, which together with the area available, determines the eventual plot size.

3.1.3 Site selection

The group and the design team should agree upon the selection of a site. Both submit proposals for discussion to come to a final selection of a site.

The designer's frame of reference in this respect mainly concerns physical characteristics, -topography, quality of the soil, drainage, flood risks, distance to the river-. The farmers' frame of reference in this stage mainly concerns:

- the settling of the rights to land: who will give a piece of land, who gave some land for a former scheme, and
- former experiences with crop husbandry: did we ever cultivate there and what was the harvest like.

> "Example: a village consists of three clans. Clan 1 gave up land for the first scheme constructed in 1979, and clan 2 for an expansion in 1984. The village has submitted a request for another expansion. It is now the turn of clan 3. However, their land is not suitable. The other clans refuse to give land for a second time unless family 3 gives first."

The result may be, for instance, that a users' group initially proposes a rather marginal site that cannot be accepted. Another site must be found. However, existing claims of ownership often result in laborious negotiations in the village as to who is to give up the land.

Decisions on such matters can make deep inroads on the social relationships in a village, and it may take years before the problem is solved. Or it may not be solved at all. A designer can sometimes disapprove of a site to put pressure on a village to come up with a more suitable site. Should this not be the case within a certain lapse of time, and the designer concludes from this that there are too many claims on other sites, or too many problems, he may have to reverse on his decision.

3.1.4 Adaptations of the design criteria

Apart from the fact that every layout is different in itself - there is no blueprint- specific circumstances in the situation concerned may make it necessary to deviate from the technical concept. The following examples illustrate this. They concern the length of a conveyance canal and the area of about 20 ha to be irrigated with the type of pump installation used.

"Example: A village that did not have a PIV yet, submitted a request. It had only one site available at a distance of 1500 m from the river. One design criterion concerns the maximal length of the supply canal, which is 1000 up to 1200 m on account of the possible losses by seepage and the conveyance period - the period between starting up the pump and the beginning of irrigation at plot level-. As the village had no other site, it was decided to accept the site after all and to make a design with a supply canal of 1500 m, and to somewhat reduce the area to be irrigated in order to meet the water requirements, which meant a second adaptation of the concept related to the first alteration. The problem of possibly higher costs and the long waiting periods between starting the pump and the water reaching the field, was extensively discussed with the farmers, who were willing to accept the inconveniences in view of the absence of other possibilities for irrigated rice cultivation."

Another village already had one scheme of about 16 ha with 122 users. The type of soil is partly clay - suitable for rice cultivation- , and partly loamy sand -not suitable for rice-. The village submitted a request for a new scheme with 100 participants, for which only one site of 32 ha was suitable for rice cultivation. The site lay next to the existing scheme.
The first idea of the designer was to aim at an area of 40 ha of irrigated rice cultivation, subdivided in 2 independent schemes, including a reallocation of land of the suitable part of the first scheme. An expansion of 15 to 40 ha could thus be realized.
However, the users' group explicitly asked not to be integrated into the existing scheme because they formed a different group of beneficiaries. If land consolidation took place with the first scheme, every member of that scheme would be entitled to join in the expansion area, which the new group did not want because among the old scheme members there were people from other villages who meanwhile had a scheme in their own village.
The only site available was quite complicated in topographical aspect. After making some alternative designs, the designer found a possibility of óne scheme of 22 ha or two schemes of 16 ha each. A third possibility of one scheme of 32 ha with a different type of pump installation was impossible given the topography.
The choice of óne scheme of standard size or two smaller schemes has considerable consequences:

- the payment or the depreciation costs of a new pump installation is relatively more expensive per ha, whereas a pump installation for 15 ha is less optimally used.

- plot size: if two smaller schemes are opted for, the plot size per user would be about 30 are. In the other case only 20 are. According to several consultancy missions, this size directly relates to the whole problem of debts -smaller plots lead to more debts-.
- the future: with the construction of óne scheme of about 22 ha, the remainder of the area cannot be used as PIV anymore.
- Organization skills among the farmers: the extension agent sincerely wonders if there are enough leadership skills in the village to manage two schemes independently.

In a discussion the two alternatives with their advantages and disadvantages were explained to the farmers in order to come to a choice. The farmers chose the option of two smaller schemes for all members to have the largest possible plot. They did not consider the management of two a problem because several people from the village had gained experience in this respect in a neighbouring village which had four independent schemes. The designer agreed and therefore the standard concept of 20 ha per PIV was deviated from.

If the designer had kept to his 'chartered territory', making his design drawings behind his desk, the design criteria would probably have been respected, and only one scheme of either 22 ha or one of 40 ha with partial land consolidation with the existing scheme, would have been constructed.
In the project described in this paper, the designer was responsible both for the preparation of a scheme in cooperation with the users and the extension agents, and for the implementation. New options were decided upon repeatedly , one of the reasons being the explicit and deliberate confrontation of the users with the design options.

3.1.5 Preliminary discussions with the farmers about a possible layout

In order to integrate the suggestions of future users into the design at the earliest possible stage , the design team organizes a discussion with the farmers about the possible layout of the area at an initial stage. This discussion may cover items such as the number of participants, the division of plots, the use, and future management, dependent on the specific situation.
Especially in cases that involve the construction of several

neighbouring schemes at one go, sometimes even for different villages discussions are not easy. In this way, however, conflicts and distrust at a later stage may be avoided.
The areas suitable for the implementation of PIVs lie close to the river. Yet in some cases villages far beyond the river banks are able to lay claims to part of the area. Consequently, when larger areas along the river are suitable, it often happens that more villages are involved. The following example illustrates this:

Initial situation:
Before the project intervention started PIVs had been constructed on behalf of the five villages concerned. They ranged from 10 to 17 ha, and laid next to one another along the river. A request had been submitted for the expansion of the area and a site had been allocated that also included the area of the five existing schemes. The total area amounted to 110 ha. The villages varied in size, but also in number of participants in the relevant groups, in the existing irrigated area per village and plot size per user.
Based on discussions with the different users' groups the extension agent in the region concerned determined that all plots were to be of equal size, irrespective of the group, in order to enable equal plot distribution to all users.

The designing team brought forward the following ideas:
' - The construction of five schemes with the same type of pump and equal plot size for all the users cannot be realized. This would mean schemes varying from 25.6 to 15 ha, which would not be in accordance with the standard pump capacity. Given the organizational structure per village, the implementation of five independent schemes seems however ideal.
- The possibility of only one large collective scheme cannot be considered on account of the organizational problems to be expected.
- In order to create better design options, an even larger area is desirable. Therefore we ask one of the villages if they have another site at its disposal.
- The transfer of users from one group to another group, or combining the largest group with the smallest one, may be considered to comply with the wish of equal plot size for all put forward by the farmers.'

  These ideas were discussed in a meeting with the extension agent and a farmers' delegation representing the five villages. Conclusions from the meeting were:
- None of the villages wanted to be transferred to another area, although some of them did have other areas available. - According to the extension agent, this refusal was partly due to the fact that these villagers

were Fulani, pastoralists, who lived far from the river. They did not want to be separated from the support of the farmers in the major village, and lose contact with the better political relationships in that village. Moreover, they did not want to give up their say in this specific area so explicitly, by deciding of their own accord to move to another site. They wished to keep their own area for a future expansion if possible for the benefit of their own village.

- Each users' group was in favour of an independent scheme.
- Users were not to be transferred to another group.

In the compromising proposal that was finally accepted, an as equal as possible plotsize for all participants was aimed at by allocating the largest site to the largest village and the smallest site to the smallest village. This within the possibilities of viable use of the pump installation (18 - 23 ha).
The schemes that were eventually implemented, bordered one another and ranged in size from 19 to 23,8 ha. The plot size per user varied from 17 to 21 are. The decisions agreed upon were never brought up for reconsideration.

The above proves that in the perception of the farmers arguments of a different order than those related to the design for that specific area, are of overriding importance. In the above example, the users give priority to stabilizing political relationships, holding on to their influence in a particular area of land, and saving particular possibilities for the future for the benefit of their own village.
It also shows that the farmers' initially firm demand of equal plot size for all, proved to be less firm than the demand of an independent scheme for every village. For the designer it is important not to accept unthinkingly particular demands or choices made by the users, but to point out their implications for the design.
A similar example is the following concerning a rehabilitation of several schemes with separate management:

Six ancient schemes belonging to one village, but managed by six different users' groups, had not been used any more for some years and the farmers had submitted a request for rehabilitation. Topographical and soil studies of the area showed that a maximum of 80 ha would be suitable for irrigated rice cultivation. The design team proposed that the groups should be regrouped and four schemes of about 20 ha should be aimed at. This proposal was initially agreed

> upon in principle. The only problem seemed to be the election of the chairmen for the new groups. The number of six chairmen was to be reduced to four. Two chairmen of the former groups were to withdraw and consequently give up some status for the members they represented. This was a problem that had come up in other villages before. No solution could be found eventually, with the result that even those who had advocated the regrouping, retraced their steps and held on to their old achievements, rights and area.

Consequently, six schemes were implemented in accordance with the former site situation, which included some areas that were, according to the design team, less suitable as regards type of soil. However, this would, according to the farmers, not cause any problem. They claimed that any other option would not be feasible.

Within the design team there was some doubt about the impossibility of regrouping and the suitability of the area, but nevertheless an agreement was reached in a fairly short time because no other possibilities for constructing a scheme elsewhere were available.

3.1.6 Key informants within the design team

The first activities that are visible to the future users in connection with the new scheme, are the reconnaissance study and the topographical survey. These usually provoque quite some reactions. Therefore this period of investigation may lead to other relevant information in addition to the physical data obtained. Also because in the approach of the project the future users are supposed to assist with the topographical survey, and the surveyors stay in the village concerned for at least two weeks. Every individual user has the opportunity to casually meet somebody who has direct relations with the designer. All the preceding contacts were more or less formal through meetings or representatives of the users.

It is an excellent period to broaden the understanding regarding the village and to get an impression of the organization skills, solidarity, political or other conflicts that may effect the realization of the scheme or start playing a role later on, the position of the chairman, problems concerning right to land or other matters of discord, misunderstandings as to the design. The designer needs this understanding to be able to anticipate possible future problems and necessary adaptations in the further course of the design and implementation.

A surveyor, as a member of the design team, thus plays a considerably more important role than merely collecting surveying data. The fact that he has the ability and the willingness to play this role, depends , in my opinion, on two factors:

- As a member of the design team in this project, a surveyor is not only responsible for topographical surveys in the period of reconnaissance, but also for pegging out the scheme, and for part of the assistance during the construction. The topographical survey therefore covers only a small part of his involvement in the village scheme concerned. Because of this prolonged involvement the quality of his work will increase,- as he does not want to be confronted with his own mistakes later on, and he knows that understanding the functioning of a village will be crucial for a successful assistance of the farmers during the construction of the scheme in a later stage.
- The relation between designer and surveyor. It is of vital importance that the surveyor has a clear understanding of the design and feels responsible for the final product. For this reason the surveyors were also involved in the actual making of the design drawings. When problems relating to the layout emerged during the construction , they were supposed to spot the problem and suggest a possible solution.

In a later stage of the construction a mason may become also a key informant. The attention was constantly focussed on shared responsibility for the final product. Not only the designer, but the whole design team, including surveyors, masons and bulldozer drivers, were responsible.

Extension agents too are key informants because of their often prolonged involvement in the villages concerned, but they often take up a position that is more or less fixed within and in relation to the village. A surveyor is relatively unknown, an outsider, and may therefore acquire a different outlook and additional information.

3.2. The design drawing

The design drawing is the basis on which the layout in the field is marked out. It may correspond with the layout that is eventually realized, but usually adaptations take place during the implementation. One or more alternative plans are drawn depending on the preparatory discussions.
Several people in the design team, including a Senegalese and a Dutch engineer, surveyors and a trainee, contrive a design. They work independently. These designs are compared and discussed together, and an attempt is made to combine the strongest points in each design into a final proposal. This proposal is again discussed with the extension agents at project level and adapted if necessary. Then it is presented to the users.

Every design has its own specific advantages and disadvantages as all designers would agree. The choices and decisions made at the design stage, may have far-reaching consequences for the future operation and management of the scheme. These decisions are often made behind the designer's desk, based on information, presuppositions and criteria that are available at that very moment.
The starting-point here is that the sustainability of a scheme can be increased by involving the users in the decision-making regarding the design.
Involving the farmers in effective discussions about the design drawing is an extremely difficult part of the design process. The farmers lack the visual perception of reading a map. An effective discussion in concrete terms can be reached by explanations in the field, oral explanations of the various

alternatives, or excursions to other schemes that are either under construction or operational.
To enable users' contributions to the design, the design plan should be such that alterations in the layout proposed can be carried out easily during all the stages of the design process after making the drawing. This is very important because the users cannot take in all the consequences at once when the design proposal is presented to them. They may come up with relevant suggestions for improvement at a later stage of the implementation. The designer may sometimes foresee these through the right information/insight, as the following example shows:

> A village had 40 ha available for a PIV , and had submitted a request for this. The designer gave them the choice between one or two schemes. One scheme of 40 ha would require more organization, but less labour to construct it because it would need only one conveyance canal. The implementation of two independent schemes would require more labour, but it would simplify management and offer the possibility of forming two independent groups. The users gave a firm answer: "Nous sommes tous unies", and preferred one scheme of 40 ha.
> However, the designer had gathered from meetings and discussions with the extension agent and surveyors, that there were conflicts in the village. One indication was the fact that it took a long time for the group to elect a new chairman after the dismissal of the former one. The design team decided to anticipate a possible split between the farmers and designed a layout in which a construction of two separate schemes could still be realized at a later stage by just adding another conveyance canal.
> During the construction works, which required a considerable organization, as every future user was to contribute labour, conflicts did emerge. The works came to a standstill because the various groups were not willing to cooperate. It was decided to divide the scheme into two schemes.

From the above example it is clear that the designer should be able to interpret the information received. What does a particular answer mean in the speaker's context, not in the designer's context. When at one of the first meetings farmers give answers to questions concerning the existing organization or the organization wished for, of the kind:
'We are one and united' ,'God is with us, we stand behind

you','If you see to the water distribution to all plots, we'll take care of the rest',
these answers do not signify much. It may mean that the designer has to do with a well-organized and homogeneous group, or that the farmers want to give the impression of a close community to an outsider and not wash their dirty linen in public. It certainly does not mean that the designer is given permission to design whatever he likes.

In other words, the designer should extend his frame of reference with information specific to that situation. This can be obtained by analyzing meetings afterwards and by systematically keeping up the information gathered. An arsenal of possibilities of what is meant with certain statements and what is implied, may thus be collected. For this kind of data collecting ways of meeting the users should also be created.
A combination of engineering work with research in one and the same function, which is still seldom seen could be a better guarantee. It would certainly help his performance if in the training of engineers attention was also paid to the collection and interpretation of social data.

No or hardly any attention is paid to the fact that the farmers' frame of reference can also be broadened by which interaction between farmer and designer can be improved. The discussions about the designing issue are too often geared to the designer. If farmers have a better understanding of the possibilities and limitations of irrigation systems in general, which is in fact the designer's frame of reference, this may lead to a considerably better communication. Ways of broadening the farmers' frame of reference of which some have been mentioned before, are the following:
- organizing excursions to other groups, some with a similar experience, some with other systems and types of organization.
- presenting and discussing alternative designs.
- working with a model on scale.
- functional alphabetization and other training.

Particularly the visits to other users' groups are useful not only in order to get a visual idea of what a scheme is like, but also to get an impression of how another group has organized itself. Furthermore it appeared that villages with a bad experience in irrigation in the past, gained confidence in starting with a new scheme again.
The following example illustrates how farmers' participation in the decision-making was achieved by presenting several alternative designs and their relevant implications for the layout:

> The site in question was rather difficult in topographical aspect because of a relatively steep slope. One of the decisions to be made was whether either the plots or the canals should be laid along the contour lines. In the first case the canals run down the slope, which increases the number of drops needed and extends the total length of the canals. This implies a rise of the costs, but above all, an increase in collective labour needed for the construction. Furthermore, after completion more maintenance of the canals is necessary. In the second case the plots run down the slope, which makes water control at plot level more difficult to handle. In short, a choice has to be made between more collective work at canal level or more individual work at plot level.
> The design team decided to work out both alternatives and to present them in a meeting with the future users, who appeared to prefer the alternative of laying the canals along the contour lines.

3.3 The construction of the physical infrastructure

The future users contribute a considerable amount of labour (150 man days per ha) to the construction works of the scheme. Therefore a continual and systematic communication between users and the designer is possible. This increases the possibilities for interaction considerably.

The first step in construction work is marking out the canals in the field by means of wooden pegs. This pegging out is an important stage for observing possible reactions of users as it explains the design in visible terms in the field. The farmers can now study the whole in detail which creates an opportunity of discussing the concept of the new system more concretely.

In this stage the users' ideas and suggestions for the layout are rather detailed. The reactions often concern matters brought up before by the design team, but which at the time were, apparently, not considered expedient by the farmers, or not comprehended, as the next example shows:

> In the preparation of a scheme the farmers were asked if cattle runs should be taken into account. The answer was no. However, when the canals had been pegged out, the farmers wanted to have one canal replaced and partly deviated to allow cattle to pass. The first negative answer may be analyzed in terms of the farmers' interpretation of the question and their objective at the moment it was asked. The farmers may have thought that this issue was so crucial for the designer that the whole construction of the system depended on it. Their objective was to get a new scheme, so they had better please the designer and answer: 'No, you do not have to take account of that.' In a later stage, when it was not a matter of the system being implemented or not -the farmers had seen a bulldozer in the field- , the issue was brought up again because the objective at that moment was to avoid conflicts with the pastoralists in the region. Another reason might have been that the farmers had not been able to visualize the exact position of the system in the field.

It has hopefully become clear from the foregoing that collecting information is an activity that must not be restricted to the preparatory stage, because in later stages additional and/or more concrete information may come up on the basis of which the design should be readjusted.

After the canal system has been marked out, a technical evaluation of the design also takes place as regards the longitudinal section of the canals, the level of the plots and the type of soil in the layout.
The improvement of the design is a continual process of evaluation and readjustment in the field even during the implementation. Knowledge of the local conditions increases progressively as the communication with the users continues.

3.4 A guarantee on the new system; adaptations of existing systems

During the operation of a scheme deficiencies may emerge. They may be caused either by unforeseen consequences of the design or a disregard of essential information, or by mistakes made during the design process or the implementation. In both cases the project is responsible for the adaptations needed after the first growing season, if these are technically feasible. In practice such adaptations were seldom needed, particularly because during the construction much attention was paid to monitoring the works. This guarantee is, however, an essential part of the design process as the users would otherwise be saddled up with the consequences of deficiencies they cannot be blamed for, without any possibility of appeal. The guarantee is invalid if the poor performance of a scheme is caused by poor maintenance or negligence by the users. Adaptations actually carried out, include:

- Repositioning and/or adding some plots.
- Reinforcing or adding protection dikes.
- Changing drains into canals, as some users used the drain to irrigate parts of their plots any way.
- Adapting the conveyance canal because of erosion risks.

The prolonged involvement in the region and the flexibility in approach have enabled the project to carry out adaptations to existing systems in a later stage as well. These include the division of three larger schemes (40 and 60 ha) into units of 20 ha because the users of these schemes had failed to make optimal use of their scheme. A relatively small intervention, by constructing a second supply and main canal, resulted in a considerable improvement of scheme operation.

4 CONCLUSIONS/DISCUSSION

In this paper I have tried to clarify that:

- The process of designing comprises more than simply making a technical drawing on a contour map and the relevant calculations.
- The design process passes through subsequent stages up to the construction and completion of the scheme. The eventual map, being a reproduction of the actual layout in the field, may therefore (greatly) differ from the design drawings.
- Designing is a dynamic process in which criteria, starting-points, assumptions, and information have to be adjusted repeatedly. It is also a cumulative process in the sense that experiences with other villages may be used in new situations.
- Interaction between users and designer in relation to the physical design is possible and necessary, and leads to adaptations of concepts used.
- Negotiation and decision-making form part and parcel of the design process. A designer must not isolate himself but cooperate with the users and other people involved like the extension agents. For this a direct communication between designer and users is necessary during the whole process, in which also the users should have a clear position in the negotiation.
- Attention should be paid to broadening the designer's frame of reference as well as the users' in order to come to a more effective interaction.
- Interaction should be continual so that new information may become available all the time. A flexible attitude and a flexible way of designing are needed to incorporate this new information in the design in later stages as well.
- The approach of the project shows some characteristics that make a fairly intensive interaction possible:
    - A scheme is implemented at the request of the users only.
    - The village structure is respected as a social unit.
    - The compilation of the list of participants and the site

selection are left to the users.

- The prolonged involvement in the region (since 1977) has led to a relationship based on trust between the population and the project.
- The project is stationed in the region itself, not in some (provincial) capital.
- Many of the project personnel come from the region itself, and are trained by the project.
- Preparation, design, assistance with and supervision of the construction, and the assistance with putting the scheme into operation, fall under the same responsibility.
- The pace of the developments in the design process depends on the users as well as the project team.

Conceptual problems in the interaction between farmers and designers in relation to the design are:

- The formation of ideas and the perception of users, non-participants, designers, donors and government agencies do not run synchronic, as a result of which the feedback of these people in relation to a particular question does not always align in the stage concerned.
- There will always be a difference in the frame of reference between users and designers. Designers have a restricted perception of social and cultural matters, the users of technical matters.
- It is difficult to come to universal conclusions concerning the interaction between designers and users because of the locally- specific conditions in which the design process takes place.

Many questions remain to be answered concerning the interaction between designer and target group, such as:

- To what extent do interaction and a better participation of users in the design process actually contribute to the improvement of the sustainability of irrigation schemes?
- Up to what level and in what way should this interaction take place? Farmers need not become designers, nor need designers

become farmers.

- What methods can be developed to provide users with a clear picture of the intervention concerned in the early stages of formulation and preparation, so that a more realistic contribution of users can be realized in the initial stage.

Finally it may be concluded that the increased attention paid to the procedural aspects of the quality of designing is an improvement compared to the concept of designing previously used. These procedural aspects, however, are still seen from the designers' perspective, rather than the farmers'. The attempts are still to much focussed on 'adapting' the farmers to the design process of the designer. I hope that this is only a transitional stage to a period in which designers will increasingly be able to adjust themselves to and to base themselves on the farmers' process of planning. In order to achieve this, the designer's task must be understood and formulated differently.

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CONCEPTION DES AMENAGEMENTS HYDRO-AGRICOLES COMME PROCESSUS INTERACTIF ENTRE LES DIFFERENTS PARTIES EXPERIENCE DU PROJET "SENSIBILISATION ET FORMATION"

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Contribution á l'Atelier International
"Conception Viable d'Aménagements Hydro-agricoles Paysans en Afrique Subsaharienne"

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INTRODUCTION

Dans la quasi-totalité des pays d'Afrique notamment ceux du Sahel, l'autosuffisance reste le premier objectif à atteindre. La contribution des Aménagements Hydroagricoles à l'atteinte de cet objectif dans ce contexte va s'accroître au vue de la permanence des aléas climatiques.
Cette assertion ne sera toutefois vraie que si la conception des Aménagements Hydroagricoles (à l'échelle humaine) est conçue comme un processus interactif entre les différentes parties en présence et laisse une large place à la concertation avec les paysans.

L'assertion repose sur la conviction que l'atteinte des objectifs attendus des Aménagements Hydroagricoles (paysannaux) sera le fait essentiellement de l'action des paysans qui sont les premiers acteurs de la mise en valeur d'où la nécessité incontournable de leur implication à toutes les phases de conception et mise en oeuvre des projets d'aménagement hydroagricoles.

L'exposé ci-dessous pose la problématique et quelques axes de réflexions à travers l'expérience du Projet "Sensibilisation et Formation" des Paysans Autour des Barrages" du Burkina Faso.

1. RAPPEL HISTORIQUE

Né de la coopération bilatérale entre le Burkina Faso et le Royaume des Pays-Bas, le Projet "Sensibilisation et Formation" s'est fixé pour but essentiel de rendre la société rurale pleinement responsable de la gestion de ses moyens de productions à savoir les Aménagements Hydroagricoles. La gestion des moyens de production sous-entend gestion technique, financière et institutionnelle. Toute l'action du Projet repose sur quatre principes fondamentaux qui sont :

- L'approche pluridisciplinaire
- L'approche "participative" programmée

- Le suivi de longue durée
- La décentralisation de l'exécution

La première phase du Projet a été consacrée à l'analyse diagnostic de la situation des Aménagements Hydroagricoles existants, la formulation d'une stratégie théorique d'action et d'une méthodologie de travail en direction des Aménagements existants et à venir.

L'analyse théorique confinée dans le document intitulé "les problèmes de coopération des exploitants des périmètres irrigués en Haute-Volta, Théorie et Pratique, Juin 1983" relève onze conclusions dont deux méritent d'être citées dans le cadre de la problématique faisant l'objet d'analyse. Il s'agit de la conclusion n° 9 et de la conclusion n° 10 de ladite étude.
"Dans les réalisations des périmètres hydroagricoles, on met trop l'accent sur les aspects techniques que sur les aspects socio-économiques".

"La participation effective des futurs bénéficiaires à toutes les phases de réalisations d'un projet et pas seulement dans les résultats est indispensable. La vraie participation à toutes les phases (conception, planning, décision, exécution, résultats et évaluation) implique plus d'autonomie du groupe intéressé".

La mise en oeuvre de la dernière conclusion tient à la fois de l'environnement politique et de la confrontation de deux visions de développement dans les démembrements de l'état ayant à charge la promotion du développement rural.

En effet l'environnement politique favorable est celui clairement et concrètement exprimé, qui met au centre du développement les masses populaires notamment paysannes.
La conception des Aménagements hydroagricoles comme processus interactif repose également sur l'affrontement de deux modèles de développement, l'un dit technocratique et l'autre dit participatif.

Le premier modèle correspond à la fixation d'objectifs essentiellement productivistes qui doivent être atteints par la mise en oeuvre de techniques dites "modernes" dans le cadre de schémas conçus à un niveau centralisé ne pouvant être discutés, ni remis en cause à la base.

Le second modèle se caractérise par une volonté de développement d'organes de conception, de discussion et de décision à la base, une volonté de stimulation de la vie associative, dans un contexte de participation démocratique.

La stratégie théorique développé au sein du Projet rejoint la vision du second modèle et réaffirme l'impectueuse nécessité d'intégrer la participation des paysans à toutes les phases d'un projet d'Aménagement Hydroagricole, seule gage de réussite de ces projets. La méthodologie et la mise en oeuvre pratique de cette stratégie sera développée plus loin dans le cas concret de l'aménagement de Nagréongo.

Au Burkina Faso l'interaction de deux facteurs essentiels dont l'environnement politique favorable (Révolution Démocratique et Populaire d'Août 1983) et le développement grandissant de la seconde vision de modèle de développement ont favorisé l'émergence d'une stratégie nationale en matière d'aménagements hydroagricoles.

Cette stratégie pose la problématique des Aménagements Hydroagricoles et leur mise en oeuvre comme étant un processus interactif entre les différentes parties concernées (autorités politiques et administratives, services techniques, paysans bénéficiaires) sous-tendue d'une approche pluridisciplinaire.

