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WEST AFRICA RICE DEVELOPMENT
ASSOCIATION - WARDA

WATER MANAGAMENT PROJECT

THE CONTRIBUTION OF DIFFERENT
TYPES OF SOCIOCULTURAL STUDIES
TO IRRIGATION PROJECTS

The Kaskas Experience



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Summary: Irrigation development has been greatly handicapped because a purely technical approach has long prevailed in irrigation studies. The authors propose a research methodology which would lead to construction of intermediate schemes which are better suited to the social organization and production objectives of the farmers.

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Foreword

Many feasibility studies conducted in the delta and valley of the Senegal River did not devote enough attention to the sociological and organizational factors involved in the construction of irrigation projects.

The long-time dominance of the technical approach has handicapped the development of large irrigation schemes in this region. Experience with small irrigation schemes, where land use and management are governed by the relationships and values of those farming the land, has led to a reassessment of the technical approach. Studies during the preliminary phase of the WARDA Water Management Project demonstrated the importance of sociocultural factors in the operation of irrigation schemes. In this report, we recommend an operational method which makes it possible to develop intermediate schemes which consider the organization of farmers and their production objectives: how to integrate social factors into the construction of irrigation schemes. To provide concrete answers, the Water Management Project played a major part in the feasibility study of the Kaskas basin carried out by SAED.

The thesis of this work is that irrigation fosters close interdependence among farmers, which is necessary to manage the scheme, and that successful project management depends on the will and ability of farmers to organize this interdependence.

Frans Huibers
Project leader

Note

This document is a translation of an original French text.

1. INTRODUCTION

At the beginning of 1986, the SAED* project *Ile à Morphil* decided to study the conditions for the construction of an intermediate irrigation scheme in the middle valley of the Senegal River. This intermediate scheme would cover several hundred hectares in one of the flood plains, and would mainly serve Kaskas, the largest village (population 4460) and administrative center of the district.

Prior to 1986, the *Ile à Morphil* Project had only constructed much smaller village irrigation schemes, but because demand was high for irrigated land, irrigation of the flood plains was increasingly viewed as necessary.

To avoid potential land tenure problems that irrigation development of such basins can create, consultants suggested first irrigating the higher land on the banks known as *fondé* (GERSAR, 1983). This land, however, is not suitable for rice growing. The *Ile à Morphil* Project questioned GERSAR's recommendations because of problems encountered in village schemes located on the same soil types, and commissioned further study with particular attention to land tenure and social organization (van Driel, 1986).

The WARDA Water Management Project was commissioned to study the sociological dimension of the proposed irrigation scheme because its research program on the design of intermediate irrigation schemes already included this aspect.

The objectives of this section of the study were to identify sites suitable for intermediate irrigation schemes and to analyze their design concepts.

To achieve these objectives, these elements were examined:

- Land rights, specifically the ownership of the basins under study, and the problem of participation by villages which had no rights over these basins.
- Total need for irrigated plots, and how they would be distributed among the population.
- Crop choice based on preference between rice and non-rice farming, and the competition between *waalo* farming and irrigated farming.
- Organization of the irrigation scheme, the definition of irrigation units, and grouping of villages.

* Société Nationale d'Aménagements et d'Exploitation des terres du Delta et des vallées du fleuve Sénégal et de la Falémé. (Senegalese Irrigation Board).

- Crop. Farmers' opinions of their cereal requirements are

considered along with suitability of the soil for different crops.

- Organization. Choosing the size of irrigation units and the degree of autonomy of the production groups must consider the possibility of mechanization, organization of the water rotation, and any social structure which functions for agricultural exploitation.

The Systems Approach

Compared to the other approaches used in the social sciences (functionalist, structuralist, etc.) the systems approach has the advantage of situating the theme under study in a global context. This approach indicates the factors which interact and how this interaction occurs. In this study, we were able to understand that what is happening within the scheme cannot be explained only by its internal functioning or by the infrastructure.

The systems approach makes it possible to exhaustively describe all the elements which make up a social system. Used in this way, the research is likely to be time consuming, and not useful in the decision process and construction of an irrigation scheme. Thus it seemed more judicious to use this approach only to situate the different elements of the system (political, sociocultural, religious, land, communication exchanges, marriage system, kinship, etc.), and to organize these elements into a hierarchy, only exhaustively describing those which have an obvious impact on the irrigation scheme.

The systems approach is limited because the necessary simulation does not make it possible to grasp all possible variations. It is a mere simplification of reality. Moreover, although the systems approach is efficient from a descriptive point of view, it is not sufficient for analysis. It only allows a static perception which puts more emphasis on the system and its mode of functioning than on its components.

The systems approach must therefore be complemented by an approach which takes better account of opinions and sensibilities, political stakes, and strategies of concerned individuals or groups. Among the different approaches cited, however, the systems approach is the most suitable for an interdisciplinary team effort. It makes each speciality accessible to the others and is able to incorporate all different findings.

Identifying a methodology which allows sufficient integration of sociocultural elements in the feasibility studies for irrigation projects comes down to researching the conditions for the "viability" of such projects. Viability can be defined in relation to several criteria, but from whichever angle the question is approached, two parameters are constant:

- productivity, and
- maintaining the infrastructure and management of the irrigation scheme.