2. SYNTHESE DE LA STRATEGIE NATIONALE DE VALORISATION DES PERIMETRES IRRIGUES (Phase non Opérationnelle)

La stratégie en elle-même brièvement s'articule de la façon suivante :

- Phase de mobilisation et de sensibilisation

Son importance repose sur le constat fondamental que les projets d'irrigation exigent une adaptation des mentalités et un comportement des populations aux contraintes de l'organisation communautaire qu'ils imposent dans la production. D'autre part ils apportent des bouleversements importants dans le milieu physique et dans les habitudes des paysans. Cette étape consiste à faire connaissance avec les paysans concernés, et à préanalyser avec eux l'environnement socio-économique.

- Phase de conception et étude

Cette phase met en présence divers partenaires dont les agents de développement, les spécialistes et les populations cibles. C'est à cette étape qu'une dynamique de concertation doit être établie entre les divers partenaires pour adapter le projet d'irrigation aux aspirations des paysans et aux conditions locales ; étant entendu que le projet est sous-tendu par une responsabilisation des paysans pour leur propre prise en charge. Le caractère pluridisciplinaire du Projet apparaît nettement à cette phase.

- Phase de recherche de financement

A cette phase on s'efforcera grâce à la concertation entre les différents acteurs d'identifier la participation de toutes les parties notamment les paysans tout au moins en ce qui concerne certaines charges (de fonctionnement et d'amortissement partiel ou total des investissements).

- Phase de réalisation des travaux

La participation des paysans à cette phase en fonction de leur degré de technicité, sur la base de variante technique préalablement conçue en tenant compte de leurs aspirations, permet de mesurer leur degré d'engagement vis-à-vis du Projet et d'en faire siennes les réalisations en cours.

- **Phase d'exploitation**

La phase d'exploitation de la vie économique et de gestion du Projet sur la base d'un contrat entre les différents partenaires et dans lequel les paysans s'identifient pleinement. Une discipline collective s'impose à tous et le caractère multidisciplinaire du Projet sera prépondérant.

La stratégie est appuyée d'une coordination générale ainsi que de mesures d'accompagnements essentielles pour sa mise en oeuvre. Les mesures d'accompagnements intéressent essentiellement la collecte et la commercialisation, le crédit agricole, la recherche agronomique, l'environnement et la cadre de vie, etc...

Cette stratégie montre clairement la nécessité dès l'initiation du Projet de stimuler la participation des paysans à toutes les phases par une dynamique concertation permanente, avec une délimitation des responsabilités et de contribution de toutes les parties concernées.

Les procédures internes la régissant peuvent paraître longs pour la réalisation physique des infrastructures techniques ; mais l'avantage considérable d'intégrer les paysans au processus de planification et de gestion du Projet est la seule garantie de l'exploitation optimale à long terme des projets d'irrigation.

La stratégie brièvement exposée ci-dessus reste encore au stade d'une vision clairement énoncé des axes d'actions à envisager dans le cadre des Aménagements Hydroagricoles. En d'autres termes, cette stratégie n'est pas encore opérationnelle sur le terrain et l'expérience du Projet "Sensibilisation et Formation" dans le cadre de l'Aménagement Hydroagricole de Nagréongo constitue un test de mise en oeuvre.

3. L'EXPERIENCE DE L'AMENAGEMENT HYDROAGRICOLE DE NAGREONGO

D'une manière générale l'expérience vécue au site de Nagréongo peut être considérée comme la mise en oeuvre pratique de la stratégie nationale qui privilégie la concertation permanente entre les différentes parties concernées en vue d'atteindre les meilleurs résultats. Dans le cadre de l'expérience méthodologique du Projet "Sensibilisation" l'accent est mis sur le transfert du savoir faire et être aux paysans qui sont les principaux acteurs de la mise en valeur. Cette dernière vision assure les intérêts bien compris des parties concernées, notamment l'état et les paysans - premiers bénéficiaires des acquis d'une mise en valeur optimale.
Les Chapitres ci-dessous conforteront cette assertion à partir de la chronologie de mise en oeuvre du Projet.

3.1. Données de base

L'aménagement hydroagricole de Nagréongo (21 ha) est situé au Centre du Plateau Mossi à environ 42 km de Ouagadougou.
Les objectifs spécifiques poursuivis par le Projet sont :

- Le développement des cultures céréalières et maraîchères grâce à l'irrigation gravitaire

- La réduction de l'émigration périodique ou permanente des populations environnantes du site vers les grands centres urbains ou à l'extérieur du pays.

Il est important de noter que le site disposait déjà d'un important ouvrage hydraulique de faible capacité (le barrage) et la mise en valeur des terres agricoles exigeait dans une première étape l'augmentation de la capacité de l'ouvrage hydraulique de base qui a passé de 400 000 m3 à 1 000 000 m3.

3.2. La conception des Aménagements comme processus interactif

La mise en oeuvre du Projet en tant que processus interactif entre les différentes parties s'articule ainsi qu'il suit :

- Etude socio-économique du milieu environnant du Projet
- Conception du dossier technique de base de l'aménagement
- Mise à disposition du contenu du dossier technique aux différents services techniques impliqués et aux autorités politiques et administratives de la zone du Projet
- Sensibilisation, information et mobilisation des populations autour des objectifs du Projet
- Rencontres sectorielles entre les différentes parties pour améliorer le contenu du Projet
- Etablissement des conditions d'attributions et d'exploitation de l'espace agricole à irriguer au vue de la législation en vigueur
- Mise en place de l'organisation des paysans pour la participation à l'exécution physique des ouvrages hydrauliques
- Distribution des parcelles par le comité d'attribution
- Mise en place d'une structure paysanne provisoire en vue d'assumer les responsabilités qui sont les leurs pour optimaliser la mise en valeur
- Mise en oeuvre d'un programme conséquent de formation afin d'assurer le transfert de connaissance et de savoir faire.
- Mesures d'accompagnement

Le caractère interactif du processus se révèle nettement durant toute la période qui précède l'exécution physique des travaux d'aménagement, car au cours de cette étape de nombreuses concertations ont lieu soit entre toutes les parties concernées ou de façon sectorielle afin de clarifier les points souvent litigieux en matière d'aménagement hydroagricole (droit foncier, mode d'attribution, condition d'exploitation et de gestion, place des femmes, etc....)

Cette étape prend le temps nécessaire jusqu'à ce que toutes les parties débouchent sur une compromis garantissant les intérêts des parties concernées.

3.3. Les différentes étapes du processus à Nagréongo

La première étape est l'étude socio-économique, cette étape est importante pour deux raisons essentielles dans le cas des périmètres irrigués villageois du Burkina.

En effet ce type d'aménagement est toujours situé physiquement à la lisière de deux ou plusieurs terroirs villageois d'où la nécessité de garantir les intérêts des villages concernés et du fait du caractère spécifique de l'aménagement (productivité élevée, stabilité de la production, etc...) ; l'Aménagement procure des revenus appréciables.

La deuxième raison est que seule la prise en compte des différents aspects socio-économiques de l'environnement de la zone de l'aménagement permet d'adapter au mieux le projet aux conditions locales et surtout d'asseoir les bases saines d'une structure paysanne adaptée capable progressivement de prendre en charge l'outil de production qu'est l'aménagement (gestion technique, organisationnelle et financière) grâce à un appui aux paysans à moyen terme.

L'étude se veut autant que possible exhaustive auprès des paysans dans un rayon de 7 kms maximum du site de l'aménagement.
La première étape de l'étude socio-économique a permis de collecter les informations relatives à la situation démographique, la situation organisationnelle, le droit foncier, le système de production et la situation infrastructurelle des villages de la zone du Projet (1987).

Cinq villages avec une population de 5 802 habitants intéressent la zone du projet dans un rayon de 5 kilomètres. L'étude a révélé qu'il existe entre les villages une bonne

connaissance des limites du terroir villageois de chaque village donc l'absence de conflits fonciers mais avec un vif intérêt au projet qui exigera d'établir des critères objectifs afin de satisfaire au mieux une partie des candidats potentiels (ménages).
L'étude révèle d'autre part une homogénéité ethnique (mossi) avec une prédominance de la population féminine (52 %) due à l'émigration.

Un des objectifs de l'étude est d'identifier l'ensemble des paysans ayant soit des exploitations agricoles sur le site à aménager ou des investissements divers (vergers) ou d'autres paysans ayant perdu des terres du fait de l'inondation du plan d'eau du barrage.
L'étude a également révélé l'existence de groupements villageois (4) et de groupements féminins (1) ce qui dénote d'un niveau
d'organisation à la base.

L'analyse des résultats de l'étude permet d'une part de juger de la viabilité future de l'aménagement proposé et d'autre part de juxtaposer les résultats de l'analyse aux conditions prévues dans les textes en vigueur relatifs à la mise en valeur des aménagements hydroagricoles villageois. L'expérience a en effet montré que dans les zones excédentaires du Sud-Est du Sud-Ouest du pays où les paysans réalisent deux récoltes de céréales par an, l'intérêt des paysans est faible par rapport aux paysans du Nord du pays.

L'étape suivante de la conception se fixe pour objectif un système d'irrigation simple mais efficace en vue de faciliter la gestion et l'entretien futur des infrastructures hydrauliques par les paysans. Les principes directeurs de cette conception étant ceux de l'irrigation gravitaire, des ouvrages de distribution et de régulations robustes et au fonctionnement efficace.

Les principaux éléments de l'étude socio-économique pris en compte dans la conception (périmètres villageois rizicoles) sont le droit foncier et le système de production.

La parcelle irriguée bien que rapportant des revenùs appréciables est un complément de l'agriculture pluviale, aussi dans la conception on s'efforcera d'avoir un maximum possible pour satisfaire le plus grand nombre tout en restant dans le seuil économique optimal qui est de 20-25 ares en riziculture et de 10 ares en maraîchage ceci ayant des incidences dans la conception de la maille fine du réseau d'irrigation qui doit garantir l'accès à l'eau en quantité suffisante de chaque parcelle et l'organisation de la distribution de l'eau au sein du périmètre.
Le système de production qui comporte des cultures pluviales et une parcelle en irrigué avec un intérêt plus accru vis-à-vis des premières entraîne au niveau de la conception de tenir compte des besoins en eau pour les cultures pratiquées ou souhaitées ainsi que les fréquences d'irrigation au vu des habitudes des paysans. Cette situation est différente de celle existante dans les aménagements de grande taille où l'essentiel du revenu du paysan provient de la parcelle irriguée d'une taille d'environ un hectare et où il n'existe presque pas de chevauchement contradictoire entre parcelle irriguée et cultures pluviales.

A cette étape la participation des paysans reste faible, car il existe des limites objectives à la discussion avec les agriculteurs des choix conceptuels. Le système d'irrigation gravitaire est contraignant car il impose une plate forme minimale à laquelle sont soumis les agriculteurs dans un cadre organisé. Il s'agit principalement de la gestion de l'eau qui doit garantir l'accès à l'eau en quantité suffisante et à temps opportun de chaque parcelle paysanne, ceci ne peut se réaliser que dans un cadre organisé avec une discipline respectée. Le système doit permettre une certaine souplesse pour faire face aux sollicitations diverses des agriculteurs (chevauchement cultures pluviales - parcelles irriguées) avec le décalage des calendriers agricoles dus aux aléas climatiques.

C'est à l'étape suivante de la mise à disposition du dossier technique aux différents partenaires techniques que l'expérience de terrain antérieur permettra d'améliorer un certain nombre d'aspects dont les incidences sont bien connues du milieu paysan (disposition des parcelles, main-d'oeuvre, tour d'eau, drainage, protection du périmètre, piste de desserte, etc....)

Dans le cas précis de l'Aménagement Hydroagricole de Nagréongo, les concertations sectorielles entre le Ministère de l'Eau (ONBAH) et le Ministère de l'Action Coopérative Paysanne (Projet "Sensibilisation et Formation") ont permis d'améliorer la conception technique du Projet.

L'étape de la sensibilisation et de la mobilisation a consisté avec les autorités administratives, politiques et les structures populaires à organiser des rencontres d'informations en direction des populations de chaque village. L'objectif étant de fournir d'une part toutes les informations relatives au projet, recueillir les propositions des paysans, stimuler l'intérêt vis-à-vis du projet afin d'asseoir une organisation des candidats potentiels futurs bénéficiaires. Ces rencontres longues et nombreuses ont permis de prendre en compte les préoccupations de chaque village et d'asseoir les critères de participation et l'organisation des paysans en vue de la mise en oeuvre du Projet.

L'étape d'établissement des conditions d'attribution et d'exploitation est facilitée par l'existence d'un texte régissant les Aménagements Hydroagricoles "cahiers de charges des Aménagements Hydroagricoles". Ce texte détermine les structures comme le comité d'attribution dans lequel tous les partenaires sont membres, le comité de gestion, les droits et devoirs des différentes parties.
L'application du texte dans un cas précis tient compte des conditions précises du milieu suite à l'étude socio-économique mais garantit les intérêts de l'état ainsi que ceux des paysans attributaires et des groupes à promouvoir (groupements

féminins, jeunes agriculteurs, etc....)

La connaissance des idées fortes de ce texte par les différentes parties, surtout par les paysans des villages intéressés permet de mettre en place une organisation pour l'exécution physique des travaux.
Ainsi à Nagréongo, tous les candidats (chefs de ménages, hommes ou femmes) se sont organisés pour travailler quotidiennement sur le chantier. Un cahier de pointage tenu par le délégué du village qui enregistre le nombre de jours de participation de chaque candidat. A la fin des travaux, le récapitulatif des jours de travail de chaque ménage effectué, le comité d'attribution composé des différentes parties siège pour définir le nombre de candidats à retenir au vue de la disponibilité des parcelles après avoir au préalable déduit les parcelles à effectuer aux collectivités (groupements féminins, essais agricoles, etc...).

Les critères essentiels d'attribution sont la disponibilité d'actifs, la participation effective aux travaux physiques et l'acceptation de s'engager dans une future structure commune de paysans (groupement ou coopérative) en vue de la gestion optimale de l'Aménagement Hydroagricole.

La distribution effective des parcelles a lieu en séance publique par le comité d'attribution. Les parcelles destinées aux collectivités étant déduites au préalable (8 parcelles soit 1.60 ha pour 3 groupements féminins et 2 parcelles pour les essais et l'école) ; le reste des parcelles sur une superficie nette disponible de 21 ha est répartie entre les candidats potentiels (chef de ménage) ayant satisfaits aux critères d'attribution par ordre décroissant de taux de participation. Les candidats potentiels satisfaisants aux critères d'attribution mais non attributaires sont rénumérés aux taux du S.M.I.G. (Salaire Minimum Inter Professionnel Garanti).

L'étape suivante avec une participation très active du Projet comporte les actions suivantes :

- Mise en place d'un bureau provisoire du groupement
- Formation intensive agricole pour démarrer la campagne
- Mise en oeuvre d'un programme conséquent de formation
- Mesures d'accompagnement

La mise en place du bureau provisoire s'effectue par la désignation par les paysans attributaires des différents responsables (Président, Trésorier, Secrétaire et Chef de zone d'irrigation) ayant pour rôle d'organiser toutes les tâches à assumer par le groupement au cours de la campagne. Le bureau sera définitif après une année d'exercice apprécié par l'ensemble des agriculteurs.

La formation intensive s'impose toute de suite pour espérer réussir la campagne ; aussi sur le terrain diverses méthodes complémentaires sont utilisées (film vidéo, parcelle de démonstration, séances de discussions, etc...).
Le programme de formation se fixe pour objectif le transfert de savoir faire et être aux paysans. Il comporte des formations générales et spécifiques (alphabétisation, formation-réflexion, gestion financière, gestion de l'eau et entretien du périmètre, visites intergroupements). Les formations générales s'adressent à l'ensemble des exploitants ; tandisque les formations spécifiques s'adressent à un nombre restreint d'exploitants occupant des responsabilités dans le groupement.

Les formations s'effectuent par session de courte durée d'une semaine en salle ou sous forme de session pratique sur le terrain à l'aide d'outils de formation (documents, film vidéo, etc) pendant les périodes proposées par les paysans.

Les mesures d'accompagnement ont trait au fond de roulement pour l'acquisition des intrants agricoles, le petit équipement pour l'entretien du périmètre et l'appui institutionnel aux paysans (reconnaissance juridique, règlement intérieur, et statuts, etc).

4. CONDITIONS DE MISE EN OEUVRE D'UNE CONCERTATION EQUILIBREE ENTRE LES DIFFERENTES PARTIES ET MESURES D'ACCOMPAGNEMENT

La mise en oeuvre de la conception comme processus interactif entre les différentes parties suppose un ensemble de conditions dont les principales sont les suivantes :

- Un environnement politique favorable sous-tendue par une volonté politique clairement exprimée qui met au centre du développement les masses populaires.
  L'environnement politique favorable met en confiance la paysannerie interpellée à assumer son développement grâce à ses capacités internes d'organisation avec l'appui de l'état. Toute autre politique ne laissant pas une place de choix à la paysannerie a pour conséquence la passivité de celle-ci dans la concertation indispensable pour la mise en oeuvre du processus avec pour corollaire l'absence de volonté d'assumer les actions de développement entreprises.

- L'existence marquée dans les milieux chargés de promouvoir le développement rural, d'une vision du modèle de développement dit participatif. Le modèle technocratique fait abstraction du savoir faire paysan et de ses capacités à participer aux actions de développement et de les assumer. Ce modèle ignore une des caractéristiques fondamentales du monde de l'agriculture "le monde de l'agriculture est le monde du temps, avec lequel on ne peut tricher".

- Un juste équilibre des forces en présence pour la concertation dynamique et enrichissante entre les différentes parties.

Le juste équilibre des forces est une étape qui ne s'atteint que progressivement . A cet effet il faut créer un cadre structurel dans lequel les différents acteurs en concertation permanente débouchent sur un consensus garantissant les intérêts de l'Etat et ceux des paysans. Les paysans doivent par l'apprentissage maîtriser leurs responsabilités, leurs devoirs et droits grâce à la formation et l'appui institutionnel.

Dans notre cas précis, il existe deux instances (le comité d'attribution et le comité de gestion) dans lesquels les membres de bureau du groupement/coopérative participent au débat contradictoire. Le comité d'attribution-structure légal de la législation statue sur la base des conditions générales prévues par les textes en la matière et la situation particulière de l'aménagement et désigne nommément les familles bénéficiaires de parcelles.

Le comité de gestion dans lequel siègent les membres du bureau du groupement a pour objet de gérer quotidiennement le périmètre en garantissant la transparence de gestion et le jeu démocratique nécessaires pour un climat de confiance indispensable à la vie de la structure paysanne.

L'absence de cet équilibre a pour conséquence la non participation effective de certaines parties ce qui rend inopérant et sans effet une telle structure ad'hoc de concertation. Il est donc important d'assurer un équilibre judicieux entre les différentes parties afin que chaque partie soit partie prenante et contribue efficacement à la mise en oeuvre optimale du projet.

La mise en oeuvre de la conception en tant que processus interactif entre les différentes parties pour atteindre sa pleine efficacité, suppose enfin des mesures d'accompagnement qui sont entre autre l'information, la sensibilisation, la formation en faveur d'une des parties essentielles qu'est celle des paysans.
En effet, la concertation dynamique entre les parties débouche sur une forme de contrat stipulant les responsabilités et engagements de chaque partie dans la mise en oeuvre du projet. Assumer une responsabilité suppose un savoir faire et c'est pourquoi en faveur de la partie des paysans des actions d'appui

doivent être déployées en vue de leur permettre d'acquérir le savoir faire qui garantit l'effectivité des responsabilités qui sont les leurs. Cette tâche importante d'appui aux paysans est une des actions essentielles du Projet "Sensibilisation et Formation".

5. CONCLUSION

Les Aménagements Hydroagricoles apparaissent comme un nouveau système de production dont la conception et la mise en oeuvre ont jusque là incombé à l'état soucieux d'améliorer la contribution de ceux-ci à la réalisation de l'objectif de l'autosuffisance alimentaire.

L'implication des différentes parties notamment les paysans à la conception a été jusque là ignorée ou tardive et sans incidence notable.

La réussite de ces projets passe par certainement la mise en oeuvre de la conception comme processus interactif entre les différentes parties concernées.
Il appartient à l'état d'impulser cette vision par une volonté politique concrète en mettant en oeuvre des cadre de concertation multiparties équilibrées - seule gage pour atteindre les résultats attendus de ces projets.

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PARTICIPATORY DEVELOPMENT OF A WOMEN'S IRRIGATION SCHEME

case: The Nyandusi Women Horticultural Scheme,
Nyanza Province, Kenya

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1. INTRODUCTION

This paper analyzes how the main actors in the development of the Nyandusi Women Horticultural Scheme:

* the women members,
* the landowners, and
* the irrigation agent

participated in the decision-making during the crucial stages of the design and implementation of this scheme.

The Nyandusi scheme is one of the irrigation schemes designed and implemented by the Provincial Irrigation Unit of Nyanza Province (PIU), which is part of the Ministry of Agriculture in Kenya. The PIU is mostly concerned with the rehabilitation and expansion of rice schemes; assistance in the realization of horticultural schemes is a side activity.

Since 1983 the small-scale (5 ha), high-tech (motor-driven pump) Nyandusi Women Scheme has been in operation under group management without the assistance of an outside agency.

The aim of this paper is to show:

1. ways in which the future beneficiaries of a farmer-managed scheme - in this case women - can participate in designing and implementing their own scheme,
2. the effect of participation of these beneficiaries on the final outcome of the scheme, and
3. the complexity of factors involved in designing a farmer-managed scheme.

This paper is based on my personal experiences as provincial irrigation engineer of the PIU at Kisumu from 1981 to 1987.

The next section gives a short history of the development of the scheme. Section 3 follows with an account of how the three parties involved in the scheme development brought about a striking change in the original design through a process of understanding, persuasion and negotiation. The subjects discussed are the organizational structure of the scheme, the security of land use, and the main features of the technical design. Section 4 deals with the training components that were incorporated in the implementation of the scheme with a view to preparing the users for the future operational tasks of the group. Section 5 gives some conclusions and recommendations.

2. THE DEVELOPMENT OF THE NYANDUSI SCHEME

Area and location

The Nyandusi Scheme is situated in Siaya District, Nyanza Province, on the shore of Lake Victoria, at a distance of about 15 km from Bondo town. The Bondo area is considered marginal and dry; it generally has a subsistence type of agriculture (maize and sorghum). The sale of livestock and the cash crop cotton are the major sources of cash for the men. Employment opportunities outside agriculture are few: the civil service, fishing, trade and minor industries like honey refinery and charcoal burning. There is a strong tendency among enterprising young men to leave the area and to seek employment elsewhere.

In a narrow strip along the lake, where rainfall averages 870 mm, but may incidentally be as low as 100 mm per year, individuals and groups have started to grow vegetables for home consumption and marketing at nearby towns. Vegetable growing is mainly done by women, enabling them to eke out an additional family income. Nearly all these schemes consist of tiny plots of kale, onions, tomatoes and food crops, which receive additional water during dry spells. Women fetch water in buckets from the lake and carry it on their heads to the plots.

The Nyandusi Scheme

The Nyandusi Scheme started in 1967 as an informal horticultural association. The original members consisted of three landowners and their extended families who jointly grew vegetables on their land bordering Lake Victoria. One of the landowners, a retired government official, was the group's promoter and adviser.

In the late seventies the Ministry of Social Services set up a policy to encourage the formation of women's groups, which could then be considered for financial assistance by foreign donors. As this policy was well-known, the Nyandusi association altered its name to: "Nyandusi <u>Women's</u> Horticultural Group", and requested for funds. It received Kshs. 20,000 (U.S.$ 800) for expansion of the scheme.

The drought of the 1980/81 season resulted in a serious food shortage that consumed the members' time and money on their search for maize, their staple food. Expansion work at the site stopped and the group agreed to use part of the government fund for maize trading. No proper records of expenditure of the fund were kept, with the result that after an inspection by the relevant officer the group was discredited by the authorities. It was only after the group's promoter defended the group at provincial level that a reconciliation was realized and the project saved from an early death.

In 1980 the group asked the PIU for technical assistance. Investigations were carried out and a preliminary design and cost estimates were made for an irrigation system of 5 ha, which were submitted for funding. On March 5, 1982, the members received Kshs. 300,000 (U.S.$ 12,000) from the Development Committee of Siaya District and the Dutch Government.

Meanwhile the PIU staff had started discussions with the group on restructuring its organization for the operation of a modern scheme.They then made the final design, assisted with the supervision of the construction of the works and with the training of the women. The group participated in the development of the scheme by preparing and discussing bylaws for the scheme management, setting up a revolving fund, and by providing labour.

The construction work, including the installation of the diesel-engine driven water pump, was completed in January 1983. Since then the PIU has only helped the women with the pegging for land levelling and sometimes with instructions for the maintenance of the pump.

The Nyandusi scheme is at present a registered women's group of 39 women members and one male member, the scheme's adviser. Each member has a total area of 1000 m^2, divided into 10 plots of 100 m^2 each. Crops presently grown are tomatoes, kales and onions, and some beans and sweet potatoes for food at home.

During the growing seasons the net income per (average) member (in cash and kind) from the scheme is an estimated 26 KShs daily. This rate is at least double the possible earnings from ordinary field work. Besides, the scheme provides employment at attractive rates during the dry seasons. Compared with a nearby traditional vegetable scheme (Ugambe), Nyandusi members make a daily income that is 5 times as high.

However, the potential of Nyandusi as an income generating high-tech scheme has not yet been reached, mainly because of sub-standard crop husbandry practices and under-utilization of the total area under irrigation. The total labour demand for collective and individual work is high. It is estimated at an annual average of 3 working days (6 hours net) per week. Especially during the rainy season and harvesting period, the women feel severe labour constraints in coping with all their additional tasks in the maize fields and at home. Women with trades or other jobs seem to solve the labour problem through the use of hired labour.

The revolving fund is growing by about Kshs 4,000.- per year. This is not enough to meet the total depreciation costs (estimated at Kshs 16,000.- per year), but goes a promising way if the future replacement of a pump and engine is sought.

The plots, small furrowed basins, receive water weekly. The operation of the pump as well as the water management are done by the members themselves, assisted, at times, by the scheme adviser. The cost for diesel per ha is quite reasonable (60 KShs per irrigation of 3 ha net). Pump maintenance (done by six women trained by the PIU) and canal maintenance are satisfactory at commercial standards, but remarkably well if compared with former collective pump schemes in the same location. Improvement of the water management could only marginally contribute to an increased output of the scheme at present.

Marketing of the vegetables is done on an individual basis and collectively. Produce is sold in the immediate area, to contractors and schools, in Bondo town and other nearby markets and also occasionally as far as Kisumu market at a 90 km distance. Produce is transported on foot, by bike, by bus, and sometimes by a rented pick-up.

The Nyandusi Women Irrigation Scheme has now been in operation under group management without agency management assistance for seven years. So it may be considered a sustainable scheme.

3. THE IMPACT OF PARTICIPATION AND NEGOTIATION ON THE DESIGN

In the following sections an account is given of how the three parties involved in the scheme, the PIU, the women's group and the men/landowners, effectuated a considerable change in the original design parameters through a process of understanding, persuasion and negotiation. These parameters concern the organizational structure of the scheme, the security of land use, and the technical design. Moreover, an attempt is made to explain the motives of the individual parties to pursue their views.

3.1. Organizational Structure and Security of Land Use

<u>Original situation</u>

When the PIU started dealing with the Nyandusi Women's Group it was, in fact, confronted with a clan group in which the women had virtually no say in managerial matters. Eight out of the 27 members were male. Four men, including the three landowners, were members of the committee. The female committee members were wives or close relatives to the landowners. Not the chairlady but the group's promoter was the one representing the group in all the discussions with the PIU. There were few indications of formalized management:

* The bylaws of the group were compiled by the promoter and were not written in Luo, the language spoken by the majority of the members. They were insufficient for dealing with the intricate problems a pump-irrigation system was to entail.
* There was no formal land-lease agreement with the members.
* The marketing to nearby schools was controlled by the landowners.
* No records were kept.

Consequently, the organizational structure clearly showed an imbalance of power in favour of the landowners. Besides, the morale was shattered. Rumour mongering about the misappropriation of the government fund for the trade of maize had led to a distrust among the women members. Field work was neglected.

<u>Present Situation</u>

Presently the group consists of 39 women and one man. All the committee members are women. The male member is the promoter - adviser who, by virtue of his abilities, is allowed to have a plot in the scheme (which is being cultivated by his second wife as her second plot). The adviser is also an "ad hoc" member of the committee, without voting power. This arrangement has been formalized in the bylaws of the group. The bylaws are written in Luo and are effectively being used for the proper conduct of meetings, the operation and management of the scheme, for loans and marketing, and for the acceptance and expulsion of members. In order to curb the influence of the landowners' families, only two wives per family unit are accepted as members. Financial records are kept and the land is formally leased to the group.

3.1.1. The Women's Standpoint

The Nyandusi women live in a traditional Luo community. All of them come from polygamous households and many bear the full financial responsibility for their own family, running their daily affairs quite independently of their husbands. However, they have little influence in public or semi-public organizations. In the Luo region many women projects are the result of a combined effort of men and women. Besides, women believe that men have to be included in order to obtain the necessary public and government support. It is, therefore, normal to find husbands and local dignitaries, like the Assistant Chief or the agricultural extension officer, as members or as committee members of a scheme. Men in the committee can be very useful as they are usually more literate (secretary and treasurer) and can better face the (male dominated) bureaucracy from where the financial support is sought.

Only when the PIU started to organize special women's meetings and brought the women's lack of active involvement up for discussion did the women voice their distrust and dissatisfaction with the committee. They insisted on an equal division of plots and a fair share in the profits, which meant that not only the influence of the landowners should be curbed, but also that of their wives and close relatives.

The actual coup in which group and committee were cleared of men came as a complete surprise to the PIU. At the general meeting following the women's meetings the chairlady expressed the women's wish to manage their own irrigation scheme without the interference of men, with the exception of their adviser whom they trusted and considered indispensable. With the assistance of a female officer and a female teacher from a nearby technical school, the women then discussed and amended the provisional bylaws and organizational structure, which the PIU had compiled and translated in Luo.

3.1.2. Standpoint of the PIU

<u>On Organizational Structure</u>

The objective of the PIU is to develop smallholder irrigation by means of a rural development approach. This requires an organizational design that benefits the target group, in this case the Nyandusi Women, who traditionally depend on vegetable growing as an additional family income. This implies that the target group itself should also be in control of the operation and management of the scheme. From the data gathered about the Nyandusi group, the PIU deduced that this point of view might interfere with the interests the landowners had in mind, however development-oriented they believed themselves to be. If the PIU approved of a male-dominated women's organization to run an irrigation scheme merely on account of the semi-public and formal aspects it entails, it would automatically restrict the informal influence the women traditionally have at home and in the community. The occasional dependency on men for formal leadership would turn into a permanent situation and thus be formally acknowledged. Besides, experience with other irrigation schemes nearby had shown that these had failed primarily because operational and financial management was controlled by people who were not the direct beneficiaries of the scheme, which had led to exploitation of the users and money embezzlement. Therefore, the PIU considered the active participation of the women in the design of a viable organizational structure as a prerequisite.

This point of view was, at first, not exactly a unanimous one shared by the whole (male) PIU staff. The influence of some expatriates who stimulated discussions about the issue, played a major role. They convinced their colleagues of the need to include rural women in the strategies of development of local management resources. When the PIU's attitude towards the women issue changed, it engaged a female locational officer and a female non-government volunteer to speak to the Nyandusi women directly. Meetings were organized in which all the women members participated without the presence or mediation of men. Relevant issues concerning the organization of the scheme, the formulation of the bylaws, the finances and management were discussed twice, at women-only meetings and at general meetings.

On Security of Land Use

The PIU considered the security of land use for the users as a precondition for sustainable scheme operation to avoid future problems over land use and to safeguard the economic return on capital assets. Many development projects in which tenancy was involved had failed because the land issue was not or improperly dealt with. The principle of mutual trust does not always apply when it comes to money. Consequently, the PIU insisted right from the start of its involvement that the landowners and the group should settle terms for a lease-agreement to be passed through formal channels and registered by the Land Registration Office.

3.1.3 The Men's Standpoint

In the traditional Luo society men consider themselves the main decision-makers in public matters and land transactions. Besides, they tend to think that when (official) money is involved they should be in charge. As to the access of land the man is the owner, but the woman acquires usufructuary rights to farmland by marrying into her husband's extended family. In this way she is able to support her own family relatively independently within the polygamous family structure.

However, the Nyandusi women could not exercise their usufructuary rights on the scheme area, as it used to be grazing land which is regarded as the men's personal property. The men argued that if this land was used for commercial purposes they could take the full profit. The alteration of the original name of the horticultural group into that of Nyandusi <u>Women's</u> Horticultural Group had served only as a ploy to attract funds donors had made available through the government to assist women cultivators. The men looked forward to having an irrigation scheme installed upon "their" land, which would raise the value. Land speculation was becoming a common phenomenon in the region, an easy way to obtain wealth.

Consequently, the landowners were not too happy with the PIU's proposal to lease the land to the group. They started delaying the formalization of the lease. The land had been adjudicated by the respective landowners, but the title deeds had yet to be purchased, for which two landlords claimed not to have the money. The group agreed to advance this payment. Especially the negotiations about the terms of agreement were time-consuming because of the conflicting interests of landowners and tenants as to plot division, marketing and lease. At the final stage the landlords demanded Kshs 7500,- per year, a rent comparable to the sale of such acreage in the area, by calculating an added value to the lease based on the land improvements carried out by the PIU. The PIU had to intervene in order to give the group a chance of survival. When still no agreement had been reached at the moment of the scheme's completion, the PIU decided to remove the pump and store it until the lease was registered at the Land Registration Office. Two weeks later the issue was settled. The landowners had leased the land free of charge for the next ten years with an option for a cheap ten-year lease after this. The men claimed not to have understood that the irrigation system belonged to the group.

The ever-present fear that the PIU would withdraw its assistance probably played a major role in the men's consent to the curtailing measures that the PIU imposed upon them. As the adviser explained a few years later: " We noticed that the Dutch government had intended the funds for the women only, so we allowed our women to run their own irrigation scheme." In any case as land speculation was the men's main concern, they underestimated the potential the irrigation scheme had to increase crop yields and income. If the lease agreement had not been realized before the first tomato bumper harvest, it must be considered unlikely that the men would have cooperated to have their power curbed.

The Role of the Adviser

The role of the adviser needs special note. Throughout the process of change the adviser showed natural leadership. Although he was one of the landowners he was trusted by all the parties involved because of his personal involvement in the development of the group. As a retired government officer, and having worked as a middleman of horticultural produce (Mombasa) he was experienced in governmental as well as commercial affairs. He proved a shrewd help in the compilation of bylaws by anticipating issues of conflict. He had a strong influence on the daily management and was a driving force behind the scheme committee. And last but not least, he had a great sense of humour and a good relationship with his wives and the other women in the scheme. However, this does not mean that the women and the PIU should have accepted him as a manager running the scheme as a private enterprise. All realized from past experience that power corrupts. Subsequent conflicting interests would have caused yet another irrigation scheme to fail. That is why the women did not allow the adviser the right to vote, to have a larger portion of land, and to control the marketing of the produce.

3.2. The Technical Design

The major changes in the original technical design made by the PIU concerned the type of irrigation, the layout of the irrigation system, and the plot size distribution. Other features of the technical design, e.g. the structures, underwent only minor conceptual alterations and will not be dealt with in this section.

3.2.1. Original Design

The initial design was largely based on the actual situation in the field as the PIU found it at their first visits. Information was collected from the landowners and the agricultural extension officer. Discussions about the layout and distribution of plots were held in English and Kiswahili among the men, while the women cooked and served the meals and continued their work in the field. Consequently, the PIU designers went along with the idea of the landowners of leaving the boundaries of ownership in tact, and designed the layout on the presupposition of collective cultivation within the areas of the respective landowners (see fig. 1).

Type of Irrigation

Furrow irrigation with the use of syphons was recommended to minimize levelling in view of the topography.

Layout

The division of the area into irrigation blocks was determined by the boundaries of landownership and the topographical conditions within these boundaries.

The conveyance system, consisting of a delivery pipeline (for the up-hill section) and a network of branch canals, followed the layout of the irrigation blocks. (see fig. 1).

The plot size distribution

The plot size distribution was proposed as follows:

land owner A	0.3 ha
land owner B	0.6 ha
land owner C	0.3 ha, and
24 ordinary members	0.16 ha each

* Landowners were to have full control over the areas allotted to them as compensation for the land given to the group. Therefore, the plot sizes of the landowners were to be proportional to the area of land leased to the group.
* Control by the landowners was understood to mean that the landowners would be free to lease their own plots to women on a mutually agreed informal lease.
* The 24 other members were to be assisted in obtaining a formal land agreement to use the land to their own benefit (and that of their families).
* Each member was to be given a plot in an irrigation block on the property of the land-owner they were related to.

* The selection of new members (to make up for the 24) was left to the group. It was assumed that the group's future bylaws would include the issue of membership.

3.2.2. Final Design

The final design was based on the distribution of equally sized plots that could be individually and independently used, on the collective lease of the total scheme area and on the collective operation of the main irrigation system. The design was the result of a close cooperation of the PIU designers with the women members and their adviser who steered their suggestions. The PIU designed the layout on the assumptions of individual cultivation and eradication of former ownership boundaries (see fig. 2).

Type of Irrigation
Basin irrigation with common inlets to clusters of individual plots was preferred to furrow irrigation as the women were only used to either bucket irrigation or irrigation in very small level basins or ponded furrows. Size of basins 10m x 10m. Syphons were considered unsuitable for basin irrigation.

Layout
The layout of the individual irrigation blocks was determined by the basin irrigation system chosen, the topography of the scheme area, the required crop cultivation practices, the required uniformity of farm plots, and the need for access.

The crop cultivation practices (crop rotation and fallow) largely determined the **number of blocks**. After discussions with the adviser the PIU assumed a diversification of types of crops per block only, the number of blocks was then fixed upon 5 (or a multiple of 5). Topography and the need for access (centre road) further determined the number of blocks to 10.

Blocks were designed of equal size to allow standard size plots and an equal number of plots per block.

The conveyance system was the logical consequence of the division into blocks. (see fig. 2)

<u>The plot size distribution</u>
A total plot size per member of 1000 m2 was eventually agreed upon. The PIU was in favour of parcelling out the area into smaller plots to allow more women to cultivate in the scheme; the adviser advocated 1000 m^2: small enough to leave the women time for other activities besides vegetable growing, and large enough to fetch an additional income worth working for.
With the new and equal plot size the number of women members could be increased to 40.

3.2.3. Present Situation

The present situation only slightly differs from the final design:

<u>Type of Irrigation</u>
The idea of making 10m x 10m basins did not really work. At some places the topsoil was removed and, as the work was done by the women themselves, it proved to be too strenuous for them. Then, when the market price for tomatoes was a real incentive, the women, in order to speed up matters, decided on their own to make zigzag furrows in roughly levelled plots. Plots of befriended members were often zipped together.

<u>The plot size distribution</u>
At the suggestion of the members, each individual member was eventually allotted one plot of 100 m^2 in each of the ten irrigation blocks. This allows each member:

* to have a certain number of plots under crop even if not all blocks are in use.
* to benefit from the better soil quality in the blocks lying at the bottom of the scheme (also less pump costs).
* to adhere to proper crop rotation practices while being able to grow the most wanted crops, such as tomatoes, continuously.
* to leave the care for one or more plots to family members in case of labour constraint due to sickness or other obligations (in compliance with the bylaws).

The allocation itself was, at the request of the women, organised by the PIU. When a new block was ready for cultivation the PIU divided it into 40 equal plots. The women would then assemble at the centre road and at a sign of the PIU official they would sprint to the plot of their choice. It is interesting to note that the women did not particularly mind being at the beginning or at the tail end of a field canal, but they definitely wanted to be amidst their friends. In this way they could take care of the irrigation of their plots in turns and thus reduce the labour input.

3.2.4. Discussion of the Process of Change

The changes in the design came about as follows:

- The work on the final design coincided with the women's discussion about the organizational structure, bylaws and land lease agreement. There it became clear to the PIU that collective cultivation was not the users' wish.
- Then the PIU was confronted with the incompatibility of the original layout and type of irrigation with the new women-only scheme organization, the lease of the land as a whole, and the equal rights to land for all members.
- The PIU decided to re-evaluate the old and the additional new information, to design for the direct users, and to change the plans accordingly.

The initial design proposal is a clear example of how closely a layout can reflect the social and political structure in the local community. The information was gathered in accordance with the socially accepted lines of communication. Male officers and designers discussed men's affairs with the social leaders, that is, the landowners. The result was a design based on a male-biased interpretation of insufficient social data. Although the PIU realized the danger of an unbalanced power structure within the Nyandusi Women's Group they, being males, initially constituted themselves the women's protectors by trying to curb the landowners' influence, but they overlooked the women's presence at the site, apart from the casual compliment for a good meal or an oversized drumhead given to them as a present.

Only after engaging female officers to talk to the women directly (engaged for making the organizational design) did they realize that the scheme did not consist of landlords with their womenfolk, but of relatively independent women running their own households. In fact, by talking to the women in the field and observing their cultivation methods, the PIU noticed that collective cultivation was rarely practised, a must if furrow irrigation was to be a success. As the furrows designed were at times relatively long, individual members would cultivate only a few furrows. From a managerial point of view it is hard to conceive how different crops could be grown on every other furrow. If furrows were cut up to form individual plots over the length of a block, a proper irrigation regime would be even harder to imagine. Although land levelling would indeed be considerably restricted if furrow irrigation was implemented, the problems discussed above might prove unsurmountable.

4. TRAINING FOR FUTURE OPERATION

In the following sections an account is given of how the method of implementation was geared to the future operational tasks of the group. The period of implementation took well over a year.

Work discipline

The group members carried out (by hand) all the irrigation works themselves, apart from the construction of structures (dividers and drops). The PIU's objective was not so much to reduce labour costs, but to give the members an opportunity to identify themselves with the scheme. Something given is not appreciated as much as something earned.
Besides, the work discipline, which involved:

* working together in shifts
* coming at a specific time and
* being penalized by the committee for absenteeism

would prepare them for the subsequent scheme activities:

* watering blocks together at a fixed time
* delivering produce in time for transportation ordered by the committee, or for collection by salesmen
* collective maintenance of drains and canals and
* meetings and collective sprayings.

The collective work proves to be fruitful in other aspects as well. It boosts the group spirit. The women like to work in the group and it gives them a higher status. "To work in the Nyandusi group is very nice" is the spontaneous reaction of members when asked for a comment. As the adviser puts it: "Members have formed close and casual friends among themselves. Here, minor family problems are discussed among close friends before they grow out of proportion. Entertainment such as dances add salt to the group gathering."

Handling money; bookkeeping

The women were persuaded by the PIU to start a revolving fund for operational purposes (to buy fertilizer, pesticides, sprayers, fuel, etc.) by converting the financial remuneration of their labour during the construction of the scheme into a revolving fund.

The building up of a revolving fund took a great effort for the women to realize; and, as it had to be done by all, it strengthened the group spirit even more. First, there were the deliberations on free labour for the construction works. Then the PIU offered to pay (half the official rate) after all, but under the condition that it should be set aside as a revolving fund for the group, a concept quite new to them. Work instructions and the resulting regulations for work attendance and payment took up a lot of time and patience of the women and PIU officers, but it went a long way in preparing the members for the future in which they had to deal with individual and collective purchases and sales of produce.

Training as pump operators

Initially, the group intended to employ a pump operator, a man, as the work involved was heavy, technical, and anywhere else performed by men. This meant contracting a man from outside, the adviser being the only male member and too busy. The PIU eventually persuaded the group to run the pump themselves when they realized after careful calculations and deliberations that funds for paid pump-attendance was just not available as they would need even more than one attendant (shifts, days off). Six members volunteered, who were successfully trained as pump operators.

The issue of the pump operators is an interesting one as it possibly touches local custom as to what is done and what is not done. Women operators of 12 hp motor-driven pumps in Nyanza, and possibly in Kenya, can only be found in the Nyandusi Scheme, and there will be many places in Kenya and other parts of the world where women cannot be persuaded to handle motor-driven pumps. The fact that Luo women manage their lives relatively independent of their husbands may have helped the Nyandusi women to take this decision.

Other training components during the implementation period

Other training courses initiated or conducted by the PIU were:

* leadership
* horticulture: nursery treatment, transplanting, use of fertilizers and pesticides
* bookkeeping
* levelling of basins, and
* first aid.

It is obvious that in order to be able to cope with a commercially run scheme, the women needed training in leadership and bookkeeping. The timing of the bookkeeping course proved to be too early. The knowledge acquired was not practised for many months because land preparation (levelling) took longer than anticipated. The training in first aid appeared to be necessary as the women worked with shovels and pick axes, tools they were unfamiliar with at first. The training in levelling involved the use of water hoses used as water-levels, necessary to level the (sub-)blocks to basins.

5. CONCLUSIONS AND RECOMMENDATIONS

The development of the Nyandusi Women Horticultural Scheme is a clear example of an interactive process in which three actors were involved, the women's group, the men/landowners, and the PIU, which was simultaneously the designer, the technical supervisor, and the one representing the donor. Each of these viewed the scheme from a different perspective. All of them exerted their influence. The PIU had money and know-how. The men had social status, land and experience in public affairs. The women were the target group and the labour force.

The original technical design was not a "blueprint". It was based on information gathered in the field in accordance with the socially accepted lines of communication. Key-informants were the social leaders and the agricultural extension officers. The result was that the layout was designed on the assumption that cultivation was done collectively within the areas of the respective landowners. It was only after the PIU had taken a clear stand in favour of the direct users of the scheme and engaged female officers to organize women-only meetings that the women's wishes were listened to and the layout was changed. The present layout enables individual cultivation of equally sized plots and has no relation with the former ownership boundaries.

The original organizational structure clearly showed an imbalance of power in favour of the landowners. Not only did it keep the operational and financial management of the scheme away from the direct users, the women, but it also restricted the informal influence the women traditionally have in the community. The dangers of exploitation of the users, money embezzlement, and land speculation, which could lead to the failure of the scheme, were close at hand. The present organizational structure which was brought about after a long period of negotiation between the partners involved has proved its worth as the scheme shows no sign of mismanagement.

The experiences discussed in this paper support the view that the sustainability of smallholder schemes is positively influenced by:

- A process of negotiation at the designing stage in which the future users of the scheme, in this case women, also actively participate.
- The incorporation of training components in the implementation stage of the scheme for the benefit of the users.

More specific recommendations are:

1. At the project identification stage information should be collected on the women's position in the society concerned.

2. The direct users should be in control of the operation and maintenance of the scheme. This implies clear rights to the use of land and an organization controlled by the users.

3. All the partners involved in scheme development - women, landowners and the irrigation agent - should actively cooperate in setting up a solid organizational structure

4. If the direct users are women, female officers trained in extension and communication techniques, should be engaged to overcome the communication barrier with the women, and they should organize women's meetings.

5. The organizational design should contain written bylaws prepared and approved of by those concerned. The bylaws should cover matters like land-use rights, members' and tenants' rights, water distribution and maintenance, meetings, financial management, purchase of inputs and sales of produce, the admittance and expulsion of members.

Members must periodically, e.g., during an annual general meeting critically review and, if necessary, adjust the bylaws to the changing conditions of the scheme and marketing situation.

6. The access and right to the use of land and water must be secured by or on behalf of the direct users before the irrigation scheme becomes operational.

7. Because the organizational design is evidently closely linked with the technical design of a farmer-managed scheme, it should have reached an advanced stage in its preparation before the designer, in cooperation with the users, can attempt to make the technical design.

8. A special training programme during the implementation of a scheme greatly increases the competence and confidence of the users, which will help them to make the operation and maintenance of the scheme a success.

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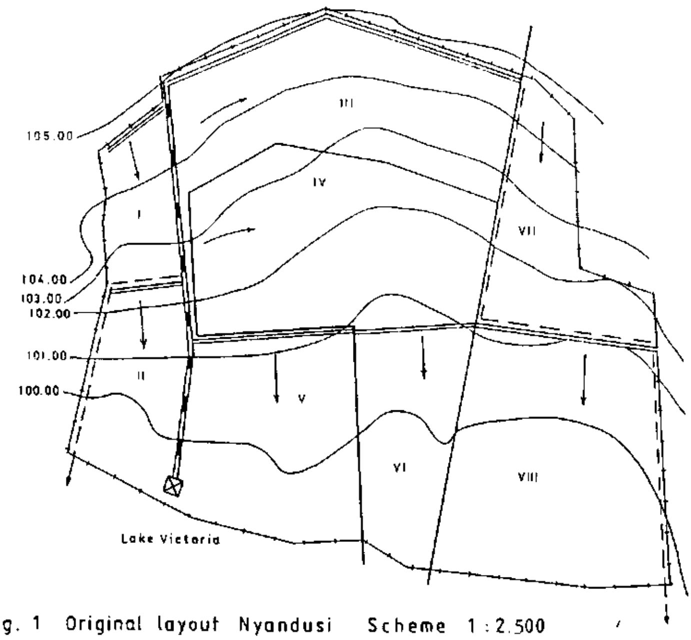

Fig. 1 Original layout Nyandusi Scheme 1 : 2.500

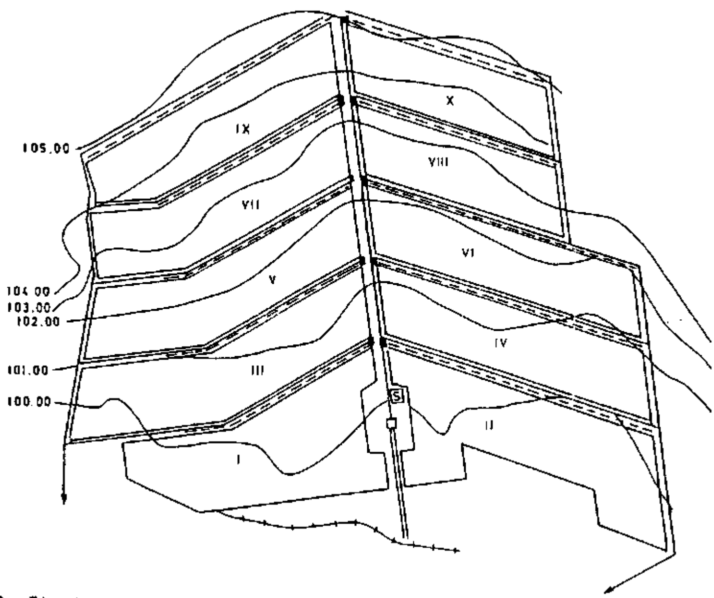

Fig. 2 Final layout Nyandusi Scheme 1 : 2.500

Scheme boundary — Contour line
Ownership boundary — Pipe
Canal system — VI Irrigation block
Drain — Pumphouse

THE DESIGN PROCESS

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Contents

Contribution to the International Workshop
"Design for Sustainable Farmer-Managed
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1. INTRODUCTION

This paper discusses the design process of a small holder irrigation project, the agents and partners involved and their contribution and some objectives and alternative approaches that should be pursued in irrigation development in what is conventionally now termed as "the developing country". The paper generally covers only one of the 4 themes of discussion during an International Workshop planned between 5-8th February, 1990, in the International AAgricultural Centre (IAC), Wageningen, The Netherlands. The theme of the workshop is "Design for Sustainable Farmer-Managed Irrigation Schemes in Sub-Saharan Africa". Other topics of discussion will be:

1. Design on the level of the production system.
2. Design on scheme level.
3. Design of external scheme relations.

Many irrigation schemes developed in Sub-Saharan Africa have performed well below expectations. Yet most governments in those countries have identified irrigation development as inevitable and are thus spending substantial amounts of the country's resources in development of similar projects. This paper gives a short look at the experiences encountered in such kind of projects, also giving some suggestions on how problems in these kind of schemes may be treated.

2. THE DESIGN PROCESS

2.1. Introduction

The design process as defined in the Basic document[1] (page 3) is "a process in which decisions are taken on the basis of information and presuppositions, and within physical constraints and political preconditions". It is also stated

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[1]. Paul Hoogendam, J. Ubels, S. Povel (April 1989), "Desig Sustainable Farmer-Managed Irrigation Schemes in Sub-Sa Africa.

that the process of designing is clearly more than a series of technical decisions, as non-technical presuppositions also underlie a design. This process is therefore the one through which the project undergoes right from when the idea itself is born to the realisation of the physical infrastructure on the ground.

Operation of the project is possible after the implementation of the physical infrastructure and does to a large extent depend on the very nature of the infrastructure implemented. As this phase comes much later when most decisions pertaining to its operation have already been taken, it is not treated in this paper as part of design of the project.

The main phases (or steps) within the design process may be taken as four:

1) project conception
2) discussions
3) the drawing table
4) construction of the project.

These steps are rarely undergone each at a time in the way presented here, and in some cases all but the first one may simultaneously be undertaken in a given time in a given project.

2.2. Project conception

Project conception is here taken to mean the birth of the idea of the project and the consequent perception and the readyness of the society to live with it or use it to solve its problems.

Irrigation development like any other sphere of development is a response to felt needs in society. The need for an irrigation project may be different for different people, depending on role of a person, group or organization in relation to the problems at hand, which define the need for the project. For the purposes of the discussion in this paper 4 groups are identified and their perceptions on the project discussed, also in relation to the design and design process:

i) the farmers
ii) the engineers
iii) the government
iv) other agencies.

Each of these groups may be involved in the conception of projects but once it is conceived, then the possibilities of the project become a matter of discussion by all of them.