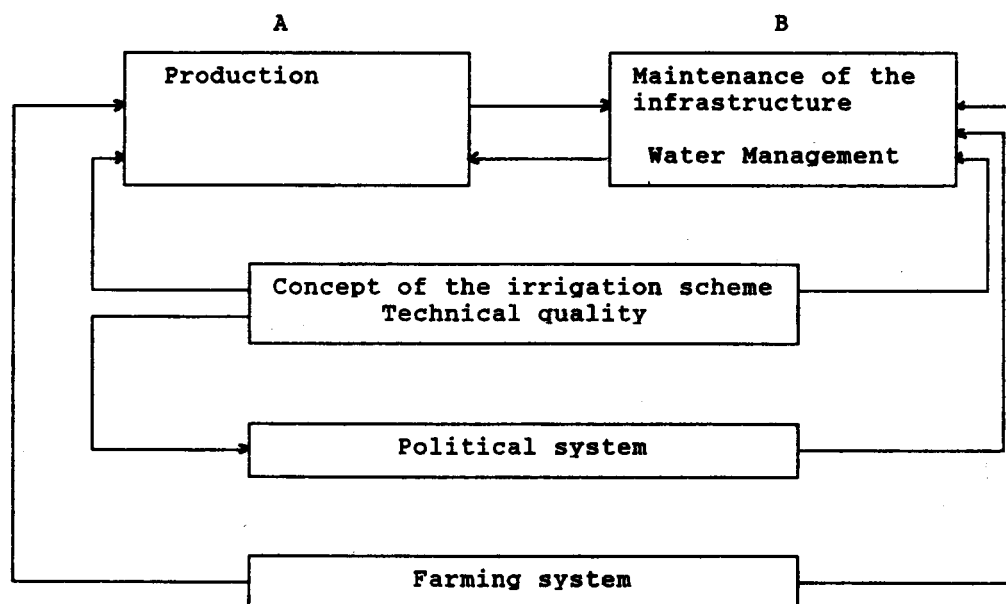
These two parameters are closely related to the design and quality of the irrigation system, to the farming system, and to the political system.

The principal interactions between the different elements which make up this system are (Figure 1):

Political System

This system directly influences the quality of maintenance and water management. Successfully organizing collective work and observing rules governing the irrigation scheme depend on the coherence of the group, the existence of an accepted authority, and the way the power relationships between individuals function. For example, putting groups which are very different in a relationship of mutual dependency, where none accepts the authority of another and where each group has a very specific form of organization, can lead to conflict and chaos.

Figure 1: Viability of the irrigation scheme from a systems perspective



Farming System

Productivity, as well as the quality of the maintenance and water management, are influenced by the farming system. The farmers' capacity to allocate time and resources to their plots depends on the degree of compatibility of an irrigated crop with other activities of the farming system.

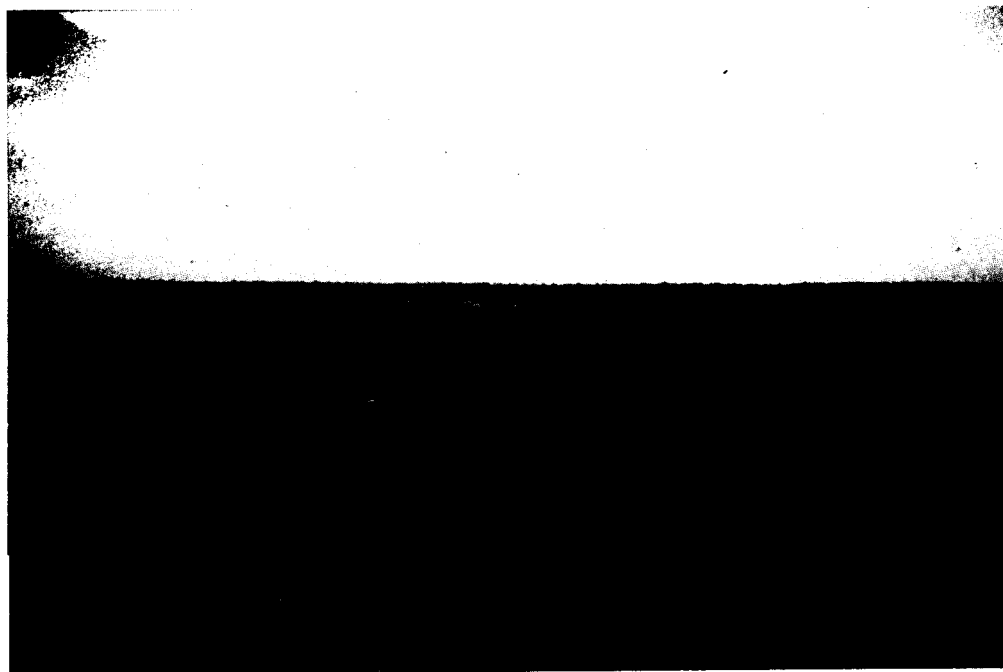
Concept and Quality of the Irrigation Scheme

Individuals and groups become dependent upon each other based on the concept and quality of the irrigation scheme: quality of the structures and lay-out, choice of soils, construction materials, and mode of water distribution. Quality of maintenance and water management depend on the management ability of the local political system. The nature of technical problems and complexity or inadequacy of the design can exacerbate the contradictions within the political system and provoke a crisis.