2.2.1. The farmers

Many irrigation projects have been identified by the farmers themselves. The main reason for farmers to need the project is to grow food, either for domestic consumption, as a cash crop or in most cases both. In most small-holder irrigation projects now implemented (in Kenya) farmers have had traditional systems of irrigation, which at one time became unoperational due to technical problems, thus forcing the farmers to request for assistance from the government. Such has been the case mostly in gravity fed irrigation projects. The farmers also perceive a possibility for expansion of the project if accepted and implemented by the government. Thus, for them, a possible project not only provides irrigation infrastructure, but also brings more land under irrigation possibilities. A possible project to the farmers is also taken to imply other areas of development, for example, access roads (if they do not exist), flood protection (where the problem exists). Implementation of these projects is very expensive and thus requires heavy financial contributions from the governments (or donors). Paid labour is engaged and then farmers may also regard this as a source of employment.

These perceptions of the project play an important role in the discussions (next section) which are necessary in order to draw criteria on which both planning and design are based.

2.2.2. The engineers

The engineer(s) here is taken to mean a person, group of persons or organization with the technical capability of assessing, designing and implementing an irrigation project.

The engineer is normally engaged in the process of project identification as a second or third person and principally to render the technical services. The fact that he is engaged means that his perception of the project may be different from that of the farmers or other agencies. The first impression of the project in the engineers' vision thus is its technical possibilities, limitations and viability. The engineer is always requested by all the other agencies to indicate how the possible project would be realised. In some cases he changes the perception of the project by offering alternatives to the way the project should be constructed. For example, when other agencies would want a gravity fed sprinkler irrigation scheme where it is not possible, then he advises either on a pumped sprinkler system or just open-channel gravity fed. In a situation like this it is worthwhile to note that this kind of alternative perceptions may completely change the nature of project finally implemented.

2.2.3. The government

The government, being responsible to formulation of the general guidelines in all spheres of development, provides the policies on which the birth and construction of the projects must be based. The perception of the other agencies is thus in line with the policies of the government. However, the policies as given are always subject to interpretation in order to suit the local circumstances in which they are used. The interpretation by agencies on a given policy is sometimes so varied that this may cause differences in perception of a project by the different parties involved. For example, a general policy on development of many specific projects like irrigation schemes, domestic water supply projects, cattle dips, is that the government provides assistance while the beneficiaries also contribute (in materials, labour or money) to its realisation. This system in Kenya is described as "development by shared costs". The interpretation of how much is to be contributed by each, is left to the local authorities and beneficiaries and thus could vary widely on the final proportions agreed on.

Experience so far indicates that the farmers' perception on this policy is quite varied, also depending on project and area. Contribution expected from them is often not given in full and it is clear that they expect the government, or any other funding agency, to do everything. This kind of farmer perception of a project is quite clear even during identification.

2.2.4. Other agencies

This group is taken to mean any other party involved in this sphere of development and not the farmer, the engineer or the government itself. In this group are politicians, governement or semi-government and non-government organizations. When any of these agencies is involved in the initial identification of this kind of projects then normally there is a wider perception of the would-be-projects. Organizations consider the project as part of a wider programme and may involve other reasons like higher foreign exchange possibilities, improvement of nutritional levels and possibilities of agro-industries.

Idendification of projects by this group may therefore involve scopes well above that of farmers and perceptions may thus be different. For example, projects thus identified give farmers an impression that the project not only provides irrigation infrastructure but also other public amenities like dispensaries, roads and credit facilities.

In most cases the agencies falling in this group, having perceived a need for an irrigation project, get also involved in preparations for its implementation, with the perceived role of assisting in soliciting for funds and actual project construction.

All these perceptions of the project formed during its conception influence the discussions that follow, as seen in the other sections in this paper.

2.3. Discussions

This stage of the design process is perhaps the most important of all, as all the parties involved have the opportunity to contribute to the formation of the project as perceived. This is the stage when the different aspects of the project are discussed and criteria formed, on which to base planning and infrastructural designing.

Discussions are held in form of meetings, workshops and seminars and not all parties necessarily need to be present in all of them. Before meetings are held with farmers, discussions are held by other agencies and engineers to clear the policy guidelines. For the purposes of this paper, two types of forums could be considered: between farmers and agencies, and between agencies themselves (agencies = engineers, government and semi-government and non-government organizations).

Meetings or forums between agencies are sometimes convened for the purposes of a given irrigation project or the particular project could just be one of the agendas of the meeting. These forums discuss the project against the national policies and priorities and also in an attempt to harmonize the approach. In Kenya, one such body is the District Development Committee, which bears responsibility of all spheres of development in the district. It comprises the District Commissioner as chairman and all heads of governmental departments in the district and the local politicians. This forum clears with the project by putting the responsibility on the technical ministry (the engineer(s)) and other relevant agencies. The agencies (and the engineer) work out the final modalities of implementations after consultations with the farmers.

A series of meetings is normally organised between the engineers and the other agencies, mainly to discuss responsibilities of each in the project. The agencies involved here are:

- Ministry of Agriculture - having the technical manpower (engineers, agronomists and extentionists)
- Provincial Administration

- Ministry of Culture and Social Services
- Ministry of Water Development
- Ministry of Cooperative Development
- some regional (semi-governmental) authorities.

This forum discusses the final details of implementation. It is necessary therefore that consultations with farmers is done before the final planning and designing is done.

The forum discusses clearly the role to be played by each agency. The services needed are all identified. In some cases it is realised that there is a shortage of technical manpower (for example manpower for community organization) for the identified services. In other cases some issues do not really merge out clearly as a result of their complexity or due to the short period within which irrigation development with the current approach has been practised in Kenya.

An issue in mind here would be a necessary organizational structure to ensure that issues from farmers' groups are fully resolved. A design (and planning) based on the assumption of the existance of such a structure would therefore succeed when the presupposition holds. Some projects have been known to operate poorly as a result of poor marketing possibilities - in a situation like this the infrastructural designs have been based on an efficient commercial assumption.

Forums between agencies and farmers discuss the final details of the projects. Meetings and workshops are convened to discuss:

- problems that define the need for the project
- possible alternative approaches and solutions
- design options and implications
- operational requirements
- responsibilities of each party and roles to be played
- organizational options, alternatives and implications
- possibilities and limitations of the project
- choice of irrigation systems and crops
- priority areas for immediate implementation and phasing, and selection criteria.

A forum between agencies and farmers includes the engineer, extensionists, community organizers, provincial administration, cooperative and marketing officials, local leaders (including politicians) and farmers themselves or their representatives.

Normally the engineer is taking the leading role in these forums, as the organizer and convenor. He draws the agenda for the forum and also does the initial framing of possible solutions to problems at hand at least to form the basis of discussions. The engineer in his professional capacity stands in a position to offer the best advice and actually does so. Whereas discussions on these forums have tended to be quite successful occasionally, a few problems are worthwhile to note:

- complexity of the issues being discussed
- communication problems
- differences in perceptions of the project.

It can be seen from the above list that some issues for discussion are themselves complex in their nature, for example: alternative design options and their implications. The forums have heterogeneous members and clearly the engineer faces a problem of expressing his ideas in a way to be well understood by all. This is more so in a new project where irrigation may be a new innovation. The choice of the final option may therefore not be understood fully by others although agreed on. Other issues (for example labour requirements) may be taken not to be a problem in the meeting but later turning out to be a big problem during operations. A design criteria based on a bigger or smaller group may not make a big difference to farmers and thus in considering which group sizes are appropriate it is quite difficult to make the farmer understand the consequences and hence give the right opinion.

Perhaps also one of the biggest problems in these forums is communication. It has been noted that the engineer has problems in having the design options and their consequences understood. It has also been noted that some issues agreed on in previous forums surface in later forums to take a new dimension in a way to leave it clear that the issue was either not fully understood at the time it was discussed or the views of the opinion leaders did not reflect the wishes of the rest of the group. In other cases the opinion expressed for a given issue may not carry the necessary seriousness with it.

An example of this is when farmers indicate that they would offer free labour (for construction of the project) up to even 2 days per week, whereas later it turns out that this is quite difficult due to other committments. And farmers here are not to blame: the organizers must ensure a system where communication is possible both ways. It turns out that the engineer is not the person to do the organization. There are now trial programmes in Kenya to use community mobilisers to initiate the necessary awareness of responsibilities of project beneficiaries in irrigation schemes. The community mobilisers are specialised in communication and organization aspects. The initial stages of the programme have reported success.

The different perceptions of projects also influence the outcome of these forums. As seen earlier, sometimes farmers do not only perceive the project in terms of its irrigation infrastructure, but also as a package involving other development areas. The discussion might turn out not to be satisfactory on understanding that the package does have the components of irrigation only. There have been instances where the limits of the project do not seem realistic as given by the engineer. An example is mostly encountered when maximum irrigable areas seem to be too low. The design concept here cannot be fully perceived.

A proper project planning is a result of the discussions in these forums. The discussions are quite often thus not exhaustive to necessitate complete planning and design of the project to be carried out. For example, if noted that a farmers' organization is not optimal for proper operation and maintenance, it is, however, decided to start implementation of the project as more efforts are put in having the appropriate group organization. Yet, for full participation, the group must have attained that level of organization. The starting of the project before the full organizational level is reached is also intended to motivate the farmers to form stronger groups. Planning, and thus designing, may be well below optimal.

From the foregoing paragraphs it is quite clear that one of the major problems in the designing process is the lack of the appropriate design criteria which should result from discussions with farmers and other agencies. For the discussions between agencies, it is noted that a number of problems are appreciated and possible solutions or steps towards solutions offered. More of these forums would therefore imply more issues resolved and the situation improved. The forums with farmers require a much more rigorous and professional approach which may be provided by community mobilisers. Engagement of these relevant staff has proved to improve communication and therefore the outcome of the discussions.

2.4. The drawing table

This is the stage in which actual design of the infrastructure is done by the engineer. The engineer incorporates all the possible requirements by different parties and indeed does his best to use all the design criteria formulated or collected during discussions. As noted, not all criteria are clear by the time they are pushed on the designer's table. But somehow, since he must produce a design anyway, then it is clear that he must use some personal judgement to interprete the criteria in order to use them.

To farmers and to other organizations, the engineer is also seen as one having all the necessary technical solutions to the problems at hand. This is obviously a misconception. In fact, even the process of planning, which should be undertaken with other agencies, is seen to be an exclusive job of the engineer. The drawing table is thus being used for more than just infrastructural design. The big question of course is: "How can this be avoided?"

2.5. Implementation

This is the last step in a design process. It is the process of implementing all decisions taken, technical and otherwise. Experience has shown that it is a phase where more is done only in the physical building of the infrastructures in the field and other systems to accompany the infrastructure have not been as fast. This would be for example marketing, training of the community on how to use the facilities, organization of farmers and generally education on the new innovation.

Again, as the engineer is mostly the person more in contact with the farmers, other agencies tend to forget their roles in the project and expect the engineer to perform it. The engineer may then end up implementing both the technical (designs) and non-technical decisions, with poor results especially in non-technical matters, which of course are required for the proper operation of the project.

3. CONCLUSIONS

The design process is one involving many parties that contribute in irrigation development. There are several discussions and meetings held to determine and decide best ways and means of planning, designing, implementing and operating the projects and the opinion of the writer is that the forums do not exhaust the agendas. Hence, engineers on drawing tables may not include all the technical requirements, the project planners may omit important matters or aspects of the project and useful agents (organizations) are sometimes not clear on their role.

Whereas it is noted that involvement and discussions with parties concerned are imperative, the outcome of the discussions is limited by the divergent perceptions the different parties may have. When this happens and the groups to implement decisions have to go ahead, then it is understood that some inefficiency is to be expected - e.g. a less optimal planning of the project. Part of the solution to this lies in holding more and more discussions which also serve to expose other parties to demands imposed by irrigation development, and which also provide opportunities to review the experiences encountered.

The irrigation engineer on his part must put all the requirements as discussed also together with other parties. As sometimes these requirements are not clarified fully, he leaves room for future adaptations. The engineer is also continuously inventorising design requirements not earlier specified.

Involvement of the social worker in development of irrigation schemes has been low. This has been more the case also because social workers knowledgeable in irrigation organization are rare to get. In some projects in Kenya it is being tried out the impact of the community mobilizers, who are expected to assist farmers identify and do what they are able to do in their projects as well as point out some more criteria to be included in the design and planning of irrigation scheme. The involvement of social workers is now seen to be quite necessary.

Irrigation being a relatively new type of development in Sub-Saharan Africa is little understood by the community, who do also practise it. In places where it is now being introduced it is not being taken up as a full time occupation, and is on the contrary given much less attention - to a common irrigation farmer, only 10-20% of the day's time is spent on matters of irrigation farming. This approach is in itself not a conducive one for sustainability of irrigation projects.

It is the system of the society in which the projects are implemented that really matter more than the actual efficiency of the design and implementation of the infrastructure. Some of the factors are very difficult to incorporate by the designer on the drawing table in such a way that improvement of the system and enhancing of maintenance (as required) is achieved.

AN ATTEMPT TO INCORPORATE FARMERS AT THE DESIGN STAGE OF THEIR FUTURE IRRIGATION SCHEMES AS TRIED IN THREE PROJECTS OF THE PROVINCIAL IRRIGATION UNIT NYANZA PROVINCE

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Contents

Contribution to the International Workshop
"Design for Sustainable Farmer-Managed
Irrigation Schemes In Sub-Saharan Africa"

Agricultural University Wageningen
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1. INTRODUCTION

1.1. OBJECTIVE

In most of the smallholder irrigation schemes assisted by the Provincial Irrigation Nyanza Province before 1989 attention has been given to the technical feasibility of the project from the engineers or designers perspective. In these schemes priority has been on collection of technical data and surveys of the landscape, water resources, soils etc then coming up with a design of the potential irrigable area.

Since 1989 in the new scheme assisted by P.I.U an attempt has been made to incorporate the farmers as much as possible. In some of these cases there has been a request by farmers for a scheme. However the individual farmers interest has not been taken into account in details at the time of designing and as a result we have experience very low participation of the farmers in their own schemes.

In the present new schemes coming up and even for those where rehabilitation is taking place we are now attempting as much as possible to incorporate the farmers' interest and opinion at the design stage as far as is possible. We are not only looking at the design of the infrastructure of the irrigation but also the design of the organization of farmers as we have found that we cannot separate the two.

For this purpose the P.I.U. with the assistance of Institute of Cultural Affairs are in the process of developing a comprehensive approach. This paper gives a review of a stage of the project cycle during which the P.I.U. tries to arrive with the farmers to a firm decision on the design of the scheme. With this new approach we aim to achieve self reliance and sustainability.

1.2. THE SMALLHOLDER IRRIGATION SCHEME

The Provincial Irrigation Unit (P.I.U.), Nyanza Province of the Ministry of Agriculture (MOA) works with smallholder irrigation schemes. Since the activities started in the province in 1978 the number of projects have grown steadily. Currently a total number of 20 projects are assisted by the P.I.U. They range in size from 5 to 250 ha. and in membership from 60 to 450 farmers. Of these the 12 rice schemes cover an area of 1,120 ha. and the 8 vegetables schemes, 80 ha.

Most of the assistance has been that of rehabilitation of the traditional irrigation system and expansion. Stages of projects vary from implementation to operation for over a period of three years.

1.3. SCHEME DESCRIPTION

A smallholder means a farmer owning a small individual plot of land, here generally ranging from 0.5 to 2 ha. in size. This existing land situation is not changed with the arrival of an irrigation system. The farmers continues to own their land, work on it and reap the profits. The irrigation system only adds an increased and reliable water availability. Besides the farming activities, the operation and maintenance of the scheme is done by the farmers. This of course requires a group effort, and consequently a certain level of organisation. As far as design is concern, the implication is that farmers have to be able to operate the scheme and maintain it independently. Thus a major consideration is the technical and organizational capacity of the farmers for whom the scheme is designed.

For operation this is reflected in the simple structures. Self regulating and proportional distribution of water in the scheme.

Operation is therefore limited to the following:

1. Farmers close parts of the scheme (blocks) in times of cleaning and maintenance by simple closing of a division box with a piece of timber.

2. Farmers close the intake of the scheme at times of cleaning and maintenance at times of heavy siltation (after rains) by closing the fixed metal place of the intake.

For cleaning and maintenance this is reflected in simple and fairly small canals, drains, dykes and bunds, of which it is known that the number of farmers in the (part of the scheme) can handle the work load of the cleaning. Very little special knowledge or tools are needed for any of these activities.

2.O. THE APPROACH IN THE FIRST P.I.U. SCHEMES

In the earlier implemented P.I.U. schemes <u>no set procedures had been drawn for starting a scheme</u> in as far as negociation with the farmers is concern. On the request of the farmers the P.I.U. team visited the area. Surveys were then carried out to establish the technical feasibility of irrigation followed by design of the scheme.

In one or two barazas (meetings) convened by a chief or subchief, the picture of the whole irrigation scheme and what would take place during implementation was presented. The farmers were allowed to ask questions and did assist during surveys (only a few farmers), but emphasis was not laid on incorporating their ideas, interest and opinion in design. Also not all the future users of the schemes attended these meetings and many of them only got information from their fellow farmers.

2.1. RESULTS

The P.I.U. experienced that problems really cropped up during the implementation stage. Work stopped every so often due to communication breakdown slowing down implementation. Several farmers lost interest in the projects. The dispute that arose included, land issues; farmers did not like channels crossing their farms and taking alot of their land, doubts on whether their land would be reallocated or repossessed by the Government, structures like dykes being built on some farmers plots, disagreement on payment for the earth works.

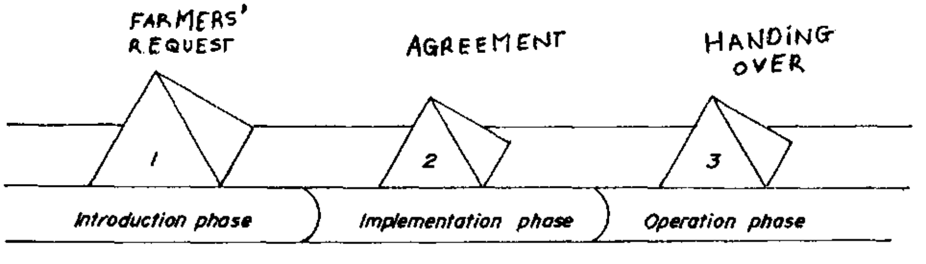
3.0. PRESENT APPROACH

3.1. THE PROCESS OF ESTABLISHING A SCHEME

During the process of establishing the scheme, the farmers were involved in several activities. Much as we would have liked all the farmers to take part in these activities, we found that it was a small representative group of farmers that had been elected to lead the scheme: the committee that we worked with.

There were however, the KEY POINTS where the small representative group was not sufficient when crucial decisions were made. For these decisions, a general agreement among all farmers was found necessary, which meant at least 70% of the farmers of the scheme had to be represented.

The three KEY POINTS are:



The farmers request is the point where farmers make a formal request for assistance in establishing/rehabilitating the irrigation scheme.
Agreement is the point where a formal agreement is made between the Ministry of Agriculture and the farmers about implementing the scheme.

Handing over is the point where the completed scheme is put in the hands of the farmers, and involvement of the Ministry of Agriculture ends (except for regular extension activities).
This paper looks at one element of this approach i.e. Agreement key point during the implementation phase. Currently the P.I.U. is developing a procedure for the introduction phase which incorporates design.

3.2. AGREEMENT KEY POINT

The element of comprehensive approach to information and training for farmers as part of establishing or rehabilitation of smallholder irrigation schemes is slowly beginning to take shape. With this approach we aim to achieve self reliance and sustainability.

We are now trying this approach in schemes presently assisted by the Provinicial Irrigation Unit, i.e. Asunda and Kopundo and Abwao projects.
These are schemes where rice farming has been done in the past in swampy areas with very little assistance from outside.
P.I.U. has come in to rehabilitate the schemes in inorder to ensure adequate water supply and drainage. The P.I.U. has convened four initiation meetings before embarking on the implementation.

3.3. THE FOUR INITIATION MEETINGS

The four meetings focussed on:
(a) Design
(b) Operation and maintenance
(c) Implementation
(d) Agreement

Several issues regarding the establishment or rehabilitation of the scheme are earlier discussed and agreed on during the introductory phase of the scheme. This is done between the P.I.U. and the farmers. The objective of these four initiation meetings that follow is rehearse and summarise all the issues that had been discussed and agreed on. It is a procedural or systematic way to go over with the farmers or revise the details about the various aspects of their scheme and confirm that everything is understood by and acceptable to all farmers (future users of the scheme) and that there is no change of mind, and if so, how to accommodate this.

These meetings last half a day each and at times a whole day. They are held in the course of two to four weeks. Details of the procedures and results for the four meetings are given in the next pages.

4.0. INITIATION MEETINGS

4.1. INITIATION MEETING 1 - DESIGN

4.1.1. OBJECTIVES

- To rehearse the layout of the scheme in detail
- To test the knowledge and understanding of the farmers about the proposed scheme
- To make sure there are no remaining issues regarding the layout, land use and desirability of the scheme.

4.1.2.PREPARATION

- Well before this meeting the farmers were informed about the whole series of meetings.
- Together with the committee 4 dates were chosen in a time span of a maximum of 4 weeks, therefore 1 to 2 meetings were held per week.
- We agreed with the committee on participation, for the first, second and third meeting; the committee, block leaders and as many farmers as possible to be present. for the fourth meeting where the agreement of work is signed at least 70% of all the farmers of the scheme had to be present.
- Materials needed for this meeting were:-
* a layout map for the scheme (simplified) with the basic features like canals, drains and structures well drawn and points of reference shown, i.e. things in the environment that the farmers know e.g. a school, market, a familiar tree etc..
* Pegs - used to mark out the future course of the infra- structure (canals, drains etc.)

4.1.3.APPROACH

4.1.3.1.Explanation

We first talked about the 4 meetings and what each would be about and why it would be important. We also explained which point in time had been reached concerning the scheme; that the introduction phase was over, the implementation phase was starting and what it meant.

The simplified layout map of the scheme was put up. The main intake, canals, drains, structures, infield system, fields etc. were shown, the flow of water, which land will be served from which canal and how they would get rid of the water from their plots. We finally explained why the layout was the way it was and why it was the best solution. Questions were allowed.

4.1.3.2.Field Trip

This involved walking with the farmer in the field along the pegged areas. The map was carried along to show people where on the map they were and any time an important and major structure was reached, it was shown on the map. This was to help clarify things to the farmers. Discussion was allowed, queries sorted. Each farmer was able to see how he would get water into and out of his plot.

4.1.3.3.Discussion

We gathered at the meeting place and got some farmers to explain to the rest how the scheme works. They were allowed to use the map. This was to see if they really followed what we had gone to see. Issues relating to land were resolved. One thing noted was that when meetings, became too many or too spread out, participation dropped.

4.1.3.4 Results(Experience)

Asunda

More than 70% of the farmers were present. The position of the main canal which fell only on the land of the Kamagaga clan was adjusted to pass in between the Kabar clan and the former. The farmers preferred this positioning. Position of group feeders on the Kabar clan land were also adjusted as some farmers felt the way in which their fields were crossed did not suit them. At the end of the workshop the farmers could explain the layout and what had been illustrated.

Kopudo

About 75% of the farmers were present. Part of the land belonging to some farmers had been left out. These farmers requested to be included. This was done by positioning the canal so that this land was now under command as water was still sufficient to irrigate this area.

Abwao

Only 5 out of 180 farmers came for this meeting. There was no quorum so the meeting was postponed.

4.2. INITIATION MEETING 2 - OPERATION AND MAINTENANCE

4.2.1. OBJECTIVES

- To rehearse responsibilities of farmers in the operation phaseespecially those relating to water management, cleaning and maintenance.
- To test the farmer' awareness on how the scheme works after it starts operating.
- To make sure the farmers understand the tasks related to water management and maintenance.
- To make sure the organization that should handle this is in place.

4.2.2. PREPARATION

- It was necessary to check whether the scheme had a committee and if there were leaders in charge of every block.
- Materials needed included simple readable charts for explaining things like.
- watering schedule
- cleaning of canals and drains of silt and weeds
- repairing of bunds and dykes
- maintaining structures like division boxes etc.

Using small models of cross-section of a canal, division box etc were found to be in even better illustration.

4.2.3. APPROACH

In this session we explained o farmers the different aspects of operation and maintenance. This included the type of work involved, the amount of time (approximately) each would take, the resources that would be needed (materials, tools, money) and organization (worksday, mandays).

After explaining an issue such as watering schedule, a farmer was asked to do the same in his/her own words and local language. Questions were allowed and other farmers were requested to try and answer them before we did.

A discussion was opened on how operation and maintenance would work in practice, like who would be involved in which activities, who would be responsible to make sure they happen, what would be the consequences if they don't happen. The intention was to make the farmers think of how to organise this work.

4.2.4. RESULTS(Experience)

Asunda

The farmers could explain at the end of this meeting what had been taught to them.

Kopudo

Here too farmers were able to explain in their own words (and language) what was taught during the meeting.

Abwao

No meeting took place as the first one had not materialised.

4.3. INITIATION MEETING 3 - IMPLEMENTATION

4.3.1. OBJECTIVES

- To clarify what works are involved in implementation
- To clarify what responsibilities the farmers have and what responsibilities the Ministry of Agriculture takes.
- To get a clear picture of the total amount of work involved and at what pace the farmers can do it (1 day/week), 2 days/week)
- To create a plan for implementation with the farmers.

4.3.2. PREPARATION

- A clear and complete agreement was drafted before this meeting which described the basic division of responsibilities between the Ministry of Agriculture and the farmers.

An overview of the steps in implementation was also presented indicating the activities, who is responsible for what and an estimate of the work load (persondays).

	Person days	Who-responsible
Clearing the area labour(harambee)	farmers free	
Main canal-metres		M.O.A - % farmers %
Main drain-metres		M.O.A - % farmers free labour % (Harambee)
Structures 1. Intake 2. Bridges 3. Culverts	Persondays - M.O.A	

4.3.3. APPROACH

A simplified map of the layout was put up again. The draft agreement was readout aloud to all present. Farmers were reminded that these were the conditions under which implementation would take place. Two different colour felt pens were used on the map. One colour was used to show area or section that the farmers were responsible for escavating and the other colour, that by the P.I.U. This was done for the main canal, main drain, the in field system, the structure etc.

The farmers were allowed to ask things that were not clear to them. The discussion was then opened. The aim was to reach a point of agreement with the farmers. This went on for sometime with the farmers offering to do least as possible. An agreement was reached in the end. After this discussion the next issue was on the amount of time the farmers felt they could invest in the implementation work and the number of people who would participate. This needed to be realistic. Based on this information a simple, imaginal planning for implementation chart was made.

Scheme Implementation

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
FAR-MERS	clearing the area				% main canal					% main drain								
	1	ISLT		ISLT		ISLT		ISLT	draft scheme rules		elect scheme leaders		register scheme		in field systems			
				create membership list														
MoA			1/3 main canal				1/3 main drain					structures				open bank account		
																	intake	

Note: - ISLT - Irrigation Scheme Leadership Training

A point to be noted in this time line was that other activities that were not not directly related to constructing the schemes were included. This was done because it was assumed that implementing a scheme meant implementing the system, the infrastructure and also implementation the organization. It was therefore considered to be essential that by the time the system is completed the organization would be somehow established, which would mean they would have:

- trained farmers
- a membership list
- a draft version of the scheme rules
- a leadership structure with block leaders
- a committee members and office bearers.

4.3.4. RESULTS(Experience)

Asunda

The major issue that arose was on payment or the amount of contribution that the farmers would make and what P.I.U. would pay for. The farmers wanted to do least amount of work as their free contribution. We finally reached an agreement to pay half of the amount of the total works and the farmer to contribute as free labour, the other half. Work timeline was drawn and our observation was that the farmers finished their bit of work faster than planned.

Kopudo

Here too there was arguement on the free labour contribution. The farmers wished to contribute only 1/3 of the total labour. We finally agreed that the total earth works would be done free by the farmers. It took us one extra meeting to come to this. The turnout for work has been about 50% but is consistent and at no time has worked stopped.

Abwao

No meeting took place.

4.4. INITIATION MEETING 4 - AGREEMENT

4.4.1. OBJECTIVES

- To inform and agree with the majority of the beneficiaries of the scheme on the proposed approach to the implementation of the scheme.
- To create an atmosphere of participation and teamwork that will be important as an element of support during implementation.
- To sign the agreement between the farmers and the Ministry of agriculture.

4.4.2. PREPARATION

- All the materials from the previous meetings were made available.
- Enough copies of the final agreement were made and all parties to sign were informed.
- A small party (lunch) to mark the occasion of the agreement was arranged by the farmers.

4.4.3. APPROACH

The presumption for this meeting was that no more issues remained. The meeting had more emphasis on motivation. The three previous meetings were briefly talked about. three different farmers were made to do this in summary. The agreement was read out loud to all present. The agreement was then signed. Speeches made. Date for the start of implementation, how and who involved were announced. Lunch was served and the women entertained us with a traditional dance. The agreement contained six aspects:

1. When and between who the agreement is made.
2. The tasks and responsibilities of the farmers.
3. The tasks and responsibilities of the Ministry of Agriculture.
4. The tasks and respobilities of the administration
5. General conditions
6. Signatures

4.4.4. RESULTS (Experience)

For the two projects Asunda and Kopudo, the agreement of work was signed. Area leaders i.e. chief, subchief and the Ministry of Agriculture Departments at the P.I.U., District and Divisional level were present. The dates to start implementation were also announced. In Abwao scheme farmers were given time to make up their minds.

5.0. CONCLUSION

The technical design of an irrigation scheme is the responsibility of the irrigation engineer, but from our experience this is only true in as far as calculation of:
- The size of the scheme (area to be irrigated in relation to the water available to for the same)
- The drainage and flood protection
- The structures to be constructed for the purpose

- Slope etc, are concerned. The engineer infact can only advice in the beginning on the potential of irrigation in the area. But what happens after that depends alot on the future users of the scheme. With our proposed approach now being tried, we hope to incorporate the future users opinion as much as possible.

So far with the approach we can already see an improvement. The implementation is going on as was scheduled in two projects and in Asunda the farmers have completed the excavation of the main drain in a shorter time than was planned. The same case is true for the main or supply canal for the neigbouring Alungo A. Project. The farmers see the scheme as theirs and not just another Government project. They have requested for faster implementation so that in the next season they may grow rice without the problems of too much or too little water.

It may be too soon the say that we are totally successful with this new approach but we can definitely say that the proceedings have covered alot of sensitive areas which had been ignored in the past and has been an orderly smoother way to work as no stage is passed before we are in total agreement with the farmers. We are also more sure that every farmer is comfortable with the proposed design. The issue that we may be trying to adjust the farmer to the scheme and not the scheme to the farmer has been considered by us. But we have found that at times what the farmer requests for may not conform with what is technically feasible. As such we advice the farmers accordingly and show them the possible alternatives. With training they are able to adjust and still use the irrigation system to the benefit.

6.0. ANNEX

6.1. <u>References</u>

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DIMENSIONS SOCIO-CULTURELLES DANS LA CONCEPTION DES AMENAGEMENTS HYDRO-AGRICOLES

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Contribution à l'Atelier International
"Conception Viable d'Aménagement Hydro-agricoles Paysans
en Afrique Subsaharienne"

Université Agronomique de Wageningen
Pays-Bas, 5-8 février 1990

1. INTRODUCTION

La crise que traverse les projets de développement en particulier les périmètres irrigués ont amené chercheurs et développeurs à s'interroger sur la validité de l'approche techniciste utilisée jusque là.

Dans l'histoire des aménagements hydro-agricoles du delta et de la vallée du fleuve Sénégal, des efforts importants ont été faits pour maîtriser les contraintes techniques qui semblaient être les seules responsables des échecs.

La persistance de la crise a finalement fait accepter aux plus réticents l'idée que les causes profondes et permanentes des problèmes sont à rechercher aussi dans la non prise en compte des aspects socio-culturels dans la conception.

Le constat selon lequel l'irrigation n'apparait pas dans la vie des villageois comme une innovation technologique qui vient s'ajouter ou remplacer sans heurts les systèmes existants, semble requérir l'unanimité.

On a souvent regrété que les spécialistes des sciences sociales ne donnent leurs avis qu'après des constats d'échecs.

C'est ainsi que depuis quelques années, des études sociologiques sont prévues par les bailleurs de fonds dans les études de factibilité des aménagements hydro-agricoles. D'après les premiers résultats il semble que la contribution des sciences sociales est très en deça des objectifs escomptés. Cela est en partie due à l'inexistence d'un cadre conceptuel et méthodologique approprié pour faciliter l'intégration des sciences sociales.

L'objectif de ce texte ne sera donc pas un plaidoyer de plus pour la prise en compte des aspects socio-culturels mais une contribution à la mise au point d'une méthodologie et d'une approche spécifique des sciences sociales dans les études sur l'irrigation.

Entre les grands aménagements de conception industrielle et les petits périmètres villageois orientés vers l'autosuffisance, les planificateurs estiment qu'il y a place pour une conception intermédiaire qui prendrait en charge aussi bien les besoins d'autosuffisance que les objectifs commerciaux.

D'autres raisons militent en faveur de cette option notamment l'urgence, conformément aux objectifs de l'après-barrage, d'aménager plus de terrains de décrue, ceux des bourrelets de berge (Fondé) peu aptes à la riziculture se faisant de plus en plus rares.

L'aménagement intermédiaire est aussi lié à une option d'objectifs de production commerciale qu'un simple choix technique. Dès lors sa conception ne saurait être une simple addition des avantages organisationnels des périmètres villageois à une échelle plus grande. Elle implique un ensemble de contraintes sociologiques dont il faut tenir compte.

En participant à deux études de factibilité, celle de la cuvette de Kaskas au Sénégal et celle du Koundi en RIM et en réalisant le suivi de campagnes agricoles dans les aménagements intermédiaires IT, de Donaye et Diattar au Sénégal et Darel Barka en RIM, le projet Gestion de l'eau, avait pour objectif d'identifier quels sont ces aspects socio-culturels déterminants.
Après l'exposé des acquis méthodologiques, nous exposerons quelques exemples pour illustrer l'importance des thèmes sociologiques indiqués.

2. POUR UN CADRE CONCEPTUEL

Si les techniciens chargés de concevoir les aménagements sont arrivés à mettre au point une méthodologie d'étude dans laquelle les variables à rechercher et leur incidence sur les décisions sont claires (même si elles sont discutables), les chercheurs en sciences sociales sont loin d'avoir identifié les aspects sociaux pertinents dont on aura vraiment besoin pour concevoir un périmètre.

Les études socio-économiques sont soit focalisées sur la question de la main-d'oeuvre (études démographiques) soit orientées vers une explication générale de l'organisation sociale. Certes la connaissance du milieu sociale est primordiale mais les techniciens et planificateurs attendent des sciences humaines qu'elles aillent au delà, en indiquant de manière précise comment prendre tout cela en compte dans la politique des aménagements et dans la conception des périmètres.

L'impasse vient probablement du fait qu'on a pas une conscience claire de la finalité commune entre études sociologiques et techniques dans le cadre des aménagements. Dans les cas où des aspects humains sont prévus dans les études de factibilité trois (3) constantes méritent d'être relevées.

- A l'exception des aspects démographiques, les résultats concernant les autres thèmes étudiés sont absents des conclusions finales ;

- L'approche est multidisciplinaire. Chaque discipline effectue de manière isolée ses études. Une synthse est faite après par un coordinateur ;

- Les domaines de compétence sont bien délimitées. Le choix des sols et des cultures revient à l'agronome et au pédologue, la conception technique du périmètre et du système d'irrigation à l'ingénieur en gnie rural, et on ne fait appel au sociologue qu'au moment de la définition des aspects organisationnels pour la gestion future.

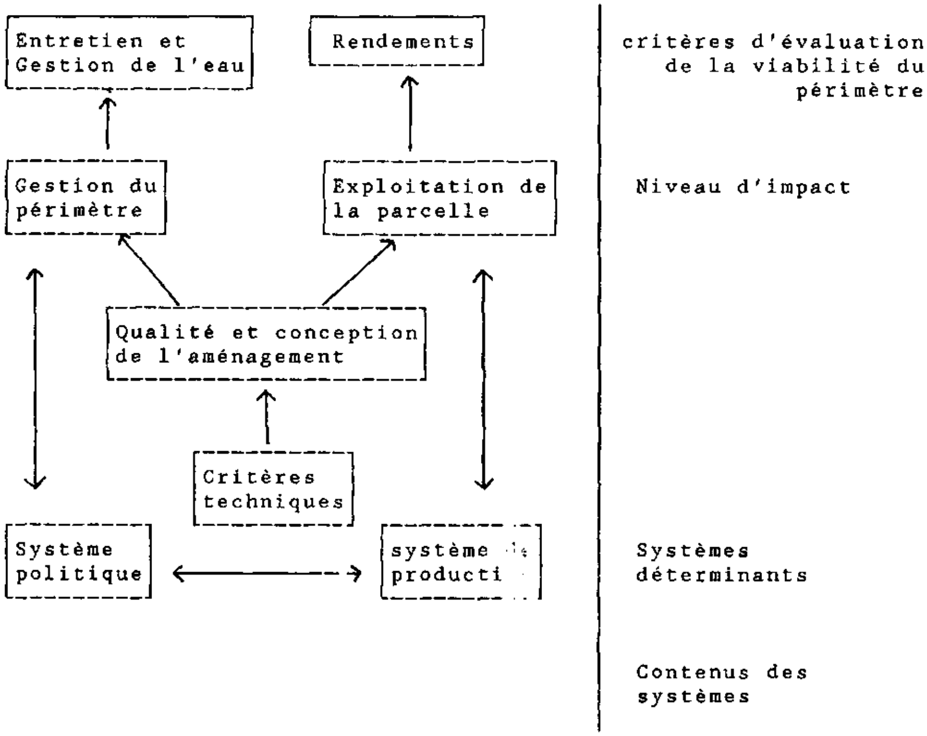
Pour sortir de cette impasse, nous pensons qu'il faudra reposer la question suivante: En vue de quoi doit on intégrer les aspects humains dans les études de factibilité ? Pour rendre les périmètres "viables" devrons-nous répondre. C'est donc autour de cette notion de viabilité qu'il faudra construire toute la méthodologie. Qu'est-ce-qu'un périmètre viable ? Cette notion renferme-t-il le même contenu pour des acteurs différents? (par exemple pour l'Etat et pour le paysan.) Deux critères minimum servent à juger de la viabilité d'un périmètre?

- Les rendements ;
- La qualité de l'entretien des infrastructures et la gestion de l'eau.

Les nombreuses études faites au niveau des périmètres irrigués de la vallée montrent que ces deux critères sont étroitement liés au système de production et au système politique local. Les aspects humains ne sont donc pas des abstractions, des généralités, elles se refèrent explicitements aux intéractions entre les contenus de ces deux systèmes.

Les principales intéractions entre ces différents éléments sont présentées dans le schéma No. 1.

Schéma: Eléments déterminant la viabilité d'un aménagement hydro-agricole



1) Le système politique

Le système politique agit directement sur la qualité de l'entretien et sur le mode de gestion de l'eau. De la cohérence du groupe, de l'existence d'une autorité acceptée et du mode de fonctionnement des relations de pouvoir entre les individus dépend la réussite de l'organisation des travaux collectifs et le respect des règlements qui regissent le périmètre. Le fait par exemple de mettre ensemble dans des rapports très dépendants des groupes dont chacun a des modes spécifiques d'organisation peut provoquer des conflits et un désordre.

2) Le système de production

Le système de production agit directement aussi bien sur les rendements que sur la qualité de l'entretien des infrastructures et la gestion de l'eau (donc indirectement sur les rendements). Du degré de jonction entre la culture irriguée et les autres activités du système de production dépend la capacité des exploitants à affecter, du temps, de la force de travail, des ressources à l'irrigation (entretien de réseau, suivi des cultures etc.).

3) Conception et qualité de l'aménagement

Il s'agit de la qualité des ouvrages et réseaux, des choix des sols, des matériaux de construction et du mode de distribution de l'eau qu'ils impliquent. La conception implique des modes de dépendance entre individus et entre groupes.

De la capacité du système politique local à gérer tout cela dépend la qualité de l'entretien des infrastructures et le fonctionnement de la gestion de l'eau. La nature des problèmes techniques, la complexité ou l'inadéquation de la conception peuvent exacerber les contradictions du système politique et provoquer une crise en son sein.

En articulant les études de factibilité des aménagements hydro-agricoles autour de cette notion de "viabilité" définie comme une prise en compte du système de production et du système politique, (c'est-à-dire les rapports de pouvoir) en vue d'assurer les conditions sociologiques des meilleurs rendements (autant que le permet les possibilités agronomiques) et de l'entretien des infrastructures et de la gestion de l'eau d'irrigation, on élargit les champs de la conception au delà de la réalisation technique. Le technicien ne doit plus se dire que sa responsabilité est de concevoir la réalisation et que l'organisation et la gestion dépassent ses prérogatives. Il est tant de réconcilier ces deux domaines artificiellement séparés (réalisation et gestion) dès la conception.

3. THEMES ESSENTIELS DE LIAISON ENTRE LES SYSTEMES POLITIQUES ET DE PRODUCTION ET LA CONCEPTION TECHNIQUE DE L'AMENAGEMENT

L'efficacité de la recherche sociologique et les chances de la prise en compte de ces résultats dépend de l'adoption d'une approche interdisciplinaire. Isolée, la sociologie a plus de chance de faire une recherche générale (sociologie de la connaissance). Il ne s'agit plus donc d'indiquer des domaines de compétence à chaque discipline mais de définir des thèmes qui interpellent à la fois le social et le technique et qui doivent servir de lien permanent entre les membres de l'équipe interdisciplinaire.

3.1. Le choix des sites aménageables. Il s'agit de mettre en rapports les critères techniques (topographiques) des tracés des digues avec tous les aspects liés aux droits fonciers et à l'organisation traditionnelle de l'espace; Dans le cas de l'étude pour l'aménagement de la cuvette de Kaskas, les résultats des études topographiques avaient indiqué, parmi quatre (4) sites aménageables, celui de cuvette denomée Moutoul. Ce site était le plus facile à endiguer. L'apport des études sociologiques axées sur les différents droits fonciers et les diverses utilisations du site ont par contre conseillé l'abandon du Moutoul. Il est apparu que les détenteurs des droits de culture étaient des éleveurs qui n'étaient pas disposés à rester de manière permanente auprès du périmètre. En outre, ils n'ont aucune expérience de la culture irriguée et ont exprimé leur préférence de continuer la culture de décrue, mieux adaptée à leur système de production. La décision d'aménager ce site compromettrait la viabilité du projet, car en dehors du conflit permanent qu'ils vont entretenir durant l'aménagement, ces cultuvateurs non-motivés ne seraient pas aptes à assurer un bon entretien de leurs parcelles et des infrastructures collectives. Il est à craindre que le métayage ne soit la solution

adaptée par beaucoup d'attributoires qui voudraient continuer leurs activités pastorales.
Les rencontres organisées entre les techniciens et paysans ont permis aux premiers d'enrégistrer certaines interrogations et de fournir les informations techniques nécessaires. Par exemple: "Quel sera l'avenir des terrains de cultures, de paturage, et lieux de peche, situés en aval du site aménagé et endigue?"
Dans le cadre de l'étude d'aménagement du Koundi en RIM, le principe de regrouper les villages voisins pour l'exploitation des sites les plus proches, a été remis en cause par les résultats des études foncières qui ont montré que l'association des voisins n'était pas souhaitable. Ceux qui n'avaient pas de droit sur le site n'était pas disposés à y cultiver et préféraient l'extension de leurs périmètres villageois situés sur leurs terrains.

3.2. Le choix des cultures: A la classification pédologique des sols à partir de leurs aptitudes culturales l'équipe doit ajouter l'opinion des paysans sur le choix des cultures; et les besoins que font apparaître le bilan céréalier. Les enquêtes d'opinion effectuées au cours des études d'aménagement de la cuvette de Kaskas, ont montré une nette préférence de la polyculture par les paysans. L'analyse des réponses a surtout relevé une volonté d'association de la polyculture à la riziculture. Par ailleurs, l'analyse des bilans céréaliers faisait ressortir une importante place occupée dans le consommation des ménages par les céréales traditionnelles (63%), mais aussi par le riz (30%) acheté et non produit sur place.
Ces informations ont permis de prévoir dans toutes les alternatives retenues des terres de polycultures représentant entre 16% et 4% de l'aménagement.

3.3. Le choix des formules organisationnelles: Sur le plan organisationnel, le choix de la taille des unités

hydrauliques et de leur degré d'autonomie et des groupements de production doit tenir compte des possibilités de mécanisation, de l'organisation des tours d'eau, et de l'identification des structures socio-organisationnelles fonctionnelles pour l'exploitation agricole: Unités socio-politiques, groupes des femmes, les migrants etc.
A Kaskas, les femmes et les jeunes avaient exprimé leur besoin d'avoir des parcelles indépendamment de celles des chefs de ménage. Pour les femmes c'est un moyen de résoudre leurs besoins spécifiques sans dépendre de leurs maris. Pour les jeunes organisés dans le cadre d'une association créée par les migrants, l'octroie de parcelles collectives permettrait de financer des projets d'intérêt publique.
Ces informations ont été intégrées dans les différents scénarios retenus (Tableau 2 et 3). La définition de l'organisation et du nombre des unités hydrauliques a été largement influencée par les résultats des enquêtes bienque des critères comme la taille optimale pour la mécanisation, aient finalement beaucoup plus pesée pour la détermination de la taille des unités.
La situation était par contre différente dans la zone de Koundi où les villages constituaient des unités homogènes. Les enquêtes ont mis en évidence les problèmes organisationnels liés à la dispersion de la main-d'oeuvre entre une multitude de petits périmètres villageois et qui pourraient s'aggraver et compromettre les futurs périmètres. Le point de vue exprimé par les enquêtés mettait l'accent sur la nécessité de tenir compte des périmètres existants notamment leur réaménagement (avec des parcelles plus grandes) et leur intégration dans la planification. Ils ont exprimé la possibilité de faire un tirage au sort pour répartir les exploitants entre les différents périmètres après les travaux.
Bien que chaque village devait conserver son autonomie, il a été recommandé de mettre les femmes de tous les

villages ensemble. Celles-ci gèrent sans conflit des structures communes et préfèrent rester ensemble contrairement aux hommes.

La liaison des études sociologiques avec les études techniques nous ont amené à concevoir l'enquête sociologique en deux étapes. La première étape s'inscrit dans le processus de choix des sites et des usagers. Les résultats de cette étape permettent d'identifier les villages et groupes futurs exploitants qui feront l'objet d'enquêtes plus détaillés. Cela permet d'éviter d'enquêter des villages qui ne seront pas pris en compte.

Pour chacune de ces étapes nous avons identifié les thèmes d'études et les types d'informations à rechercher (voir Tableau No.1).

Chaque thème doit être étudié en fonction des informations spécifiques à rechercher, ce qui permet d'éviter leur exploration abusive. Par exemple, l'intérêt des études historiques, est de pouvoir classer les groupes en fonction des droits dans l'histoire et de comprendre leurs rapports actuels en fonction de ce passé.
Le recoupement des informations documentaires (s'il en existe) avec les différentes versions des faits recueillis auprès des populations permettent de reconstituer les événements et l'évolution des differents droits.
Alors qu'à Kaskas les différents droits revendiqués par les villages correspondaient aux unités historiques qu'on peut retrouver dans les documents anciens, dans le Koundi, ces unités ont connu des évolutions importantes suites aux ventes de terrains effectuées par certains lignages et aux distributions récentes de terrains décidés par l'administration.
Il en est de même en ce qui concerne les études démographiques qui doivent être adaptées à l'objet et non générales. Les méthodes de recensement doivent être basées sur un travail

préalable d'identification des niveaux de l'organisation sociale pertinente. Par exemple: doit-on situer les individus dans des quartiers, des lignages, segments de lignage, groupe statutair, groupe ethnique?
Dans le Koundi Nord, il est apparu que seule la variable ethnique était importante, alors qu'au Sud, c'était le segment de lignage. Dans la zone de Kaskas, c'est le quartier et le lignage qui constituraient les variables les plus importants.
Dans la mesure où l'aménagement s'inscrit dans la dynamique des systèmes politiques et de production, les techniques de recueil des informations doivent être aussi variés que possible pour couvrir l'ensemble des acteurs et comparer leurs points de vues et objectifs quelques fois contradictoires.
Dans le cas où il s'agit des décisions collectives engageant les intérêts d'une communauté, comme la disposition à donner les terrains du village ou du lignage pour un aménagement, les décisions collectives l'importent sur la somme des points de vue individuels. L'avis des chefs pese aussi sur la balance. Dès lors il est préférable de privilégier les points de vue exprimés lors des assemblées villageoises, qui sont souvent le reflet d'un consensus.
Par contre les avis individuels sont plus importants quand il s'agit de la constitution des unités organisationnelles. Dans le cas de Kaskas, par exemple, les avis exprimés en assemblée notamment par les chefs et élus de la communauté rurale était qu'il fallait mélanger tous les exploitants sans tenir compte des quartiers d'origine, le village étant indivisible.
L'enquête d'opinion revela un point de vue largement majoritaire proposant de partir des quartiers.
Dans la mesure où il s'agit de rapports directs de coopération, ce sont les dispositions individuelles à gérer une unité hydraulique avec d'autres qui l'emportent sur toute autre considération. C'est pourquoi l'étude sociologique a recommandé de considérer les avis individuels, d'autant plus que les observations faites au niveau du périmètre villageois ont montré l'impossibilité réelle des différents quartiers à s'entendre et à gérer convenablement ensemble une exploitation.

Tableau 1 : Axes de recherches sociologiques pour une étude de faisabilité des aménagements hydro-agricoles

Etapes	Types d'études	Informations recherchées	Techniques
Processus de choix des sites et des usagers	Histoire	Processus de fondation des villages, d'installation des groupes et d'acquisition des terrains de culture	Interview des chefs de villages et informateurs Recherche documentaire
	Identification des sites	Les utilisations des sites et les groupes impliqués	Observation et interview d'informateurs
	Bilans fonciers	Disponibilité en terres aménageables par village et par groupe	Interview chefs de village, chefs de quartiers et d'Assemblées villageoises
	Enquête d'opinion	Les groupes sont-ils intéressés par l'aménagement de leurs terrains de cultures traditionnelles	Enquête au niveau des Assemblées villageoises
Processus de conception	Etude démographique	Main d'oeuvre disponible; Force de travail émigrée susceptible de revenir; Poids démographique des villages, des groupes et des unités familiales ; Flux de la main d'oeuvre	Exploitation des recensements administratifs suivis d'un recensement directe à partir d'un échantillon, portant sur le ménage et le segment de lignage
	Etude des réseaux politiques locaux	Comment fonctionne les rapports entre groupes et entre villages	Interview d'informateurs, chefs de villages, de quartier, de lignage, de groupement de production, de parties politiques au niveau local
	Etude des PIV	Aspects organisationnels affectant ou facilitant la gestion de l'eau et des infrastructures Aspects techniques affectant ou facilitant l'organisation	Observation et suivi d'une campagne
	Etudes du système de production	Bilan céréalier des villages et des ménages ; Niveau de concurrence entre les différentes activités de production et de l'irrigation ; Place des autres activités dans les objectifs de production des paysans ; Caractéristiques et contraintes des activités des femmes.	Enquête à partir d'un questionnaire/ménage sur la base d'un échantillon
	Enquête d'opinion	Sur quelles bases les exploitants voudraient être organisés ? Sur la base de quels critères devrait se faire l'attribution ?	Enquête à partir d'un questionnaire/ménage sur la base d'un échantillon

Tableau 2 : Caractéristiques des alternatives A, B1, B2 et C

	Alternative A	Alternative B1	Alternative B2	Alternative C
<u>Superficie nette</u>				
Riziculture (ha)	301	323	323	72
Polyculture (ha)	65	63	63	50
Total (ha)	366	386	386	122
<u>Taille des parcelles</u>				
Riziculture (ha)	1	0,5	0,5	0,27
Polyculture (ha)	0,2	0,2	0,2	0,19
<u>Mécanisation</u>	oui	non	non	non
<u>Les exploitants</u>				
Riziculture				
Nombre	302	626	626	270
Qui ?	Chefs de ménage (h+f) et autres hommes actifs de Kaskas et eventuellement villages satellites	Chefs de ménage (h+f) et autres hommes actifs de Kaskas, vill. satell., Doungel, Barangol, Sare-Souki et Bilwil	Chef de ménage (h+f) et autres hommes actifs Kaskas, vill. satell., Doungel, Barangol, Sare-Souki et Bilwil	Chef de ménage (h+f) de Kaskas
Polyculture				
Nombre	305	315	315	270
Qui ?	Femmes de Kaskas et Ass. de jeunes Kaskas	Femmes de Kaskas et Ass. de jeunes Kaskas	Femmes de Kaskas et Ass. de jeunes Kaskas	Chefs de ménage (h+f) de Kaskas
<u>Nombre de ménages</u>				
Kaskas				
Riziculture	270	270	270	270
Polyculture	270	270	270	270
Autres villages				
Riziculture	0	265	265	0
Polyculture	0	0	0	0
<u>Nombre d'unités autonomes</u>				
Riziculture	16	18	18	3
Polyculture	4	4	4	3
<u>Exécution des travaux</u>				
Infrastructure principale	par entreprises	par entreprises	par entreprises	par entreprises
Aménagement des U.A.I.	par entreprises	par entreprises	par projet + participation paysans	par projet + participation paysans
Durée des travaux	12 mois	12 mois	4 ans (enterprise 1 an)	12 mois

<u>Source</u> : SAED/DCIS (1988)

Tableau 3 : Synthèse de l'organisation du périmètre

Organisation	Niveau d'action	Alternative A			Alternative B			Alternative C		
		Nombre	Nombre partie au gr.	Surface (ha)	Nombre	Nombre partie au gr.	Surface (ha)	Nombre	Nombre partie au gr.	Surface (ha)
Groupe	arroseur	64	5 ag	5	72	10 ag	5	24	13 mé	5
Gr. de femmes	arroseur	12	25 f	5	12	25 f	5	-	-	-
Gr. de jeunes	arroseur	-	-	-	-	-	-	-	-	-
Groupement	UAI/ss	16	20 ag	20	18	40 ag	20	6	50 mé	20
Gr. de femmes	UAI/ss	3	100 f	20	3	100 f	20	-	-	-
Gr. de jeunes	UAI/ss	1	-	20	1	-	20	-	-	-
GIE	UAI	4	80 ag	80	5	160	80	3	90 mé	40
Unités de méca.	UAI	4	80 ag	80	-	-	-	-	-	-
GIE (f+j)	UAI	1	325 f+j	80	1	315 f+j	80	-	-	-
Unités de méca.	UAI	1	325 f+j	80	-	-	-	-	-	-
Commission de Gestion du périmètre		1	320 ag + 325 f+j	360	1	646 ag + 315 f+j	380	1	270 mé	120
Organisme de Gestion stp/sp/ss		1	-	360	1	-	380	1	-	120

Source : SAED/DGIS (1988)

UAI : Unité Autonome d'Irrigation
GIE : Groupement d'Intérêt Economique
ss : Système secondaire
stp : Station de pompage
sp : Système primaire

ag : Agriculteurs
f : Femmes
j : Jeunes
mé : Ménages
gr : Groupement

4. L'ETUDE D'AMENAGEMENT COMME ANIMATION SOCIOLOGIQUE

Un aménagement hydro-agricole est toujours localisé cela signifie qu'il est réalisé dans un espace déjà à usage multiple et que sa gestion met en relations des unités sociales et non des individus. Celles-ci sont douées de volontés, de logiques et stratégies propres. Les enjeux sont multiples et leurs rapports au périmètre ne saurait se réduire à une simple question d'adaptation ou de non adaptation mais à des modes possibles d'intégration de ce système aux objectifs spécifiques de production et au contexte politique local.