2.2. The Use of History and Culture

As we emphasized in other studies of farming systems (Fall, 1987), it is a mistake to study cropping systems without taking into account historical and cultural factors. These factors promote a more thorough understanding of the system, and place a system in a more global perspective. The way in which a population manages the irrigation scheme allocated to it depends to a large extent on their basic ability to manage production. An historical perspective makes it possible to clarify the importance of relationships between the groups in question, and may avoid a hasty classification made on the basis of observation and collection of current data. Moreover, studying the history of an area makes it possible to reconstitute historical units, better define the context, and expand the study of land tenure.

Figure 2: Waalo agriculture



3. THE PROGRESS OF THE KASKAS STUDY

The importance of conducting social science research in an area where an irrigation scheme is proposed was demonstrated by the hostility of farmers in the *Mutul*, who opposed the project. Based on this research, project planners continued their search for a location where farmers favored an irrigation scheme.

3.1. Site Selection

In *Haalpulaar* society, land is central to all social relations, and even determines them. The study of land tenure enabled us to understand the organization of space. The means of access to the land is important in that it explains the entire history of political rivalries which underpin it. For the specific case of Kaskas, the study of the land tenure structure enabled us to understand how the traditional management system of the flood plains is organized. It revolves around three groups:

- masters of the land, *jom leydi*,
- owners of the fields, *jom ngesa* and
- actual farmers, *remoobe*.

This classification is important because it makes it possible to identify all those who have tenure rights, and to pinpoint the groups and villages directly concerned by the irrigation scheme. If these groups are not precisely situated in the interplay of land rights, the consequences of demands they can make may prove detrimental to the construction of future irrigation schemes. The development of certain irrigation schemes in the valley were held up for several years because villages located a long way from the site were not included by planners, and these villagers demanded to be involved. Examples are the case of Saldé Wala and NDombo Thiago (FAO, 1983; Seck, 1986). Listing all those eligible for land rights, at whatever level, makes it possible to gather precious information, in particular:

- size of the area,
- average size of the individual plots, and
- number of non-eligible villages or farmers to be anticipated.

Another aspect of land tenure is the motivation of the farmers who own land. The land rights of one of the first basins studied, called *Mutul*, revolve around the lineage of the *Eliman Cambé* of Kaskas as *jom leydi* and the *pel Siranabé* of the village of Bilwil as farmers. In this case the real power was in the hands of the actual farmers, the *pel Siranabé*. After identifying the various owner groups with different rights, evaluation of the power of each one over the site made it easier to assess which group would prevail.

The analysis of the social and legal systems of the basin

revealed various contradictions which any newly introduced irrigation scheme is likely to encounter.

The Mutul Basin

The *Mutul* is a flood plain chosen by the irrigation scheme developers as a priority site for the future intermediate irrigation schemes of Kaskas. This area was chosen primarily because it fulfilled certain technical criteria such as soil type and structure, with appropriate topography.

The structure of land ownership in the area is:

- *Jom leydi* (masters of the land): the *Eliman Cambé* of Kaskas.
- *Jom ngesa* (owners of the field): *Siranabé* of Bilwil.
- *Remoobe* (actual farmers): almost exclusively *Siranabé* of Bilwil.

A blood pact binds the *pel* and the *Cambé* of Kaskas.

Reservations about the Irrigation Scheme

The *Mutul* is one of the most frequently flooded basins of the *Ile à Morphil*. According to the farmers interviewed, this land is very rich and yields well. The *pel Siranabé* have a twofold interest in this land: in addition to producing the diet staple sorghum, the *Mutul* serves as pasture land for their cattle after the harvest. This common grazing land operation, *nayngal*, is linked to flood plain farming and is a very important function for the *pel* breeders.

According to Schmitz (1985), agriculture on the flood plain is closely linked with cattle breeding. To combat the damage caused by animals, the *Haalpulaar* allow the *pel* breeders to graze their animals in the flood plain only after the fields have been harvested. At this point in the dry, hot season, the *jeeri* pastures are reduced to almost nothing.

The majority of the *pel Siranabé* who farm the basin are cattle breeders who own large herds. They spend more time in the *jeeri* with their animals than in the *waalo*, where they only come to grow crops and graze some of their cattle.

Not many of the *pel Siranabé* live permanently in the *waalo*. There are seven *galle* at Bilwil and three *galle* at Kaskas. These are families which have become sedentary because they no longer have large herds. Only these few families have become experienced in rice growing. For the others, rice growing requires too much time in the *waalo*, which is incompatible with the need to be with their cattle. They favor farming the flood plain, which is as important as their cattle rearing, and the two activities complement each other and enable them to be self sufficient in cereals throughout the year. When the harvest is good, they are

able to sell the surplus production or to exchange it for tea, sugar, etc.

The women are particularly attached to sorghum production. This commodity is the basis of their culinary habits. When asked why they do not want to grow rice, their most frequent question is: "If we grow rice, where will we find sorghum to make cous-cous?"

Many *Siranabé* women who come from Janja village in the *jeeri* have never set foot in a rice field. All they know about growing rice is expressed in a few clichés which make it seem very complicated. They speak with irony of small dams, water rotation, and "shovels and stakes".

The cereal requirements of the *Siranabé* of Bilwil depend on their production in the *Mutul*. They do not farm other basins, and do not have any *jeeri* fields. They did not think it necessary, given that the *waalo* was sufficient for their needs, and that the sorghum grown there (*sammé*) is of superior quality, in their opinion.