La viabilité de l'irrigation dépendra de l'attention qui sera porté à ces aspects avant toute décision d'aménagement.

Les études d'aménagement doivent être conçues dans la perspective de provoquer la participation de la population à la recherche de solutions alternatives notamment par rapport aux contraintes techniques. La réalisation au même moment des études techniques et des enquêtes sociologiques facilitent ces dernières et leur confère un caractère "sérieux" et concret aux yeux des populations. On doit cependant éviter que les pédologues et topographes ne précèdent le sociologue, pour ne pas créer un conte hostile. Le sociologue doit servir de lien entre les techniciens et les populations. Cela lui permet d'organiser des rencontres pour permettre un échange d'informations.
A Kaskas, la réorientation des choix des sites a été faite à partir de réunions entre paysans et techniciens. Au cours de ces rencontres, les problèmes techniques que peut poser l'endiguement de certaines cuvettes ont été soulevés par les paysans. Les techniciens ont pu exposer les différents choix techniques possibles.
En RIM, nous avons expérimenté avec un technicien de la SONADER, cette forme d'animation, durant la conception d'un nouveau périmètre pour le village de Ar. Pour ce nouveau périmètre villageois de 20 ha, les paysans avaient confectionné une liste de 120 exploitants. Au cours d'une

première rencontre, il leur fut expliqué que pour faciliter la mécanisation, la taille des parcelles sera de 0,50 ha. En outre, toutes les enquêtes ont montré que les paysans se plaignaient de la taille trop petite des parcelles. Au cours de cette rencontre, les paysans ont estimé que tous ceux qui étaient sur la liste avaient des droits de culture. La décision fut prise de laisser chaque parti ce concerter. A la dernière rencontre, les paysans proposent une liste reduite et proposent à la SONADER d'augmenter 5 ha de plus pour couvrir tout le monde. Ainsi à la place de la répartition par "foyre" (ménage), ils ont substitué celle par galle (concession) ou segment de lignage. Chaque galle procédera en son sein à un remembrement entre les anciens périmètres et le nouveau. Il a été également retenu de laisser entre le fleuve et le début de l'aménagement 5 à 10 ha reservés aux extensions. Les ingénieurs devront tenir compte de cela dans la conception des canaux.
Comprise comme un processus de négociation entre ingénieurs et planificateurs d'une part et paysans d'autre part, la conception des périmètres irrigués a plus de chance d'intégrer les variables socioculturels.

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WHOSE DESIGN?

SUSTAINABILITY AND IRRIGATION IN SUB-SAHARAN AFRICA

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Contents

Contribution to the International Workshop
"Design for Sustainable Farmer-Managed
Irrigation Schemes In Sub-Saharan Africa"

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1 Introduction

Why do scientists of a Centre for Environmental studies attend a workshop of irrigation professionals? The ultimate aim of our scientific work is to stop environmental degradation and to rehabiliatate degraded environments because we know how important a high quality environment is for the well being of the rural poor in particular. The severe socio-economic impacts of the present environmental crisis in Sub Saharan Africa are accurately reviewed by Lloyd Timberlake (1985). Environmental science is an interdisciplinary field of studies on the socio-economic and ecological causes to natural resource degradation and the ways towards a more sustainable use and management of natural resources while maintaining their natural biodiversity. Thus sustainability and biodiversity are the two pivotel target variables for environmentalists.

In the field the complex relation between irrigation and environmental degradation can be observed. There are many examples of irrigation projects that have led to degradation of surrounding natural resources (Rodenburg et al, in prep.). Often, but not in all cases, environmental degradation causes a weak performance or even total destruction of irrigation systems (Eckholm, 1976). In some cases however, well designed irrigation has contributed to the rehabilitation of degraded areas (see below).

Historically the target variables of irrigation engineers are different. In the first place they tend to emphasize the productivity by the irrigation system. As we can learn from the title of this workshop, they are now aiming at the systems sustainability too. Environmental scientist therefore should share their knowledge concerning the operationalisation of sustainability with irrigation engineers and vice versa. The first joint question will be: 'Are we after the same type of sustainability?'

The historical focus of environmentalist was to promote the ecological sustainability of the whole resource use system of local communities. The last decade we have learned that there is no ecological sustainability without social and economic sustainability. Therefore environmentalists more and more tend to emphisize the need for sustainable livelihoods.

How does this relate to the workshops' aim of sustainable irrigation systems? Although we feel that it will be interesting to further explore the differing targets and scope of environmental scientist and irrigation scientists, we will instead focus this paper on their common interest in design. Any design should start from reality; and thus we will first give a short outline of the living conditions of the rural poor in sub-Saharan Africa. Secondly some principles of design will be discussed.

2 The living conditions of the rural poor in Sub-saharan Africa

The rural populations of Subsaharan Africa have adopted strategies for the multifunctional utilisation of the natural resources available to them. These natural resources utilisation strategies show a high degree of diversification, making use of various interrelated sources of income such as fisheries, transhumance herding, rain-fed- and recession agriculture and forms of wage labour (Drijver and Marchand 1985).

A second characteristic is that many of these strategies are centered around small units, the family or socio/cultural category to which one belongs.

Thirdly, there is a strong dependence on the directly available local natural resources such as water, soil fertility and wood. This strong dependency is maintained by the limited number of sound possibilities for integration into the market economy and by the weak terms of trade maintained with an exploitative macrostructure.

As a reaction to this strong interrelationship between man and nature, a large resource of local environmental knowledge has been built up by these rural communities. Under situations of limited utilisation pressure, this local environmental knowledge leads successive generations into an organically developing relationship with nature, in which risk aversion is an integral component of natural resources utilisation strategies.

The sub-Saharan environment the rural communities are so much dependent on is a fragile environment. Nowadays the environmental assets available in these areas have in many cases reached a disequilibrium leading to environmental degradation and unsustainable levels of exploitation. As Drijver and Marchand indicated in their 1985 case study on the Senegal Valley, fuelwood consumption in the valley had reached a level eight times the estimated production of forests could sustainably deliver (Drijver and Marchand 1985).

However, most of the rural communities in Sub-saharan Africa cannot find alternative options to safeguard their livelihoods and in this manner escape from the vicious circle of poverty and environmental degradation; industrial employment options lack and the natural resources managment problems can hardly be tackled without external inputs.

Given the problems discribed above one should ask the question what could be the guiding principles for the particpatory design of solutions. Four principles are reviewed below.

3 The Principle of participatory design and negotiation

Rather than harvesting information from farmers to be processed behind the drawing tables of rural developmend headquarters, it is our task to create a two-way information exchange also allowing farmers to harvest information from us, and a participatory design process allowing farmers to formulate and select their solutions too.

Quoting Dr. Peter Oakley in his key-note address to the 1989 Leiden Conference on the People's Role in Wetland Management, the meaning of participation as a process becomes well illustrated:

'Apart from efforts to distinguish between definitions of participation, there are several other broader approaches which we can use to help differentiate alternatives within such an all-embracing concept. One major form of differentiation is to distinguish between participation as a **means** or and **end**. Participation as a means implies the use of participation to achieve some pre-determined goal or objective... Participations as a means stresses the **results** of participation in that the achieving the pre-determined objectives is more important than the act of participation... In may ways it can be argued that participation as a means is a passive form of participation. Participation as an end is an entirely different concept. Here we see participation as a **process** which unfolds over time and whose purpose is to develop and strengthen the capabilities of rural people to intervene more directly in development initiatives' (Oakley 1989).

The two forms of participation distinguished by Oakley serve well to illustrate one of the differences between the environmental science and the irrigation science approaches towards rural intervention. In irrigation science the final result of the design process is largely predetermined in an early stage (irrigation scheme), while in the environmental science approach the design discussions, although also partly result oriented, more open ended. The outcome can be any form of resource management. This leaves more room, although less than 100%, for participation as a process. The operational consequences of this approach are explained below.
In the design of environmental projects, much value is given to flexibility, which in practice means that changes in ecological

processes and/or traditional resources are acceptable; neither need to be conserved as they are, but in any intervention a new sustainable man-environment relationship with equivalent value is strived for.

Notwithstanding our appreciation of flexibility and active participation in design it must be realized that in situations of serious environmental degradation top-down measures may be needed. These measures will often call for a less exploitative use or even a total stop of present resource exploitation during a number of years. In the short run this will cause a loss of benefits for local communities which will generally need to be compensated. This brings us to the principle of negotiation. Experiences in resource management projects have shown (Drijver 1989) that negotiating an agreement with local communities can be a successfull way of operation as long as these negotiations are done directly with the local users, take into account their (internal) priorities and guarantee the security of their benefits.

4 Focus on problems and not on systems

Irrigation science in the field originally emerged from problem oriented thinking. In subsequent phases, however, system oriented approaches became predominant in irrigation science (Drijver, Kloos and Toornstra, 1989). Does this workshop really present an important step for the irrigation sciences to return to a direct focus on the real problems of rural communities in the field without being led too much by (irrigation) system requirements? In order to answer this question it is interesting to know that also environmental sciences is in the process of freeing itself from (eco)system oriented biasses.

The Centre for Environmental studies tries to develop research methods focusing on problems rather than systems as a point of departure for the analysis and design of solutions. Often it is difficult to clearly mark the boundaries of ecosystems,farming systems, social-cultural systems and other systems invented by scientists. Secondly, describing or analyzing systems tends to shift the researchers' attention away from the real problems. Environmental problems are not inventions of scientists, they are in the field and can be discussed directly with local communities.

Environmental science is actor-oriented and, by the very nature of environmental problems themselves, needs to be multisectoral and interdisciplinary. Figure 1 shows how two analytic pathways integrate socio-economic and ecological factors in problem analysis.

The major difference between this process and the common scientific approach in resource management projects is that there is no harvesting of information by external agents (environmentalists or irrigation engineers) with the intention to take this local information home to the drawing table and come back some time later with a 'best-fit' intervention package.

5 Forget your external knowledge

In the case of the Turkana Rural Development Project (North Kenya), from attempts to have reforestation initiated by means of external (financial) stimuli a switch was made to an approach of designing together. Village seminars proved a crucial element of this strategy. During these seminars researchers and local people discuss problems together and put forward proposals for improvement.

In the information exchanging process, the (cattle keeping) Turkana proved to have an indigenous system of vegetation management and that reviving and stepping up this system would appear a good approach to combat deforestation. A somewhat radical result of this experience was the idea that the environment would be much better helped if the researchers 'threw overboard vitually all forestry theories', during the first period of interaction with the local reality. The result of the Turkana designing debate was that the local chiefs instituted an effective ban on charcoal export from the area, regulate the protection of samplings, while the rural community planted almost a million seedlings per year without any financial incentives as a result of a revived 'tree awareness' (Kerkhof in De Groot 1989)

6 The principle of learning by doing

A logical consequence of promoting peoples participation in irrigation design is the need to shift from pre-conceived projects to more open-ended programmes, in which design and implementation of activities is much more a continuous process enabling local people to participate and to adapt the activities to changing conditions or needs.

This presents a great challenge to the scientific communities: firstly, studies and implementation will no longer be separated in different phases. They will be closely interwoven in action research. Secondly, research will have to be designed and carried out by local people and scientists together.

This principle is well illustrated by Keyzer and van Schooten (1989). Their project is situated in the village of Gounougou in the downstream area of a large dam in North Cameroon. Changing socio-economic and environmental conditions in the region of the dam have forced the local population to search for other land-use systems.
The project's objective is to stimulate the people to undertake activities that re-direct the present developments towards sustainable use and management of wetland areas around the village. Its activities in the field are related to fish culture, small scale irrigation, biological control of waterbreeding organisms and wetland vegetable gardening. In their article Keyzer and van Schooten describe the approach of this project as a learning approach, based on the cycle of 'knowledge-action-change-knowledge etc'. The philosophy behind it is that relevant knowledge is obtained by initiating an

action and monitoring the changes that follow. One of their examples concerns the issue of fishing rights. The villagers of Gounougou had constructed small dams in a creek in order to enhance fish culture in the small waterbodies behind these dams. Women from other villages came with their baskets and started to fish because they were used to having access to this area. A conflict arose between the villagers and these women. As a result of this small conflict several in-depth village discussions were held on resource management and the local rules for it. From these sessions a good insight was gained into the question of existing and potential regulations for resource use. This insight would have beem difficult to obtain without the action of the dams and the resulting conflict.

7 How to apply these design principles in practice?

A methodology for the application of the forementioned design principles in practice has been written down by Scheuermeier (1988) on the basis of his experience in the Tinau Watershed Project in Nepal. In 1990 the Centre for Environmental Studies will make a start with applying this approach in two of its resource management projects in the field, in Cameroon and Sri Lanka. A good practical illustration of how a project evolves along the lines of these principles is given by Mishra and Madhu Sarin (1987). Their project lies in Sukhomajri, a village at the foot of the Himalaya mountains. Deforestation, erosion and the rapid filling of downstream reservoirs with silt from uphill catchments were common problems in the area. The government tried to regulate the problems by restricting land use. Herding and wood cutting was allowed close to villages, but more remote areas were set aside, sometimes by fencing them off. The local poulation did not agree with these regulations and a continuous control by officers of the Forest Service was not feasible.

They found that the erosion was at its maximum in the surroundings of Sukomajri, situated on the plateau and close to its edge. Its roughly 400 inhabitants practised rainfed agriculture on the plateau around the village and they kept cattle. Altogether they had a few hundred head of cattle, of which a large number of goats that could often be found grazing on the already heavily eroded pastures of the hill.

The researchers decided to measure the speed of this erosion process first. For this purpose they constructed al little dam in an erosion gully to see at what speed it would silt up. Not only sediment, but also water was caught behind the little dam and in the dry season the vegetation around it remained fresh and green. The people of Sukomajri got interested and asked the researchers whether they could make a second bigger dam from which they could irrigate their fields.

The assigment given to the researchers however was to control erosion and not to initiate irrigation, moreover the fields of the villages were in fact not a part of their project area. On the other hand they understood that the participation of the villagers would be indispensable for them when they started on their attempt to stop the overgrazing and ersion of the hill side. After long discussions in the village they decided to convince their insitute and the supervising representative of the city council of the urgency of making a deal with the people of Sukomajri. The deal was simple and clear. The project would construct a dam to enable irrigated agriculture and in answer to that the goats and cows would be removed from the hill.

Within two years the irrigation programme got underway. The researchers were very disappointed to see that goats and cows could still be seen on the hills, although there were fewer than before. When they complained about this to the villagers a conflict situations arose.

The villagers that still had cattle on the hills were furious and said that the researchers should not think that they were the boss in the village. From further talks it appeared that the people who continued to held their cattle on the hills also complained about the fact that thy did not profit from the new irrigation. Either the location of their fields was too far from the dam and water reservois, or they hardly had any agricultural land at all. It thus appeared that the unequeal distribution of access to land and water formed an obstacle for the proper functioning of the negotiated solution.

After much debate and negotiation, the project was agreed upon to redistribute the agricultural fields in such a way that every household would get an irrigable plot of sufficient size. Further a Water Users Association would be founded to organize the distribution of the water. One representative of each household would become a member of the Association. Each member would get a watershare, however the household would lose its water rights if its cattle was to be found grazing on the hill.

After two years the villagers appreciation of the project increased. The living conditions had improved. Goats were increasingly replaced by milkcows (kept in a stable). The hills gradually regenerated and the grass production increased too. Up to that time the right to cut and harvet the grass was leased to a private enterprise, that in its turn leased to villagers. Since the productivity of the hills was then increasing due to the better management of the villagers, the Forest Service decided to lease the exploitation rights directly to the village collecting the futre. The village community itself took care of collecting the licence fees. The price for the people was lower now and also part of the collected fees remained at the disposal of the villagers. They decided to reinvest this in the management of the hill (amongst other through the buying of seeds and seedlings).

Within the village it was the Water Users Association who kept organising all this and as a result its name was changed to Hill Resource Management Society. The way things had developed in Sukomajri was appreciated in the other villages at the edge of the plateau too. By 1987, 18 villages had founded a Hill Resource Management Society.

This case provides an example of how the application of the earlier applied principles led to a sustainable project, that could be handled and replicated by other local communities. The researchers, led by their focus on problems, were forced to go beyong their original area en discipline of activities. Forgetting about their original intentions and suppositions, they negotiated a first action to be undertaken with the farmers. This action, the construction of the dam, led to the emergence of a conflict; the researchers and farmers learned from their intervention and negotiated into adaptations in the manner in which the new resources were to be managed. In this manner, both soci-economic and ecological objectives of the farmers and the researchers could be achieved.

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FARMER MANAGED IRRIGATION SCHEMES IN SUB-SAHARAN AFRICA: POSSIBILITIES AND LIMITATIONS FOR CONSULTANTS

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Contribution to the International Workshop
"Design for Sustainable Farmer-Managed
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1. INTRODUCTION*

The role of the consultant in development projects can frequently be compared to the role of a conductor of an orchestra. He has the difficult but challenging task to perform a modern symphony for an audience that mainly has grown up to listen to and love classical music and national folk music. The audience will appreciate a modern concert as long as they recognize their local tune and rithme on the background. However, at the same time they are full of expectations towards the improvisations made by the conductor and his orchestra. If the conductor brings well his message to the orchestra and can touch the inner feelings in the right way, the audience will participate by emphasizing the rithme and hand clapping.

However, part of the audience is pessimistic and conservative in view of the sound waves, although they like music performances and have a special relationship with the musicans. Meanwhile, music critics keep a watching eye on such a symphony that may lead to a cacaphony of instrumental sounds. They tend to be highly critical towards the performance of the conductor and his orchestra, their improvisations and the response of the audience. It often depends on their point of view, if a follow up of such a concert is granted, and if content and themes must be changed.

From this imagery, it will be clear that a development project requires the input and interaction between different groups of participants which have their particular responsibility and expectations in the development process.

* The author acknowledges comments on an earlier draft by Ir J. Faber and Dr W.H. van den Toorn

The role of the consultant, one of the participants, is to design and accompany the process. Like the conductor he will interface with his orchestra (local committees), his audience (target farm community), the critics (national and local governments), and his employer (donor agency).

It is obvious that the various participants cannot share all views of the others and will experience limitations and confrontations in their contribution towards project development. In the title of this workshop, the words sustainable, farmer, irrigation, and farmer managed, immediately associate with type of development projects, the participants and their interest and expectations, design and process approach and the specific role of the consultant. At the same time, however, these words call attention to their opposite meaning, like confrontations between participants which have completely opposite views and interests. In the following paragraphs, attention will be placed on these subjects, especially the role of the consultant. Our view points will be supplemented with project experience and special observations.

2. TYPE OF DEVELOPMENT PROJECTS

In general, two main types of development projects can be distinghuised:

- the ones directed to an acceleration of existing developments, and which relate to the local agro-socio-economic context;
- the ones that are aimed at drastical change of the direction of the development.

Improvement of rainfed agriculture belongs to the first type of projects. Introduction of new varieties, improvement of cultural practices, input suppy and credit systems can be superimposed on existing systems without forcing drastical changes in the local structure. The same is valid for improvement of "cultures de décrue", traditional systems along the river banks, as found frequently in West- and Southern Africa. An important characteristic of this type of projects is that creative support will have to increase as the requested acceleration of the development exceeds the "natural" rhythm of the development. For this type of projects, normally simpler technology and input delivery services are require then for the second type of projects. Furthermore, implementation constraints for the first type of project are often less severe, due to its demand driven nature, the fact that less agencies are involved, and that management and leadership are useally more transparant.

Introduction of irrigation on the other hand calls for an acceleration of development and for "jumpwise" changes in direction. Especially irrigation at full technical level and tight water distribution schedules radically upset the existing local system. This type of development projects is often characterised by a top-down approach, supply driven strategies, involvement of various agencies, management of multi-components, insufficient formal coordination between government agencies and between these agencies and the target group, and requires strong leadership.

3. PARTICIPANTS AND THEIR INTEREST IN DEVELOPMENT PROJECTS

In farmers-managed irrigation projects, the following participants can usually be distinguished: rural community, national and local government, the donor and the consulting agen
cy. This strongly schematized picture consists of many sub-systems.

The rural community

Agriculture and social systems are complex and deeply rooted in to the community. Under difficult conditions, the farming communities depends on these systems by means of subsistence strategies in order to survive. Through an abrupt transformation resulting from interventions, the rural community cannot directly accept and cope with changes in their socio-cultural system. Many examples of project failures are known and are more than once based on (1) a weak or completly absence of integration of productive aspects with a variety of human resources, (2) the absence of a focus on institutions building, and (3) emphasis on the development of human capital rather than swift physical implementation.

Acceptation by potential users is the main condition for success of a project. Acceptation of all project components, each with its own time schedule, requires a decision of all participants in the rural community, that means the large and small farmers, cereal cropping farmers and farmers with annual husbandry, fishery or wood production, male and female farmers alike. The introduction of irrigation often means an improvement of the real income, spreading of risks, and an increase in cropping intensity and intensification as a result of increased land pressure and repayment conditions.

The government

The motivation of the government is in general based on national objectives, such as import substitution with respect to food crops, self-sufficiency of food crops, export promotion, diversification of crops. The interest is clearly more directed to macro-economic and political development levels, with in addition often a preference for hardware and high technology projects.

The donor

The interests of the donor are often closely related to the interests of the government, although they may conflict with those of the government. Especially during the last years, donors such as WB and IMF, emphasize selective government involvement, with the accent on privatisation and liberalisation. Large donors are more directed towards western modernisation and macro-economic orientation, while the bilateral donors tend to be more oriented towards politics and micro-economic aspects. Donor interest has gradually resulted in selective government commitments. Allocation of land and other physical facilities required by the project are increasingly supplemented by various government activities. For example participation of government schemes in project costs, recurrent costs to sustain the programmes, policy changes required to facilitate implementation of the project, and extensive use of existing institutional arrangements and capabilities rather than the creation of new executing agencies and expatriate technical assistance.

The consulting agency

Information on the rural community is often limited, and feed-back on the real situation is sometimes not undertaken. Under these conditions it may occur that terms of reference offered to the consulting agency, are formulated for small-scale irrigation projects in which the word "farmer" does not appear. It is frequently assumed that an increase in agricultural production and the procedures to arrive at this goal, serve the government as well as the farmer. However, in the actual situation, differences in motivation and objectives of the various participants, will often be conflicing. The consultant should promote an interactive process between the various participants.

The consultant agency participates in the development project not so much anymore as a technical agency but increasingly as a katalyst. He has to (1) identify each party's interests, (2) phase and design the project activities, carefully so as to maintain mutual credibility between the parties involved, (3) build upon existing structues, and (4) make technology as much as possible compatable with the socio-economic and cultural environment of the project. However, his contract often dictates a limited time span for planning and implementation and a limited budget. This will force him to deviate from a programmatic and process approach with a long-lasting social impact, to an intervention of which the changes for succes will tend to be rather slimmer.

4. THE ROLE OF THE CONSULTANT

As illustrated above, the role of the consultant in a development project is very much determined by the different participants. He should tune his capabilities to the needs of the other participants. Besides technical abilities, these should include organizational, analytical and process support abilities. He should not accept to be confined to the role of following dictated policies, not even under the "harshest" terms of reference: there is always some play for an institutional orientation in his work.

The above needs to be translated into "participation". Participation would concern project formulation, design, implementation and management in the traditional way. In addition however, participation is required to elicit commitment from farmers, farmer organizations, local officials and other parties involved, and to adjust design, formulation and timing of the project accordingly. Gaps in information should be filled in gradually, and the target community and other parties involved should be enabled to gradually absorb the intervention. This means that, an appropriate development project should normally start with a limited, but well defined (by all parties agreed) number of components, that some project components should be filled in at a later stage, and that the project budget should bear some flexibility. It goes without saying that this approach requires a strong monitoring and evaluation unit together with a programme manager/coordinator in stead of the traditional teamleader with a well-defined technical input and standard administrative obligations.

Much of the above concerns "shoulds and ifs". The regular type of terms of reference for expatriate consultancy in irrigation developments, does not normally leave much room for an institutional geared and farmer driven approach. At the same time traditionally the consultant is not geared to such an approach either. Gradually over the last decade, donor agencies and clients, but also the consultants, would seem to have started to recognise the need to embark on more creative and sustainability oriented methodologies and approaches. New concepts and instruments are now being designed and field tested. They are aimed at bringing together and making articulate to various voices the matching of which is needed to orchestrate development in a way that intervention develops into routine matters. These recent insights and adolescent approaches and methodology might be viewed as the compromise between the output oriented, yet inflexible but well structured technocratic intervention of the 50' and 60', and the much more creative and sensitive, but structureless programatic approach of the 70's.

The consultants like the other players in the orchestra simultaneously follow and "make" developments like the ones sketched above. At the same time, the consultant is located in the somewhat uneasy corner of having to survive financially, a requirement that does not apply to the other players apart from the farmers. As a result the consultant has little room to stray too far from the terms of reference and the contract by which he is engaged. The one area where consultants should have a creative role to play is in projects of a long term nature which allows regular adjustments and changes in orientation. The consultant in such a situation is in the position to assess with some precision, approach and perfomance against the requirement of sustainability, and should and does advice funding agency and clients accordingly. * Of course there may be areas of incompatibility of objectives between parties but practice indicates that the frequency with which such conflicts occur is rather low.

* see for example the IOV report called: "UITBESTEED, GOED BESTEED?" Annex 5 paragraphs 23.1 -> 23.8)

Concluding remarks

1. Development can be likened to an orchestra: many players with different instruments. The creative co-ordination between these players and the level of their capabilities are decisive for the level of sophistication and the qualicy of the music that is conveyed to the listener.
2. Viewing development as that the "comming together" of many and different interests, is of recent age.
3. The rules by which the music should be written and played are as yet not firmly established. This means that the room for creative sustainability oriented and farmer-driven methods and approaches is modest. Many contracts are still of a traditional and technocratic nature.
4. Greatest promise is in long term assignment where contracts allow frequent reformulation and adjustment, and can reflect increased understanding and new insights.