The management of the fields is the responsibility of a group of five *mawdo*, who are the eldest representatives of the five big families which make up the *Siranabé* group of Bilwil. Among them,

Figure 3: Cattle rearing



the *Ardo kolangal* is the main person responsible for the management of the land. Every year the fields are redistributed between the members of the families.

The fields are the "property" of a line of descendants (*lenol*), and not of a single person. The *lenol* is considered to be all the people with a common ancestor. Farmers are not allowed to give away their fields because of the responsibility they feel for future generations. The current owners consider themselves as being only temporarily in charge. This concept of land rights explains why the present *jom ngesa* think that they have more duties (of protection) than rights. The right to lend, give, or sell the land belongs to the whole *lenol*, including future generations. In traditional land management, the system of redistributing fields, as well as the social obligation to redistribute the harvest, makes it possible to maintain a balance and compensate for any inequalities.

In an irrigated system, it is necessary to allocate each household a plot of land. This is likely to create two main problems:

- There will be a progressive reduction of the area cultivated by each household as the land is divided and passed on to each new generation.
- The distribution of the plots will not allow those entitled to land to acquire large areas.

The number of individuals farming at Mutul was estimated at 452, including 412 *pel Siranabé*. In addition, there were farmers from Kaskas, Doungel, and Barangol which the project planned to incorporate into the intermediate irrigation scheme of 400 hectares.

The group of *mawdo* in the basin with whom we spoke told us of their hostility to the irrigation project for their basin. They decided to do everything in their power to prevent its construction. They would abandon and not operate the scheme if it was constructed against their wishes.

Under these circumstances, with unmotivated farmers who were inexperienced in rice growing and favored grazing their cattle in the *jeeri*, the viability of the scheme would be compromised.

The Study of Other Sites

Following the refusal of the *pel Siranabé* to have the Mutul irrigated, the study of other sites became necessary. It was essential to choose other sites likely to fulfill the technical criteria defined by the developers of the irrigation scheme in an area where farmers would not be hostile to irrigation.

Five adjacent basins varying from 29 to 175 hectares (totaling

452 hectares) were studied. We named the Guilngol, Diogdé, Bogue Dow, Lédé, and Sagana basins as the Kaskas basins. We identified the *jom ngesa* (owners) in the Kaskas, and encountered three types of traditional land rights:

- The field is part of a *leydi* (territory) presided over by a *jom leydi* (master of the land) who receives the *asakal*.
- The field is part of a *jowre* (the total number of undivided fields belonging to a line of descendants or to a segment of a line) presided over by the eldest member of the big *galle mawdo* who receives the *asakal*.
- The field belongs to an individual who can give the *asakal* to anybody.

In the Kaskas basin, the field is often part of the *jowre*. The list of *jom ngesa* (Table 1) is not exhaustive, but shows which groups are present in the different basins. Note that the main owners of fields and farmers are the *Kanhanbé* of Kaskas (the lineage of the head of the village of Kaskas), who own 64 percent of the fields.

Conclusions of the Site Selection

Choosing the site for an intermediate irrigation scheme focused on the *Mutul* basin and the five Kaskas basins. The *Mutul* site was abandoned for the time being because farmers were hostile to the idea of an irrigation scheme. In the second choice of the Kaskas basins, a database was created, and the lay-out of the plots and their organization, management, and use were studied. The planned irrigation scheme was redefined, taking into account the social groups which own the land, their relationships, and a project organization which was best adapted to their way of life.

Table 1: Villages and groups affected by the irrigation scheme

Groups (names of lineages)	Villages of residence
Kanhanbé	Kaskas, Jaéré Gollere, Haéré MBar, Séno-Bousobé (RIM)*
MBarnabé	Kaskas, Haéré MBar, Séno Bousobé
Cambe	Kaskas (RIM)*
Gollernabé	Kaskas, Haéré Gollere (RIM)*
Pullo Yalalbé	Barangol, Wouno, Janja (RIM)*
Pullo Siranabé	Tylla

* Islamic Republic of Mauritania

3.2. Social Organization and the Design of the Irrigation Scheme

In the *Haalpulaar* society, the *Foorodo*, *Ceddo*, *Cuballo*, and *Pel* are at the top of the hierarchy. Most of these groups are farmers, who are higher than groups of craftsmen. At the bottom of the hierarchy are the descendents of slaves.

Apart from castes and statutory groups, the social reference from the organizational point of view is the age group (*fedde*), which functions mainly for mutual assistance. Each statutory group is structured according to lineages (*lenol*) and segments of lineages (*galle*, *suudu*), which are responsible for managing the land, but the unit of production and consumption is the household (*foyre*).

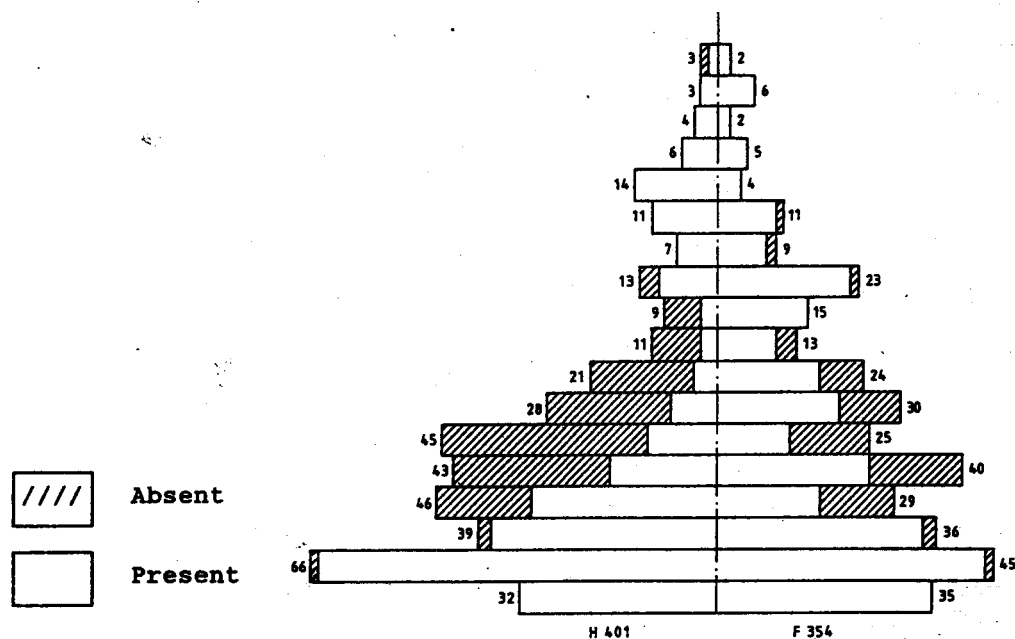
This social organization is extremely important, because if correctly understood, it respects the wishes of farmers in the new forms of organization created by irrigation. This is why we devoted a great deal of attention to identifying the structure of social units and their mode of operation, and also explains why the irrigation scheme was designed around local terms such as *galle*, *foyre*, and *jowre*, which are not only traditional, but also fundamental. They are specific to this society and make it possible to understand how it works.

During this stage, formation of groups was emphasized, recognizing the role and position of women, land tenure problems at plot-level, and the type of agricultural equipment. The study also tried to ascertain the criteria with which plots are allocated, the functioning of the existing village scheme, and the creation of irrigation units in the planned intermediate irrigation scheme.

The first objective of these studies was to assess the size of the work force that was either available or potentially available. This assessment made it possible to project the degree of mechanization, the size of the plots, and the number of farmers to be included (Figure 4). We then estimated the investment capacity of the farmers, and inventoried the cereals to better understand the choice of crops (Tables 2 and 3).

In order to make the irrigation scheme correspond as closely as possible to traditional territorial units (*leydi*), we tried to reconstruct these units. It is among these units that alliances are still made and broken, and relationships of power and mutual assistance operate. These factors are more important in the flood plain, which was not included in the village schemes because the pressure of land ownership is stronger there. It also became clear that the land-owning structure constitutes the basis for social divisions within *Haalpulaar* society. The dependence between social groups is very visible in the context of access to the land. All this information was gathered and taken into account in the Kaskas study.

Figure 4: Age Pyramid at Kaskas (those present and absent)



Note: The large number of boys aged 5 to 9 is explained by the fact that many children are left with families either by members of the family who have emigrated or by relatives from neighboring villages so that they can attend one of the many Koranic schools in the village.

Table 2: Cereal production at Kaskas in 1986

Cereal	Quantity	Percentage
	kg	%
Sorghum	1,160	90
Fela	85	7
Millet	35	3
Rice	-	-
Corn	negligible	-
Total	1,280	100

Source: Dia, I. (1988)

Table 3: Average consumption per foyre per year at Kaskas.

Cereal	Per foyre	Percentage
	kg	%
Sorghum	928	63
Fela	68	5
Millet	28	2
Rice*	450	30
Total	1,474	100

* Acquired with income from migrants and through barter.

Source: Dia, I. (1988)

Demographic Studies

Demographic studies included the contributions of migrants. The analysis enabled us to identify the *jom foyre*, and assess the size of the infant population and the active present population in terms of potential agricultural workers (Figure 4).

We analyzed the contribution of migrant income and its potential impact (Table 4) as a means to establish the role of migrants in the future irrigation scheme.

These data made it possible to propose alternatives in terms of the size of the irrigation schemes, the irrigation units and plots, and the minimum and ideal degree of mechanization in order for the technical design to correspond with the management capacity of the operational social units.

Village Organization and the Proposed Irrigation Schemes

We studied plot distribution, operation of existing village irrigation schemes, and the make-up of irrigation units, all of which enabled us to better understand the complexity of land ownership problems at the plot-level and on a wider level. Irrigation of the basins not only affects the Kaskas and surrounding villages, but also nearby Mauritanian villages. The experience of other so-called intermediate irrigation schemes in the valley was noted.

Examining existing village schemes enabled us to appreciate the difficulties farmers encounter, and made it possible to suggest a more viable organization. A 35-hectare village scheme for 350 farmers was no longer operable as a result of power struggles

Table 4: Distribution of money orders in the Kaskas districts (1985)

District	Number of households	Number of money orders	Distribution between districts		Average per household
			FCFA	%	FCFA
Kanhambé	72	72	2,024,480	13	28,118
Gollernabé	61	170	6,100,659	38	100,011
Cambé	67	71	1,304,580	8	19,471
MBar	28	64	2,951,606	18	105,414
Tantadji	17	128	3,738,689	23	219,923
Total	245	505	16,120,014	100	65,796

between districts, as well as technical problems and low productivity. The many independent political entities in the Kaskas district were jealous of their autonomy to organize production, and grouping them in one structure led to a management crisis.