TECHNICAL AND ORGANISATION DESIGNS FOR SMALLHOLDER IRRIGATION SCHEMES: THE KENYAN EXPERIENCE

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THE DESIGN OF FARMER MANAGED IRRIGATION SYSTEMS: EXPERIENCES FROM ZIMBABWE

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DISCUSSING DESIGN FOR SUSTAINABLE FARMER-MANAGED IRRIGATION SCHEMES IN SUB-SAHARAN AFRICA

a compilation of results of recent international meetings

Contents

Contribution to the International Workshop
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1. Introduction

The purpose of this workshop is to help achieve an approach to design that provides a sound basis for the development of sustainable farmer-managed irrigation. This is not an isolated attempt, as can be seen from past international discussions on how to improve strategies for future irrigation development in sub-Saharan Africa. Using material from proceedings and reports, this paper gives a concise overview of the findings of seven recent international meetings on irrigation and related themes in sub-Saharan Africa (Ref). These various seminars, symposia, workshops, consultations and forums were attended by people from a variety of disciplines and professional backgrounds.

Given the widespread decline in per capita food production in Africa, all the meetings unanimously assigned important roles to future irrigation development. However, they all stressed the need to learn from past failures. The common objective of these meetings was to identify various features of irrigation development and irrigation technology that are likely to be most appropriate to regional needs in the future. Most of the discussions contained the message that irrigation schemes should be regarded as socio-technical systems where neither social nor technical aspects can take automatic priority. Furthermore, efforts were made to identify the key areas of interface between both domains.

This paper also summarizes some implications for irrigation design that resulted from these meetings and indicates where the present workshop tries to link up with these implications and take them a step further.

2. The key issues addressed and their relevance to the present workshop

The main issues discussed at the various meetings depended on the specific objectives of the meetings and on the professional backgrounds of contributors. Likewise, the recommendations these meetings came up with were geared to different types and levels of irrigation related interventions. However, in all these meetings there seemed to be a general consensus on the major drawbacks of irrigation projects and the future challenges they face, as can be seen from the considerable overlap of the key issues addressed.

2.1 Policy, planning and donor roles

During these meetings it was repeatedly stated that the process of systematic irrigation planning and policy formulation has not yet started in many sub-Saharan countries. Irrigation planning is seen to require knowledge on numerous physical, economic and social variables and on their interrelations. It also requires that priorities be set for national and community objectives which change in time, and this makes it essential to have feedback to policy and planning levels. A growing need is identified for clear objectives, clearly formulated agricultural policies framed in the national and regional context, the development of project-planning and implementation capacity, and training and research addressing both the physical and the social conditions for development.

Generally, supportive and complementary actions from international donors are needed to remove the constraints mentioned above and to contribute to project sustainability, e.g. by technical assistance in training, and with management and administration of irrigation development activities, long-term financial commitments and short-term acceptance of recurrent cost deficits and improving the local, national and international information base, e.g. with systematic feedback from past experiences.

The implications for irrigation design derived from the issues above primarily have a bearing on broader strategies for irrigation development. "Modern" capital-intensive irrigation within Africa is seen as the least cost-effective option. Furthermore, it creates a series of potential conflicts of interest between users and irrigation agencies. For countries without substantial irrigation experience it seems more remunerative to learn from small-scale developments. However, small-scale development does not guarantee better performance than large-scale, if similarly conceptualized. Irrigation should be based on a concept that initiates a development process rather than that plans a development action. Moreover, in the documents studied there is a general agreement about the need to include more than a one-sided consideration of the Economic Internal Rate of Return in irrigation planning by giving greater weight to human and social advantages or disadvantages of specific options.

Relevance to the workshop: The above clearly indicates the need for approaches to irrigation design that take different socio-economic and socio-political factors into consideration. It is the workshop's major aim to systematize the type of important factors and to analyse how these factors can be integrated in design. What remains unaddressed in the reports under review is the fact that the objectives of national governments and donors often prevail over those of future users in irrigation planning. Therefore, external biases characterize the role that designers often unintentionally and almost always unwittingly play. During the workshop we will also try to examine the "external content" of presuppositions on which many designers currently base their decisions.

2.2 Local farming system

Most forums agreed that irrigation development may disrupt the family economy by imposing rapid transformation of subsistence farming into competitive commercial farming, rather than innovations in or improvements of pre-existing activities. Also, irrigation schemes that impose uniform production patterns on many farmers may be unpopular. The newly introduced component to the local farming system should be brought into balance with other food-producing and cash-earning activities, in a combination attractive to farmers and acceptable to other actors. For instance, if rainfed farming increases, the productivity of irrigated plots sometimes drops. This underlines the economic compatability of rainfed and irrigated agriculture. A combination of these types of agriculture is preferred over sole reliance on irrigated production.

Therefore, irrigated agriculture should not compete with pre-existing resources (land, labour, capital and water) beyond the extent acceptable to farmers. For example, farmer preferences and irrigation project presuppositions frequently diverge in regard to the labour input required by irrigation. For farmers, labour shortages are important. There may be wide variations between households, but at peak periods labour supply emerges as a keyconstraint because of the marked seasonality in African farming. Overstretching labour and other resources should be prevented by maintaining the "chain complementarity" that exists among productive activities.

Access to land is another example of why plans should be based on an in-depth farming systems analysis and consultations with farming families. By wishing to impose crop choices, cultivation techniques and timing of operations governments cause those tilling the land to become more like tenants rather than landowners. Leases allow project authorities to control the production process, because thes authorities have the power to remove a person's tenancy rights. However, conditional tenancy diminishes the farmer's commitment to modern irrigation. Furthermore, customary laws are still very much in operation. It seems appropriate that irrigation planning should take these traditional arrangements for the management of land-use into account, particularly to avoid conflicts between different groups of people.

In general, all the documents reviewed underline that for better irrigation performance one has to get to the roots of the social, organizational and motivational aspects from a farmer's perspective. A first requisite in this respect is to know how male and female farmers choose, combine, manage and rank the various activities they engage in.

<u>The implications for irrigation design</u>, that resulted from the above considerations relate to the need for "chain complementarity":
- Plot sizes and land allocation principles should enable households of different size and composition, and changes over time to be accommodated.
- Plot sizes should only be chosen after farmers' budgets have been financially appraised. The plot size should guarantee an acceptable income without eliminating other important productive activities (even if this means modifying the size to allow for a small supplementary activity).
- Low cost irrigation systems or methods that can give acceptable returns when used only for supplementary watering of traditional crops should be identified.
- Landuse systems that integrate crop production and livestock-rearing should not be ignored.
- Anything that can make a system more reliable, robust and simple should be adopted, to minimize requirements for farm labour.
- The design should anticipate irregular periods of absence of the farmers, otherwise it may prove to be inappropriate in real-life conditions.
- Designers should search for design options that can reduce the labour demands of the operation of an irrigation scheme without increasing the capital-intensiveness of production.

Apart from advising that location where land and water rights are already contested should be ignored, the documents reviewed contained no recommendations that designs should take land tenure/land rights into account. Furthermore, resources like water, cash, agricultural equipment and knowledge were barely discussed, if at all.

Relevance to the workshop: The more general problems with regard to integrating considerations on the farming system into design have been addressed in former meetings. However, attempts have been made to link aspects of the local farming system with design-decisions. In theme 1 of the present workshop, additional efforts will be made to systematize the design-approach to the local farming system and to inventory coherent ways that help us to deduce what conditions the local farming system poses on the irrigation design. Furthermore, theme 1 should, hopefully, illustrate that as well as better insights alternative design options are also needed to support more viable irrigation designs.

2.3 Irrigation management

There is general awareness that irrigation management has been weak in many African farmer-managed and agency-managed schemes. In the African setting three domains of managerial farmer-action have proven problematic time and time again: achieving corporate identification and accountability on a non-kinship basis; managing money; and managing equipment shared between more than one operator. Unfortunately, irrigation projects require fairly high levels of proficiency in all three domains. However, many have observed that outsider-staffed scheme management gives an illusion of development, a state of affairs promoted by the lack of government funds and an ineffective and top-heavy bureaucracy. Therefore, discussions on institutional constraints generally come down to the recognition of the need to delegate scheme management to water users, associations as much as possible.

As regards the three problematic domains mentioned above, water users' associations should preferably be formed on the basis of traditional forms of cooperation. Organizations of people involved in irrigation systems are not implemented in a social vacuüm. Therefore, preparatory studies should devote time and energy to finding and assessing what form of organization will fit in the existing local socio-political network, given the prevailing traditional forms of cooperation and mutual aid. Knowledge of local community structure and of village or clan leadership relationships is necessary for this aspect of institution-building.

Existing local organizational structures should be modified as little as possible, while at the same time ensuring that the project revenues be recognisably fair to all, with safeguards to prevent progressive loss of economic and political power by the relatively poor in favour of the relatively wealthy.

Implications for irrigation design: Most of the reports reviewed here recommend that schemes be laid out as a series of modules, each of which is capable of operating semi-independently and is adjusted in size according to the number of irrigators in a group. The optimal group size mainly depends on the degree of social cohesion in the local community. Furthermore:

- Designs should be realistically maintained by local irrigators and, if necessary, should be able to continue to operate reasonably well even under sub-optimal maintenance.
- Designs should allocate/distribute water in such a way that is locally perceived to be equitable. For example, division of water in fixed proportions, irrespective of its availability.
- Design and construction methods have to be better adapted to local capacity for operation and maintenance (e.g. requiring minimal adjustment during the season).

Relevance to the workshop: The workshop intends to focus on the above issue in theme 2. Currently, issues on irrigation management are usually approached from the angle of management science. Without wanting to label this angle as unimportant, the workshop would like to stress a different dimension by exchanging practical experiences on the design-implications of farmer-management objectives in irrigation development. Additionally, the question of <u>how</u> the farmers' organization should be analysed in the context of design should also be addressed. What are the crucial elements of farmers' organizations and how do these favourably affect specific elements of physical design?

2.4 Women and irrigated agriculture

Statistics suggest that women are accountable for two-thirds of all working hours invested in African agriculture. However, the factors that matter to women - legal security, access to credit, to land, to water, to labour available for productive activities, and a share in profits - tend to be glossed over within irrigation planning. At previous international meetings it was agreed that it is incorrect to assume that the farming family is a homogenous unit, with a single purse, and with freely interchangeable or free family labour. These false assumptions contribute to the phenomenon of women 'losing out' in the transition from traditional to modern forms of agricultural production. Especially when projects seek to commercialize what was originally subsistence food production, women risk ending up with their formerly used best land in the hands of men, and they themselves left with marginal areas or working as labourers on men's crops. The development of irrigation may have a differential impact on the various categories of women within a community, depending on the traditional socio-economic status of their families, and within one family (age, marital status).

All the documents reviewed mention that balance should be rectified and more attention should be given to women's needs, problems and potential, which for cultural, religious and economic reasons may be different from men's and less visible.

<u>Implications for irrigation design:</u> In general, the various meetings concur that in addition to a sensitivity to women's issues, irrigation design also requires knowledge of the

existing social structure in the project area and an alertness to the processes that may arise as a result of development measures. Some general recommendations are: to identify target groups by gender, to collect data on the socio-economic organization of farming, giving special attention to the gender-based divisions of labour and responsibilities, to assess the likely impact on men and on women, both inside and outside the irrigation scheme and to make specific plans to ensure that both men and women are given access to land and water, equipment and services.

Only a few recommendations directly concern irrigation design. For example that irrigation should alleviate women's workload in the household by incorporating facilities for non-agricultural use of water. Also, the location and size of the household plots should be carefully considered, and forage options and livestock movements maintained.

Relevance to the workshop: The workshop intends to elaborate on the relation between gender issues and specific characteristics of irrigation design. It is this field which, to date, has been undervalued. This relation will be systematized on three levels: farming system level (theme 1), local community level (theme 2) and in relation to external actors (theme 3). The issue of how to involve women in project-design will also be addressed (theme 4).

2.5 Irrigation and external factors

Irrigation is highly sensitive to external factors. Levels and nature of food demand, countries' economic situation, actions of financing agencies, population growth, increase in rate of urbanization, growing demand for food crops, all encourage the demand for irrigation, whereas other factors impede it (deterioration of cash-balance of trade, reduction of external aid). More direct influences on the performance of irrigation relate to the factors linking irrigation with the region and the nation.

For example, if the output delivery system, comprising roads, rivers, railways, transport, power supply, spare parts, maintenance and competent operation, is defective, farmers are unable to respond to signals emanating from the market place. Also, the input delivery system needs to be thought of in irrigation development before its inadequacy imposes a constraint. This has become a difficult requirement for some governments to meet, especially where irrigation has become very sophisticated and external inputs of credit, seed, fertilizers, pesticides, pump and tractor fuel, spare parts, and mechanical maintenance are needed. Project strategies based on introducing intensive, modern techniques are even more vulnerable in small-scale projects, since their smallness and scatteredness brings them more problems in securing inputs, services and timely technical advice than their larger-scale equivalents.

The same applies to extension and training services that are already weakly developed. It is often unquestioningly assumed that farmers will, spontaneously, become expert managers, accountants, and mechanics without adequate and sustaining training. Furthermore, as the success of small-scale irrigation has generally depended on the cooperation of a large range of government institutions and individuals, small schemes tend to have more budgetary and institutional problems than major schemes. Almost all the abovementioned services require capable and enterprising managers, who are currently likely to be extremely scarce.

Implications for irrigation design: Most recommendations on this subject deal primarily with institutional and policy reform, developing training capacities, etc. Only a few implications deal with irrigation design; for example, that irrigation schemes should rely on simple design of pumps and other items of small-scale equipment that can be manufactured locally. This is to avoid failure as a result of the imposition of unsupportable technology ("orphan" equipment). Loan financing for infrastructural costs should also be avoided. Intensive preparatory work with farmers can often stimulate them to generate simple structures from their own resources. Projects should refrain from being involved in the operation and maintenance of irrigation infrastructure and re-designs are needed to simplify the management tasks. Furthermore, production practices that minimize cash costs (external inputs) and indebtedness should be promoted.

Relevance to the workshop: The central questions, whose importance has now become clear, are how input supply, marketing, extension and external management are arranged, and to what extent this could/should be arranged by the State, the private sector or by the farmers themselves. Furthermore, theme 3 of the workshop will focus on how the risks, arising from the farmers' dependence on external factors beyond their control can be minimized through modifying physical designs of irrigation schemes. What happens is that designers tend to rely on over-optimistic presuppositions regarding the reliability with which the external relations can be arranged. Theme 3 intends to illustrate that realistic assumptions have to be made about the possibilities and constraints of the interactions with the region and the nation. These assumptions should subsequently be integrated in decision-making on irrigation design.

2.6 The design process

There is a need to distinguish between poor technical irrigation design and inappropriate "system architecture". "System architecture", which is the focal point of this section, should occur as an imaginative piecing together of the various parts of an irrigation system by a multidisciplinary group including local farmers. The major factors signalled as leading to poor irrigation performance as a result of inappropriate designs are:

- Time pressure: e.g. caused by unrealistic timetables for implementation; technical assistance units' overriding impulse to show immediate results; governments and donors wishing to minimize the duration of their involvement; and the disregard of the importance of incorporating elementary socio-economic conditions, creating a tendency to move to action before the situation warrants. Time pressure generates a natural withdrawal of beneficiaries from the preparation of project proposals and design.

- Poor preparatory studies: e.g. caused by the fact that feasibility studies are conducted under pressure to produce high EIRRs; that research workers do not speak the same professional language; and shortcomings of survey procedures. A feasibility study should include an assessment of the sustainability of the project, in which constraints at farm level and farmers' priorities primarily dictate the content of the applied research, and not only economic criteria. The study should ultimately lead to sound criteria for the final design of the project.
- Premature decision-making: crucial decisions on Terms of References (TORs) and projects' scope, size and institutional form are often made <u>before</u> the main feasibility study is undertaken. The TORs of consultants require them to design a particular type of project as decided centrally, even if it appears not to be the best alternative given local objectives, resources and constraints.
- A communication gap between policy-makers, field officers and farmers.

Some of the recommended modifications in the design process are dealt with below.

The project concept of fixed targets to be reached within a fixed time-span should be replaced by a phased development in which irrigation is extended or introduced only after it has been thoroughly tested in pilot schemes. The latter is especially important in areas with little or no experience of irrigation. The reasons for this replacement include: the ability to implement projects in stages, with the possibility of correcting problems with the initial design during implementation; the ability to spend much more time talking to local people before commitment is made to a final project design; and, the lack of adequate institutional capacity for alternative, but very demanding approaches. The advantages of flexibility are likely to apply particularly to the development of small-scale irrigation. Beginning with moderately sized schemes allows for the programme to be fanned out satisfactorily as knowledge, experience and qualified local manpower become available.

Dividing the project cycle into stages tackled by different specialists breaks the connection between design and its consequences. The persistence of many social and economic problems in African schemes is evidence that a sharp discontinuity between designers and implementors inhibits the accumulation of useful experience. Donors will need to allow for more flexible, organic, evolutionary pre-design study. This will reduce their ability to control the scheduling of project design and implementation, but will increase the continuity of staffing and institutionalize memory.

It is generally recommended that the design process be reversed. Rather than begin with the design of the irrigation system based on what is technically and economically optimal, designers and planners should begin with the participants and institutions responsible for implementation. Only after the strengths and weaknesses of each of these have been identified and the structure of incentives clearly understood, should technical design begin. This process can then proceed in iterative fashion as governments and farmers decide which changes they are willing and able to make. Thus, first and foremost, design considerations should centre around what is feasible and acceptable to government and farmers and what impact this will have on project performance.

It is very difficult to ascertain just what is feasible in a particular context. Therefore, not only do project designers have to solicit the views of farmers and executing institutions, they also have to understand and appreciate what these are saying and what they mean. This is why the development of indigenous capacity for project design that includes meaningful participation by all involved in the project, is of the utmost importance.

<u>Relevance to the workshop:</u> From the above it may be concluded that irrigation projects need <u>time</u>, <u>continuity</u> and <u>meaningful interaction between the actors involved</u> to arrive at <u>desirable change</u>. Theme 4 of the workshop intends to elaborate on these key issues through four general questions. How can the continual flow of information be guaranteed throughout the design process? How do we translate desirable processes of change, namely those that lead to new stable and viable situations, into irrigation design? How can these processes of change be phased in? In what ways should the actors involved interact to support a design process that brings about desirable change?

2.7 Participation

As discussed in the foregoing sections, farmer participation is a prerequisite for the adequate management of irrigation schemes and for the establishment of an appropriate "system architecture" in which the irrigation and production technologies harmonize with the experience and resources of farmers and their existing land use. The reports reviewed, moreover, recognize that the erosion of traditional knowledge and skills should be prevented, and that western agricultural knowledge not only has definite limitations but sometimes also has definite negative effects on the development of agriculture in tropical areas. Few reports, however, address the question of <u>how</u> local farmers can be actively and effectively involved in different stages of the project cycle.

The concept of participation is frequently ignored (e.g. for fear that it will delay the project completion) or is misinterpreted (seen primarily as cost-reducing factor or something that merely has to do with system operation and maintenance). As a result problems occur because users have not been consulted during the design phase. Others regard participation as a ruse used by outsiders to obtain information to use themselves, in order to diagnose problems <u>for</u> the farmers. This as opposed to the approach of trying to help the farmers to consider their situation and diagnose their own problems, to build up their ability to analyse their situation and to decide what further actions to take. It is the latter aspect that, also according to some of the reports reviewed, should be regarded as the essence of participation.

Moreover, it has been recognized that the willingness of the intended beneficiaries to allocate land to irrigated agriculture, and also their participation in terms of finance and labour should be regarded as a precondition for <u>any</u> government involvement in development. Proposals should be presented, discussed and compromised on with farmers, and their support and commitment for the agreed project should be solicited. Negotiated designing is regarded as possible, particularly in rehabilitation, since farmers will have detailed knowledge of the faults in the existing system and some ideas of its potential should improvements be made.

<u>Relevance to the workshop:</u> Theme 4 of this workshop intends to highlight some of the possibilities and limitations of negotiated or interactive designing. Efforts will be made to identify ways to functionally interact with farmers throughout the entire project cycle.

2.8 Environmental and health issues

The environmental implications of irrigation development in Africa have been significant. The construction of reservoirs and canal systems for irrigation without adequate drainage, for example, has tended to lead to higher water tables in some regions and to create waterlogging and soil salinity. The introduction of perennial irrigation has also substantially increased the incidence of water-borne diseases. Most of the international meetings reviewed here have recognized the importance of considering these environmental and health aspects of irrigation. The Organizing Committee of the workshop fully concurs with this but it has decided not to focus on these problems. Firstly, the gravity of these topics merits full attention, not merely passing reference. Secondly, a deliberate choice was made to narrow the scope of the workshop to four major themes and thereby to increase the chance of advancing our knowledge on these themes.

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IRRIGATION DEVELOPMENT
PROFILES OF:

- BURKINA FASO
- SENEGAL
- TANZANIA
- KENYA
- ZIMBABWE

Contribution to the International Workshop
"Design for Sustainable Farmer-managed
Irrigation Schemes in Sub-Saharan Africa"

Agricultural University Wageningen
The Netherlands, 5-8 February 1990

IRRIGATION DEVELOPMENT PROFILE OF BURKINA FASO

National background

Average annual rainfall in Burkina Faso ranges from less than 600 mm in the north to 1400 mm in the south-west. The rainy season begins between end of May and beginning of June and ends in October. The country's rainfed growing period ranges from 75 to 230 days.

Its land area of 274,000 sq.km. is populated with some 6.5 million people (1985). This population, which is growing relatively slowly (1.6% per year) is fairly mobile. The three major migration flows are towards towns, abroad, and towards the "terres neuves", which are settlement areas in the south-west region of the Comoé River. The population consists of some 60 different tribes, of which the Mossi (48%) and Peul (10%) are most numerous. Agriculture contributed 38% to the Gross National Product in 1979, with 92% of the working population being employed in this sector.

Irrigation potential and present status of development

In 1982 FAO estimated Burkina Faso's irrigation potential at 350,000 ha (1.3% of the total land area). The area developed increased from 1,000 ha in 1965, to 6,000 ha in 1974 and 29,000 ha in 1982 (1.1% of the total area cropped). Of this area, 9,000 ha was developed for "modern" irrigation and 20,000 ha for small-scale or traditional irrigation. The main irrigated crops are rice, vegetables and coarse grains.

Types of irrigation and scheme sizes

In Burkina Faso the traditional production system is based on rainfed agriculture. There are no traditional forms of irrigation , although since 1950 some people have been supplementing rainfed culture with "la culture inondé" in the "bas-fonds". This method of cultivation consists of retaining natural runoff from small catchment areas and cultivating rice in the low parts and sorghum and cotton on higher slopes.

In the 1970s Burkina Faso started improving and implementing numerous small-scale (10-100 ha) gravity systems operating downstream or upstream of small earth dams. Several 500-1000 ha schemes were built, to irrigate from diversion dams in rivers. However, parameters such as the type of management, the extent of water control and the cropping pattern are more importnt to scheme typology. Using these parameters irrigation in Burkina can be roughly classified into five categories:

- Schemes with total water control, producing food, and having externally assisted management with cooperative and technical direction. The schemes are equipped with permanent irrigation structures up to tertiary level. The farmer- family allotments vary from 0.5 to 1 ha. According to rough estimations this type comprises about 20% of the irrigated area in Burkina Faso. It is mainly located in the Western part of the country and is used for settlement.
- Schemes with pump-irrigation, oriented to the production of vegetables and fruits. The family farms make use of local wage-labour and their allotments are about 0.25 ha. This type covers about 10% of the total irrigated area and is mainly found on the Central Plateau.
- Schemes called "les avals de barrage" where rice and/or vegetables are produced on allotments of between 0.1 to 0.25 ha. This type covers abour 50% of the country's total irrigated area and is found on the Central Plateau;
- Schemes with partial water control, producing rice upstream of small dams (6% of irrigated area). These schemes are located on the Central Plateau.
- Schemes without an external support component where people use manual water-lifting devices on very small allotments, mainly producing vegetables. Private irrigation developments are included in this type (10% of irrigated area).

<u>Irrigation policies and planning</u>

The government of Burkina Faso assigns priority to self-sufficiency in food production and to reducing trade deficits. In view ofto the country's climatic conditions, irrigation development is seen as the only secure base for attaining these objectives.

The ORDs (Organismes Régionaux de Développement), which were instigated in 1966 as part of a policy of decentralization, concentrate on all technical and organizational aspects of rural development. In 1973 new rights and obligations were formulated for the ORDs (extension; water and financial management; collection of credit repayments; input deliveries) as well as for evolving farmer groups or Groupements d'exploitation (maintenance; compliance with cultivation calendar; credit payments). External involvement in irrigation, however, remained authoritarian, with farmers having little formal say in the management of existing schemes. The ORDs' role has been enlarged since 1975 to include produce commercialization and training.

Irrigation started to play an increasing role in the national development policies in 1976 when a programme to engage in "des grandes plaines irriguées" (with total water control) and "des avals de barrages" (small irrigation schemes) was introduced. This programme originated with the creation of the ONBAH (Office National des Barrages et des Aménagements Hydro-Agricoles). It was not until 1987 that this office shifted its activities from the construction and rehabilitation of small dams to the implementation of irrigation schemes downstream of existing small dams.

Gradually, more and more public, private (NGOs such as CESAO) and local organizations are engaging in irrigation. Faced by public structures that encounter many financial and organizational difficulties, village structures are increasingly taking over the operation and management of the irrigation schemes. Village structures are now performing tasks that formerly accrued to the ORDs. There is a tendency for farmer groups to evolve into official cooperatives. Towday the government is increasingly involved in training that focuses on getting farmers to adopt new techniques and stimulates communities' sense of responsibility and solidarity.

The implementation programme for the period 1986-90 foresees 2400 ha of small and intermediate schemes and 2900 ha of "large" schemes and 4800 ha of semi-controlled "bas-fonds" developments.[1] These goals run parallel to complementary activities geared to resolve severe organizational and institutional constraints and to enhance the commercialization of produce. Non-governmental organizations will play a major role, especially in the former.

IRRIGATION DEVELOPMENT PROFILE OF SENEGAL

National Background

Senegal spans several agricultural zones, which range from Sahelian conditions (350 mm annual rainfall) in the north to coastal swamps (1600 mm annual rainfall) in the south. Areas along the Senegal river in the northern third of the country have a rainy season lasting only one or two months (August-September). The rainfed growing period varies between regions, ranging from 70 to 180 days.

Its land area of 196,860 sq.km. is populated by approximately 6,600,000 people (1985), with an average growth rate of 2.8% per year. Senegal has considerably higher rural population densities and more urbanization (35 %) than typical for Sahel countries. The population is fairly mobile, and is comprised of seven main ethnic groups: Wolof, Serer, Peul, Toucouleur, Diola, Mandingué and Sarakolé. Agriculture (including fisheries) contributes 30% to the Gross National Product, and almost 70% of the country's working population are employed in this sector.