Our study of the farming systems showed the importance of other production activities on the farmers' calendar, and the way in which family labor is distributed. Women are important, and we concluded that it is necessary for them to be organized independently and have their own production space. The farming system affects production objectives which are specific to women, and recognizes their right to play a leading role and not simply function as a source of labor.

Assessment of Research for the Irrigation Scheme

The interdisciplinary team carrying out the study proposed various alternatives. Their proposals combined recommendations to include social considerations with the assumptions made by planners (dual crop, technical, and financial constraints) (Tables 5 and 6).

Sociological Considerations

- * The village of Kaskas is the main holder of land rights and is interested in irrigation. Part of the village of Barangol is involved; the village of Dungel has no land rights.
- * The availability of irrigated areas varies for each village.
- * The women from the village of Kaskas should be involved in farming in their own right.

- * The young people should take part through their young people's organization, which aims to provide a community service.
- * Organization should be based on the residential districts of Kaskas. Villages which are dependent on Kaskas will be included in these districts, whereas independent villages will retain their village status.
- * The areas allocated should be a function of the irrigated areas already acquired.
- * The size of individual plots should vary between 0.5 and 1 hectare according to the size of the household. These will be divided up within the groups.
- * Rice and mixed cropping are the crops to be encouraged, according to the wishes of the population and the total requirement of cereals produced.
- * The population is in favor of mechanized farming. Without mechanization, the labor force available for the village of Kaskas is not large enough.
- * It is important to extend the principle of self-management by homogenous groups controlling the water source. Water should be permanently available in sufficient quantities.

Technical and Financial Considerations

- * Double cropping should be encouraged in order to maximize the financial investment.
- * Experienced technicians doubt the financial viability of mechanized farming. Small-scale mechanization is considered too costly and the use of draft power is excluded because farmers lack experience.
- * Contractors should construct the irrigation scheme, but farmers could be involved in certain types of work.
- * Design of the most technically suitable and inexpensive dikes means that the size and construction costs will vary.

Three alternatives were identified and studied.

Three Alternatives

Initially, the entire area for the scheme will be divided into autonomous irrigation units (AIU), each of which will be independent because it is connected to a main canal. The size of the AIUs is a compromise between the technical constraints (topographical and pedological), and the social structure (number and size of the organized units identified by sociological research). In this respect, the various districts of Kaskas will be independent of each other.

Alternative A: The scheme has an area of 366 hectares, 301 for rice and 65 for non-rice farming. Plowing, threshing, and transport are mechanized. This alternative is strongly inspired by the desire of the target population to mechanize these three activities, based among other things, on experience of manually plowing the heavy earth of the drainage basins. Plots for rice

Table 5: Characteristics of alternatives A, B1, B2, and C

	Alternative A	Alternative B1	Alternative B2	Alternative C
Wet surface area (ha)				
Rice	301	323	323	72
Non-rice	65	63	63	50
Total	366	386	386	122
Size of plots (ha)				
Rice	1	0.5	0.5	0.27
Non-rice	0.2	0.2	0.2	0.19
Mechanization				
	yes	no	no	no
Rice farmers				
Number	302	626	626	270
Who are they?	Heads of hh (m+f) and other men from Kaskas and possibly satellite villages	Heads of hh (m+f) and other men from Kaskas and sat. vill., Doungel, Barangol, Sare-Souki, Bilwil	Heads of hh (m+f) and other men from Kaskas and sat. vill., Doungel, Barabgol, Sare-Souki, Bilwil	Heads of household (m+f) from Kaskas
Non-rice farmers				
Number	305	315	315	270
Who are they?	Women from Kaskas + young people's associations	Women from Kaskas + young people's associations	Women from Kaskas + young people's associations	Heads of household (m+f) from Kaskas
No. of households				
Kaskas				
Rice	270	270	270	270
Non-rice	270	270	270	270
Other villages				
Rice	0	265	265	0
Non-rice	0	0	0	0
No. autonomous units				
Rice	16	18	18	3
Non-rice	4	4	4	3
Work performed by				
Main infrastructure	contractors	contractors	contractors	contractors
Autonomous irrigation unit	contractors	contractors	project + participation of farmers	project + participation of farmers
Duration of work				
	12 months	12 months	4 years (contractor 1 yr)	12 months

Source: SARD/DGIS

Table 6: Summary of the organization of the irrigation scheme

Organization	Level of activity	Alternative A			Alternative B			Alternative C		
		No.	No. per group	Area (ha)	No.	No. per group	Area (ha)	No.	No. per group	Area (ha)
Farmers' group	field canal	64	5 f	5	72	10 f	5	24	13 hh	5
Women's group	field canal	12	25 w	5	12	25 w	5	-	-	-
Young people's group	field canal	-	-	-	-	-	-	-	-	-
Farmers' group	AIU/ss	16	20 f	20	18	40 f	20	6	50 hh	20
Women's group	AIU/ss	3	100 w	20	3	100 w	20	-	-	-
Young people's group	AIU/ss	1	-	20	1	-	20	-	-	-
Economic interest group	AIU	4	80 f	80	5	160	80	3	90 hh	40
Mechanical units	AIU	4	80 f	80	-	-	-	-	-	-
Economic interest group (w/yp)	AIU	1	325 w/yp	80	1	315 w/yp	80	-	-	-
Mechanical units	AIU	1	325 w/yp	80	-	-	-	-	-	-
Management Committee for zone		1	320 f + 325 w/yp	360	1	646 f + 315 w/yp	380	1	270 hh	120
Management Organization pst/ps/ss		1	-	360	1	-	380	1	-	120

Source: SAED/DGIS (1988)

AIU: Autonomous Irrigation Unit hh: household ss: secondary system
 f: farmer ps: primary system w: women
 gr: group pst: pumping station yp: young people

are allocated to heads of households. Non-rice crops are the responsibility of women and the young people's organization. The size of the mixed farming plots was set at 0.2 hectares based on a study of women's activities and the availability of female labor for farming. Each district forms an Economic Interest Group (EIG) and is allocated an appropriate number of AIUs. The women form an independent EIG.