Irrigation potential and present status of development

The irrigation potential within Senegal occurs around the nations's periphery, along the Senegal, Faleme and Cassamance rivers. In 1982 FAO estimated the country's irrigation potential to be 180,000 ha (0.9% of the total land area). The area developed increased from 13,600 ha in 1965 to 38,100 ha in 1974 and 100,000 ha in 1982 (1.9% of the total cropped). Of this area, 30% has been developed for "modern" irrigation and 70% for small-scale or traditional irrigation. Rice is the most important irrigated crop, preceding maize, vegetables, peanuts, sugar cane and cotton. After the completion of two dams in the Senegal river (1987) plans were drawn up for extending the irrigation potential along the Senegal valley by 224,000 ha. In this region, irrigated agriculture competes with or supplements traditionally important flood-recession and rainfed cultivation.

Types of irrigation and scheme sizes

Irrigation has taken different forms in the three major regions where development projects have been attempted. In the Senegal delta upstream from St.Louis, saline intrusion during the season of low flow has hampered crop development and has excluded all crops except for rice. Here, projects for crop irrigation involve large investments, and as a consequence have tended to be medium (50-500 ha) and large-scale (> 500 ha). Land distribution has been carried out according to the criteria of 0.5 ha per "actif", sometimes adding up to 1.5 ha per household unit. In contrast the more densely populated middle, and upper portions of the Senegal River provide an opportunity for numerous small (20-50 ha) and medium-sized schemes, utilizing river terraces, old channels, and small swamps. All schemes along the Senegal river practise pump-irrigation. And, finally, the Cassamance area in the extreme south resembles the Gambia River in having mangrove swamps at its mouth, a long distance subject to salt intrusion, and traditional techniques for "swamp-rice" cultivation.

All the workshop papers on Senegal focus on the Senegal River Valley, notably on the small-scale village schemes. Some 600 of these schemes were constructed during the 1970s and 1980s. The idea for these, still very popular, schemes arose from farmer experiments, originally with measures to retain floodwater on low-lying areas in the floodplain in order to cultivate rice. The size of individual holdings on these pump-fed village schemes varies between 0.1 and 0.5 ha, but is most commonly 0.2 to 0.3 ha.

Irrigation policies and planning

Irrigation development has a long history in Senegal, but its modern involvement dates from the 1930s, when pumping stations were built to serve several large rice schemes in the delta. The Senegalese government's current strategy to reduce substantial imports of staple food (which are about a third of the national requirements) relies heavily on developing irrigation for food production and fostering formal cooperatives to give peasants a place in the national economy.

To effect this the state corporation SAED (Societé d'Aménagement et d'Exploitation des terres du Delta du fleuve Sénégal) was set up in 1965. SAED originated with the objective of bringing modern, large-scale irrigation to the delta region. Parallel to this, cooperatives were initiated from above in a highly centralized manner, bypassing whatever associations already existed at local level. It can be said that SAED did learn from its own mistakes as its emphasis shifted increasingly upriver to the middle and eventually upper basins to support small-scale village controlled perimeters.

The rapid spread of the village schemes principally used to ensure food-security of farmers took the Senegalese government by surprise. Senegal's national plans for the 1970s forcast the construction and rehabilitation of large-scale schemes only. Village schemes were not even mentioned. At the villagers'request, the government marshalled foreign technical expertise to provide them with topographical surveys, basic designs and diesel pumps. After construction the schemes are managed by farmer groups, not by the agencies. The latter are only involved in providing maintenance and repair services, collecting the amortization fees and replacing worn-out pumping equipment. They also train pump operators, sell agricultural inputs (e.g. seed, fertilizer) and, depending on the location of the scheme, deliver fuel.

A new agricultural policy, announced in 1984 stated that the SAED would begin a five-year programme to wind up its activities. The procedure began with SAED's withdrawal from providing of credit, supplying inputs, and marketing rice. SAED is now withdrawing from the operation of rice mills, machinery repair and maintenance, and from the operation and maintenance of the primary infrastructure of its larger schemes. Another recent trend is SAED's growing desire to channel the village scheme developments into what is called "un stade d'intensification intermediaire". The framework for this transitional phase consists of intermediate schemes of a few hundred hectares and is supposed to combine the advantages of small- and large-scale schemes and of farmer-management and commercialized production.

IRRIGATION DEVELOPMENT PROFILE OF TANZANIA

Actual and Potential Irrigated Area

The irrigated area in Tanzania is more than 150,000 ha, which is about 3% of the total cropped area.

A breakdown of the irrigated area shows that about 25% of the irrigated area is large-scale irrigation. These schemes are normally owned by para-statal organizations in which production of agricultural outputs can be compared with industrial processes (centrally managed, hired labour, medium to high level of mechanization). Sugar cane and rice are the main crops in this type of scheme.

The remaining area of over 110,000 ha consists of schemes in which agricultural production is by individual farmers and there is a limited area of land per farmer family. Rice, vegetables and, in drier areas, some maize, are grown in these schemes. Almost the entire area of 110,000 ha can be characterized as traditional schemes, in which natural rivers are partly blocked by means of boulders/branches and grasses/clay, and water is channelled through non-regulated canals (often called "furrows") to the nearby fields. A small part of the 110,000 ha are rehabilitated traditional schemes (called "modern schemes"), in which a permanent weir, intake structure and main canal are often provided.

The irrigation potential of Tanzania is estimated to be 2.3 million hectares for short and long transporting distances and 4.0 million hectares for long transporting distances. The vast surface water resources and availability of arable land explain the high potential, which is 16 to 25 times the present area irrigated. Groundwater is scarcely exploited as a source of irrigation water.

Government Policies and Historic Review

Since the mid 1950s successive governments have accorded high priority to irrigation development. The succession of droughts during the late 1970s and the early 1980s induced the government to place even more emphasis on the role of irrigation in achieving its objectives of self-sufficiency and security of food production.

Government involvement in irrigation started in the 1950s, with improvements of modern irrigation schemes. Between 1955 and 1973 the Water Development and Irrigation Division was moved from the Ministry of Agriculture to the Ministry of Water Development and back again. Experienced staff, however, largely remained with the Ministry of Water Development.

As part of the policy of decentralizing development activities, the responsibility for small-scale irrigation projects (those less than 400 ha) was allocated to the regional administrations in 1974-1975. This resulted in the establishment of irrigation sections in all regions. These sections were controled by the Regional Agricultural Development Officers (RADOs). Large numbers of expatriate experts were recruited to lead the regional sections but, because of lack of resources and supporting staff, they were largely ineffective. No clear relationship was defined between the regional irrigation sections and the Irrigation Division.

By 1980, the adverse effects of decentralization were apparent, particularly in the poor performance in development and operation of village irrigation schemes. The basic causes were the inadequate resources and lack of technically competent staff in the regions and in the Irrigation Division, and the failure to establish institutional competence. To correct this situation the Project Preparation and Monitoring Bureau (PPMB) of the Ministry of Agriculture, proposed that the National Village Irrigation Division be reorganized to comprise a strengthened headquarters and six zonal units, each covering three or four regions. It was envisaged that the zonal units would supervise and provide technical backstopping to the regional irrigation sections and, in particular, would

- survey, plan and design high priority village irrigation projects
- construct, rehabilitate and improve village irrigation schemes to be handed over to regional irrigation sections for operation and maintenance when fully developed
- carry out trials in improved water management and irrigation practices

- train regional irrigation staff in operation, maintenance and management
- train extension workers and farmers in improved water management and crop husbandry practices.

It was proposed that the role of the regions should be limited to cooperating in the identification and preparation of projects for construction; mobilizing resources and local staff for construction; mobilising and organizing farmers; running trials and demonstrations; and training extension staff and farmers. The regions would also be responsible for operation and maintenance.

Since 1980 the Irrigation Division has attempted to implement these recommendations, but progress has been slow because of lack of resources. The lack of any clear government directive on the role of the Division and its relationships with other institutions, particularly the regional administrations, together with the Division's limited capability, has prevented the Division from undertaking the responsibility proposed by teh NVIDP. As a result, many regions have continued irrigation development independently, often as part of donor-assisted Regional Integrated Development Programmes (RIDEPs).

The degree of success achieved by the regions is variable and almost entirely dependent on the availability and quality of donor support. The degree of Irrigation Division involvement depends largely on informal relationships developed between the zonal units and the regional administrations, but is often minor.

Present Development in Irrigation

Attention is directed on smallholder irrigation in schemes of limited size (around 500 ha or less).

At the moment an inventory is being made of areas that can easily be irrigated and/or need rehabilitation. This exercise is being undertaken by the UNDP-financed "Institutional Support to Irrigation Development" project, executed by FAO. The inventory is intended to produce a ranking of priority areas for development.

The "modern" irrigation schemes (as distinct from the "traditional" ones) under construction or recently constructed are gravity schemes with a fairly complete infrastructure including canals, drains and roads to individual farms.

Some experts are already wondering whether a policy of assisting farmers should be followed, by partially upgrading of traditional schemes and providing only the main system of new schemes. "Modernization" and "upgrading of traditional schemes" seem to be in conflict with each other. In practice, however, the two approaches will certainly overlap.

IRRIGATION DEVELOPMENT PROFILE OF KENYA

National Background

Although the area of Kenya is 583,000 square km, the core zone of settled agriculture, consisting of two wedges of fertile land - mostly highland - on either side of the Rift Valley and a small slice along the Indian Ocean is only some 120,000 square km.

This highland zone (mean annual rainfall from 800 mm up to over 2,000 mm) is surrounded by drier agro-pastoral lands, and these in turn by a much wider belt of semi-desert extending to the Somali border in the east and to Ethiopia to the north. These outer lands contain patches of true desert, and have on average less than 400 mm of rainfall per annum, making them genuinely "Sahelian" and permitting only semi-nomadic pastoral use. Kenya is thus clearly divided into three sections: a central highland populated by densely settled Kikuyu, Luo, Abaluya and Kisii peoples; an encircling zone of drier, mixed farming and ranching lands populated by the Masai, Kamba, Meru, Samburu and Kalenjin peoples; and the outer zone of pastoral lands held by the Somali, Boran, Gabbra and Turkana. Two-thirds of the country receive less than 500 mm rainfall per annum.

In 1985 the population of Kenya was over 20,000,000 people and had one of the highest rates of population increase (4 % p.a.) in the world. Currently, 80% of the working population is employed in agriculture, while this sector contributes around 12% to the country's Gross National Product.

Irrigation potential and present status of development

In 1987 a World Bank study group estimated Kenya's irrigation potential to be 244,000 ha. The Tana & Athi river and the Lake Victoria basins have most potential for irrigation development. Development is constrained by low availability of investment money, and certain land and water relationships: where water is in surplus the area tend to be densely populated, and where land is readily available water becomes scarce.

Given the current population pressure on the land resources with high potential, irrigation is expected to play an important role in the future expansion of agricultural production.

Types of irrigation and scheme sizes

Since the early 1950s the National Irrigation Board has been the principal developer of large-scale public irrigation schemes for settling tenant farmers on plots ranging from 1 - 1.6 ha. Such NIB projects are centrally managed, and tenant farmers have virtually no say in crucial decisions relating to irrigation water, cropping pattern, farm inputs and the marketing of produce. In the last five years Basin Development Corporations have attempted to set up relatively large irrigation schemes. Because of the generally poor performance of the centrally managed schemes, the government has recently shifted more emphasis on smallholder irrigation. Since 1987 the Ministry of Agriculture has been engaged in designing irrigation schemes that are intended to be managed by the farmers themselves.

At present the total area under irrigation is about 52,000 ha, of which:

-	private, large-scale		
	coffee	18,000	
	vegetables and flowers	5,000	

			23,000
-	smallholders		
	group-based	15,000	
	private	1,200	

			16,200
-	centrally managed by		
	govern. agencies		13,000

			52,200 ha

Government schemes mostly produce cash crops, including rice, cotton and sugar cane, and few food crops. Group-based smallholders produce subsistence crops, as well as cash crops such as rice and vegetables.

In all eight ministries and fifteen donor institutions (governmental and non-governmental) are involved in the planning and implementation of irrigation development.

Irrigation policies and planning

Kenya's government policy is directed to reducing its financial and managerial involvement in the implementation and operation of irrigatione schemes. At present, most centrally managed schemes need government assistance to meet the costs. For this reason, policy-makers see the development of smallholder irrigation as a welcome alternative way of achieving the national objective of food production and of creating income and employment opportunities.

The World Bank study (1987) regards irrigation development in Kenya as a sound economic proposition, because most projects will not require heavy primary investment. The unit size of projects should, however, be small (50 ha) or medium (125 ha).

The Kenyan Government, through its fourth "Five Year" plan intends to develop 18,000 ha of irrigated land per annum.

IRRIGATION DEVELOPMENT PROFILE OF ZIMBABWE

National Background

Zimbabwe is part of the great plateau that is a major geographical feature of Southern Africa. The climate is modified by altitude: sub-tropical conditions prevail over most of Zimbabwe and only the low-lying Zambezi and Limpopo basins experience tropical conditions. Annual rainfall ranges from 1000 mm in the central high veld to less than 400 mm in the lower areas, and falls from late October to April, mainly in thunderstorms. Only 36% of the country receives more than the 700 mm annual rainfall considered necessary for semi-intensive farming.

Zimbabwe occupies an area of 39 million ha and is populated by some 7.5 million people (1982). There are basically two agricultural sectors: (i) "commercial" agriculture, which is more modern and technically advanced and involves some 1.7 million people and accounts for about 12.8 million ha (39% of agricultural land), and (ii) "communal" agriculture on less favourable land, comprising an area of 16.4 million ha (50% of agricultural land) and involving some four million people. Small-scale commercial areas and the new resettlement areas account for the rest.

Irrigation potential and present status of development

In 1986 the irrigation potential of Zimbabwe was estimated at 500,000 has. About 151,000 ha are currently irrigated, 89% of which area under commercial farms. The area developed increased from 36,000 ha in 1965 to 65,400 ha in 1974 and 151,000 ha in 1986 (5% of the total area cropped).

Types of irrigation and scheme sizes

Schemes in Zimbabwe use different methods of irrigation and are of varying sizes. Five main subgroups can be distinguished.

Large private commercial estates: of 3,000-12,000 ha producing cotton, sugar cane and citrus. Both sprinkler and flood irrigation are used. These schemes, which are primarily located in south-eastern low veld, are efficiently managed and production levels are high.

Private commercial medium-sized schemes: range from 20 to 100 ha, giving a total estimated area of 90,000 hectares. These schemes are found in different parts of the country, with the majority in areas north of the railway line. They have been developed by commercial farmers mainly as to supplement their normal rainfed farming. Overhead sprinkling is the common method of irrigating. A variety of crops is grown, including maize, soybeans, cotton, tea, coffee, tobacco, citrus and vegetables.

State schemes: range from 100 to 2500 ha and produce cotton, wheat, barley, rice, beans, tobacco, coffee and tea. The object is to run these schemes on the same basis as commercial farms with high calibre management staff. These schemes cover a total area of about 9,000 ha.

Settler schemes: For these schemes, which are developed by Government through ARDA (see below), people with an aptitude for irrigation farming are selected and allocated land. The size of the plot allocated to the farmer varies from 2 ha or slightly less to about 160 ha. The larger schemes are highly productive and efficiently managed.

Communal schemes: Between 1944-1980 74 such schemes were established in the communal areas. They range in size from 2 to 400 ha. The irrigated area available to each plot-holder varies from 0.5 to 2 ha. The majority of these schemes depend on river flow and use flood or surface methods of irrigation. Some of these schemes were established as food security schemes in the drier parts of the country and plot holdings were open to anyone. Irrigation was and is seen as a supplementary operation to dryland farming and livestock husbandry. The levels of production and irrigation efficiency range from good to very poor. At present, most of these schemes are technically unviable and there is need for some to be rehabilitated. The total area under peasant irrigation is about 5,700 ha.

Irrigation policies and planning

After independence in 1980, the Government of Zimbabwe indicated that irrigation would play an important role in transforming the rural sector in the Communal Lands (where small-holder farmers are concentrated). The government subsidizes about 89% of the operation and maintenance costs of all smallholder schemes and does not recover any of the capital costs. This level of subsidy is justified on the grounds that most of the schemes in Communal Lands are financially unattractive yet socially desirable to promote household food security.

These government-supported schemes fall under the Department of Agricultural Technical and Extension Services (AGRITEX) in the Ministry of Lands, Agriculture and Rural Resettlement. The responsibility for farming on behalf of the government and for managing the resettlement schemes is vested in the Agricultural Rural Development Authority (ARDA). Since independence, Irrigation Management Committees (IMC) have emerged as a type of "water users' association" to liaise and assist in the management of the schemes. On AGRITEX and ARDA schemes the committee members are elected by the plot-holders. It is a government policy objective that farmers will ultimately take over the management and maintenance of irrigation schemes, thereby enabling a phasing-out of subsidies.

The government strategy is to give priority to the rehabilitation of existing schemes and expand those with potential before constructing new schemes. The policy is to encourage small irrigation schemes constructed and run by local communities. The government has set up a National Farm Irrigation Fund for this purpose. However, little investment in small-holder irrigation has taken place since 1980. Now that policy places more importance on financial viability, most potential schemes fail to meet the criteria for funding. Not much has been borrowed from the NFIF, even for approved schemes, since participating farmers would then have to fully cover the operation and maintenance costs of their new schemes.

ARDA schemes also include a few smallholders. As in the case of AGRITEX schemes, policy objectives stress the need to increase the economic viability and the involvement of smallholders in management. ARDA schemes, however, are organized on different lines from AGRITEX schemes. A typical ARDA scheme is managed by an "external" team. It provides land preparation, water supplies, credit and other services to the settlers. A special Settlement Officer provides extension services, controls the settler accounts and recovers credit. This system of production and management makes it more difficult to involve farmers effectively in decision making.

G L O S S A R Y

Contribution to the International Workshop
"Design for Sustainable Farmer-managed
Irrigation Schemes in Sub-Saharan Africa"

Agricultural University Wageningen
The Netherlands, 5-8 February 1990

GLOSSARY

Actor:

A person or group directly or indirectly related to the irrigation scheme and having a specific position, function or interest.

Agronomical design:

Design of the agronomical characteristics for the use of the irrigated plot.

Conditions of the farming system:

Demands or limits imposed on the use of the irrigated plot by the characteristics of the farming system.

Conditions of (the social structure of) the local community:

Demands or limits imposed on the irrigation organisation by the characteristics of the local community.

Conditions of the regional/national context:

Demands or limits imposed on the use of the external relations characteristics of the external context.

Decision-making (in the design process):

The act of ariving at a pusposive decision about a certain design element, on the basis of technical considerations and negotiations and exchange of information on farming systems, local community and national or regional context.

Design:

The depiction (by means of a drawing, computation or description) of something that will be built or created.

Designer:

Somebody who is responsible for the scheme design.

Design of the external contacts:
Design of the ways in which farmers have to maintain contacts with external actors in order to enable the irrigation scheme to function.

Design options:
The different ways conditions can be translated into a design. Within an irrigation scheme, options can be distinguished at the level of the physical element, as well as at the levels of plot use, organisation and external contacts.

Design process:
All the activities concerning technical and socio-economic considerations, decision-making and interactions between actors, that together lead to the realization of the physical design.

External:
Reaching beyond the boundaries of the local community.

Farmer-managed irrigation scheme:
A scheme in which the water users themselves are responsible for the operation and management of the irrigation system.

Farming system:
The complex of food-producing and cash-earning activities of a farming household.

Household:
Social unit of production and/or consumption.

Interaction (in the design process):
The mutual influencing of the various actors involved in the design process, by means of exchange of information and negotiation.

Irrigation (scheme) design:
The depiction of the physical, organizational and interactive processes required to use water for the production of crops.

Irrigation scheme:
The irrigation system and the way in which it is used (including use of the plot, irrigation organisation (use of the irrigation system), and the external contacts).

Irrigation system:
The physical system of an irrigation scheme, consisting of 6 main elements: a) water source; b) location; c) plot; d) water application; e) water distribution; f) layout.

Local community:
The community of farmers whose members are involved in the use and management of an irrigation scheme.

Management:
The process of realizing and implementing measures within the organizational framework (Manig 1989).

National and regional context (or social environment):
The complex of external actors which provides inputs for, or uses the outputs of the irrigation scheme.

Organisation:
Pattern of interaction and cooperation between a certain number of people in order to reach certain goals.

Organisational design:
Design of the ways in which farmers (or other actors involved) will operate and manage the irrigation system.

Physical design elements:

Aspects of the geographical arrangement of water and land about which choices should be made during the design process. The main elements are: water source, location, plot, water application, water distribution and layout.

Physical or technical design:

Design of the physical characteristics of an irrigation system which have to do with the arrangement of land and water: water source, location, plot, water application, water distribution, layout.

Production system:

The component of a farming system that uses a specific plot or group of plots in an irrigation system.

Project cycle:

The total of the various phases by which a project is conceived.

Scheme design:

Made up of the four types of design distinguished (irrigation design, physical or technical design, agronomical design and organisational design).
N.B. The design of a <u>system</u> only deals with the physical elements).

Social levels:

Different tiers of social units related to the irrigation system: a) farming system; b) local community; c) national or regional context.

Social structure:

The subdivision into social-cultural units (groups or functions) and the interrelation between these groups (In the Workshop, mainly used at the level of the local community).

Sustainability:

The degree to which the irrigation scheme continues to function.

System design conditions:

Requirements or limiting conditions for the physical design elements, based upon technical considerations, 'use of the plot', 'use of the irrigation system (irrigation organisation)' and 'use of the external relations'.

System design decisions:

The ultimate choices made regarding the design of the physical elements.

Technical considerations:

Attuning the technical constraints and possibilities to the design conditions and options.

G L O S S A I R E

L' Atelier International
"Conception Viable d'Aménagements Hydro-agricoles Paysans en Afrique Subsaharienne"

Université Agronomique de Wageningen
Pays-Bas, 5-8 février 1990

GLOSSAIRE

Agent

Une personne ou un groupe qui, de manière directe ou indirecte, est impliqué dans un aménagement hydro-agricole et qui peut être identifié par sa position, sa fonction ou son intérêt.

Aménagement hydro-agricole (périmètre)

Le réseau d'irrigation et la façon dont il est utilisé, y compris la mise en valeur de la parcelle, l' organisation de l' irrigation et les formes de rapports avec le monde extérieur.

Aménagement hydro-agicole paysan

Aménagement hydro-agricole où le réseau hydraulique est géré par les utilisateurs de l'eau.

Communauté locale

La communauté d'agriculteurs qui est impliquée dans l'utilisation et la gestion d'un (futur) aménagement hydro-agricole.

Concepteur (aménagiste)

Personne reponsable de la conception technique ou physique d'(une partie d')un aménagement hydro-agricole.

Conception

Expression concrète d'une image, par le biais d'un dessin, d'un calcul ou d'une description, d'une chose qui doit être réalisée dans l'avenir.

Conception agronomique

La conception des caractéristiques agronomiques de l'utilisation de la parcelle irriguée.

Conception de l'organisation

La conception de la façon dont les agriculteurs ou autres agents feront fonctionner et géreront le réseau d'irrigation.

Conception hydro-agricole

Expression concrète de la manière dont, sur une superficie donnée, l'eau doit être utilisée pour alimenter des cultures.

Conception du contexte extérieur

La conception des rapports qu'entretiennent les agriculteurs avec des agents extérieurs pour assurer le fonctionnement de l'aménagement hydro-agricole.

Conception physique ou technique

La conception des caractéristiques physiques d'un réseau d'irrigation ayant trait à l'aménagement du site et à l'eau : la source d'eau, le site, le plan du réseau, la distribution de l'eau au niveau de ce réseau, la parcelle et l'application de l'eau au niveau de la parcelle.

Conditions de conception

Les conditions pour la conception physique des principeaux éléments du aménagement hydro-agricole qui proviennent de considérations d'ordre technique ou portant sur la mise en valeur de la parcelle, l'organisation de la gestion du réseau et l'utilisation faite des rapports avec le monde extérieur.

Conditions de (la structure sociale de) la communauté locale

Les conditions qu'impose la structure de la communauté locale sur l'organisation de l'irrigation.

Conditions du système de production

Les conditions ou limites qu'impose le système de production sur la culture de la parcelle irrigable.

Conditions extérieures

Les conditions qu'impose le moinde extérieur sur les rapports qu'entretiennent les agriculteurs avec ce monde .

Considérations techniques

Le fait d'accorder les conditions et options de la conception aux possibilités et contraintes techniques.

Contexte national et régional (ou milieu social)

L'ensemble des agents extérieurs qui sont à l'amont ou à l'aval d'un aménagement hydro-agricole.

Cycle du projet

Le total des phases que parcourt un projet.

Décisions de conception

Le choix final des caractérestiques relatives aux éléments physiques du périmètre.

Eléments physique de la conception

Les éléments physiques qui nécessitent des choix tels que la source d'eau, le site, la parcelle, l'application de l'eau au niveau de la parcelle, la gestion du réseau et le réseau lui-même.

Extérieur

Le monde à l'extérieur de la communauté locale.

Gestion

Le fait d'organiser, de diriger.

Interaction (dans le processus de conception)

Les efforts fournis par les agents impliqués dans le processus de conception de s'orienter mutuellement par le biais d'échange d'informations et de négociations.

Ménage
Une unité de production et/ou de consommation

Niveaux sociaux
Les unités sociales d'échelle variable qui sont liées à un périmètre: le système de production, la communauté locale et le contexte national et régional.

Options (de conception de l'aménagement)
L'ensemble des possibilités de traduction les conditions de conception en caractéristique relatives aux éléments physiques. Les options se situent au niveau de la mise en valeur de la parcelle, de l'organisation de la gestion de l'eau et des rapports avec le monde extérieur. Les caractéristiques doivent également répondre à des considérations techniques.

Organisation
Les interactions et actes de coopération répétés entre un certain nombre de gens et orientés vers la réalisation de certains objectifs.

Présupposé
Un facteur dont la véracité est acceptée sans qu'il ait été prouvé et qui sert de base à un raisonnement.

Processus décisionnel
L'ensemble des activités conduisant la prise d'une décision motivée concernant un élément de la conception d'un aménagement hydro-agricole sur la base de critères techniques, de négociations et d'échanges de données sur le système de production, la communauté locale et le contexte national et régional.

Processus de conception
L'ensemble des activités d'évaluation des aspects techniques et socio-économiques, de prise de décision et d'interaction entre agents devant aboutir à la création ou à l'adaptation

de proposition pour une conception physique.

Réseau d'irrigation

Le système physique d'un aménagement hydro-agricole, constitué de six éléments majeurs : la source d'eau, le site, la parcelle, l'application de l'eau d'irrigation (au niveau de la parcelle), la gestion du réseau et le plan du réseau.

Structure sociale

La division de la société locale en unités sociales et leurs rapports mutuels.

Système de production

L'ensemble des activités d'un ménage visant son alimentation et ses revenus monétaires.

Viabilité

La mesure dans laquelle un périmètre continue à fonctionner.