The relationship between the need for cereals of the various groups and villages and the availability of the work force was

instrumental in determining the average area to be cultivated per person and per household. Standard irrigation units of 60 hectares were selected. This size was based more on mechanization than on the results of sociological research, which recommended different sized units according to the size of the groups. Construction will be carried out entirely by contractors. The clay soil and the quantity and quality of labor available from these villages precludes even partial participation by farmers, which could extend construction time unrealistically.

Alternative B: This non-mechanized scheme would cover 386 hectares, 323 for rice and 63 for non-rice crops. In Alternative B1 the construction would be entirely by contractors, while in B2, farmers participate in construction.

Alternative B is inspired by the technicians' doubt of the economic viability of mechanization, and by the political considerations of sponsors who favor participation by as many farmers as possible.

Without mechanization, the population of Kaskas would not be large enough to cultivate the double rice crop envisioned by the planners--other villages would have to participate. The choice of these additional villages, the size of the area allocated to them, and their integration into the organization were based on the results of research into the land rights of other villages, their relationship with Kaskas, their level of food sufficiency, motivation, the irrigated areas available, etc.

The area for the scheme was increased from 366 to 386 hectares because of the population of the additional village (Dungel). In terms of organization, there are no differences between Alternatives A and B.

Alternative C: This alternative, with an area of 122 hectares, differs from the first two in that it requires a lower level of investment. The scheme is situated on higher land which is easier to plow. Because of its much smaller area, it is worked entirely by the village of Kaskas. The relatively large number of farmers in relation to the area excludes women and young people.

The study recommended Alternative A as presenting fewer sociological and organizational problems than B. Alternative C was not particularly attractive given the area per farmer. The financial disadvantages of A do not justify rejecting it because the cost of investment per person is only slightly more than B1 and B2, between 3 and 8 percent.

4. SURVEY METHODS AND TECHNIQUES

4.1. Exploratory Survey

Following the elimination of the Mutul as a potential area to construct an irrigation scheme, an exploratory survey was conducted in the Kaskas basin. It was based on administrative censuses, and was checked with traditional local authorities. Questions were asked at meetings of local officials at various levels: rural councils, irrigators' groups, young people's and migrant workers' associations, and village authorities.

Through such meetings and visits with families, we wanted to elicit people's concerns so that they could be included in a questionnaire, and also find out how well informed they were and the depth of their support for the proposed project.

The research also dealt with questions of history, relationships between and within villages, problems of land rights, and opinions on irrigation and future irrigation schemes.

4.2. Survey by Sampling

The sample was based on a survey of villages (residential units) and the identified units of lineage, and was preceded by extensive surveys to compile a socioeconomic database.

Questionnaire

The questionnaire had four sections: population, agriculture, cereal balance, and irrigation.

Population

A census of household members (*foyre*) made it possible to determine the available working population according to age and sex. A distinction was made between those who were actually living in the household and therefore formed the work force available for irrigation, and those who were temporarily or permanently absent. Married women no longer living in their parents' household were included among those defined as absent from the household in question, even if they were living in Kaskas. Because a financial statement of household accounts would have involved a study of income and expenditures, the study was limited to a purely qualitative assessment by estimating the number of migrant workers likely to send money. Since it was not possible to monitor a consumption budget for a feasibility study which had to be completed within a limited period, a study of money orders handled by the Kaskas postal service quantified the financial contribution of migrant workers.

Agriculture

These data were used to study the relative importance of the various types of cultivation: *waalo*, rainfed agriculture, *falo*, and irrigated production (in village schemes and gardens).

Cereal Balance

Data from this section of the questionnaire were used to estimate agricultural production (particularly cereal) and define relative levels of self sufficiency.

Irrigation

We determined what proportion of the population favored an irrigation scheme in flood plain areas, and the type of crops, optimum surface area, and type of organization preferred.

Sampling Process

Surveys conducted during the first phase of the study were considered preliminary and used to develop a suitable sampling technique which corresponded to research objectives.

We compiled an exhaustive list of all the *jom galle*, those owning houses in Kaskas, from the administrative census maintained by the heads of each district (*mawdo leegal*). They were first classified according to district, then according to statutory group and units of lineage (*kinde*), and finally by family units or large *galles*, etc.

Table 7 shows sample distribution by district and statutory group. A sample of 67 *jom foyre* (18 percent) were questioned from the 378 *foyre* in Kaskas. The distribution of statutory groups according to survey results is given in Table 8.

It noted that a certain number of *jom foyre* were no longer resident in Kaskas although their names were still on the official listings and they were paying local taxes. They were counted by district before the final sample was carried out, and it is worth noting that this applied mainly to families from the *Maccudo* and *Pei* statutory groups.

This sampling method enables both residential units and statutory groups (professional and political units) to be represented. Prior to sampling, residential subunits were identified by means of a plan of the village and a study of the administrative censuses. The same techniques were applied to the other villages involved in the scheme.

Table 7: Distribution of the sample according to district and statutory group

District	Statutory groups						Total	Perce
	Toorodo	Baylo	Cubalo	Maccudo	Mabo	Capato		
Thiambe	14	1	1	1	-	-	17	25
MBarnabé	7	-	-	1	-	-	8	12
Kananbe	11	-	-	3	1	-	15	22
Golerenabe	17	1	1	-	1	-	20	30
Tantaaji	2	-	1	1	-	3	7	10
Total	51	2	3	6	2	3	67	100
Percent	76	3	4	9	3	4		

Table 8. Distribution of foyre according to district and statutory group in the village of Kaskas in 1987

Statutory group	Foyre					Total	Percent
	Thiambe	MBar	Kananbe	Golerenabe	Tantaaji		
Toorobe	73	23	77	72	4	249	66
Maccudo	18	7	16	24	3	68	18
Pel	-	4	2	14	2	22	6
Cuballo	5	2	3	1	3	14	4
Sakke	4	-	-	-	-	4	1
Baylo	5	-	-	2	-	7	2
Mabo	-	-	3	3	-	6	2
Cayato	-	2	-	-	5	7	2
Wolof	-	-	-	1	-	1	-
Total	105	38	101	117	17	378	100
Percent	28	10	27	31	4		100

4.3. A Study of the Existing Village Schemes

Existing village schemes were studied and monitored daily using plans provided by SAED or those drawn in the field which indicated owners of individual plots. This made it possible to identify the organizational and technical aspects affecting irrigated production which should be considered in planning future schemes. It was also possible to compare what the farmers said with what had been observed, particularly by comparing the assessment of individual plots of land and behavior patterns of farmers.

Monitoring village schemes made it possible to analyze the motivation and behavior patterns of the inhabitants. In the village of Kaskas, an analysis of the lack of activity in the village schemes made it possible to predict difficulties likely to occur in future intermediate schemes if political conflicts within the zone are not considered.

5. SOCIOLOGICAL PARTICIPATION

Our investigation was greatly assisted by local participation. Apart from a preliminary survey which helped shape the research sample, meetings and interviews were conducted with those who would be actively involved in the scheme. During the study of the *Mutul* basin, a policy of active participation helped researchers observe and understand at the farmer level. Without this information exchange, the reasons for the refusal of the *Siranabé* would never have been discovered.

This policy of participation was continued on other sites until alternatives were suggested.

6. CONCLUSIONS

By linking feasibility studies for an irrigation scheme to the idea of its "viability", an irrigation project extends beyond its mere technical implementation. Technicians can no longer limit their responsibilities solely to construction on the grounds that organization and management are beyond their expertise. The artificial separation of technical and cultural considerations in the initial stages of irrigation planning can only be overcome by contributions from social science. The design of a viable irrigation scheme takes into account the power relationships defined in the farming system and political systems in order to ensure that conditions exist to improve production, improve maintenance of infrastructures (within the limits of natural constraints), and improve management of irrigation water. Our research identified stages and essential lines of study which will facilitate this contribution.

First Stage: Choice of Sites and Users

The case of the Mutul basin demonstrated that irrigation scheme development in the flood plain is not always self-evident. Questions of land tenure in an area must be assessed before further research is conducted. This first stage mainly includes an historical study to inventory village land, and an opinion poll about irrigation development on traditionally cultivated land. Such a poll must be conducted by village meetings because the definitive point of view is not the total of individual opinions, but rather a consensus of community opinion.

At the beginning of a study, it is also advisable to compile a list of village land in the study area rather than starting with a single site. This not only provides alternatives, but could speed up and even ensure continuation of the study. Any constraints which have not been listed at this stage could compromise the future functioning of the scheme. All users of the sites must also be listed, as well as the groups involved.

Second Stage: The Design Process

In irrigated areas, the interdependence observed between farmers implies that the size and number of irrigation units should correspond to the size and requirements of the sociopolitical units identified. The willingness and ability of farmers to cooperate must be taken into account. This stage involves these studies:

- demography,
- local political networks,
- village schemes (to identify organizational problems),
- farming system (to estimate the grain balance), and
- views on irrigation, the level of cooperation desired, and size

and design of irrigation units.

Conclusions from the sociological studies highlighted certain principles which should be considered when implementing irrigation schemes. In fact, surveys can identify sociopolitical groups which are both functional and cohesive, and therefore less prone to conflict, or those which have already combined to set up functional bodies. These groups are not necessarily the same as village residential units, but rather form as a result of traditional cooperative production and management, according to an existing set of rules and methods known and accepted by the farmers within the groups. The notion of the sociopolitical group should override concepts of caste, statutory groups, ethnic groups, and village units.

Irrigation engineers tend plan their schemes using symmetrical figures, which is probably a legacy of the industrial concept (Diemer *et. al.*, 1987). This must be replaced by an approach which considers size variations of both irrigation units and individual plots. This approach would make it possible for each group and household to be allocated areas which are suitable not only in terms of their land rights, but also their needs and labor availability. The incorporation of social considerations into the design of an irrigation scheme is necessary so that the management independence afforded to groups extends to the control of the water source and its distribution.

Methodological Recommendations and Precautions

The Kaskas project has made it possible to identify certain issues which can be used to determine procedures to study intermediate irrigation schemes in flood plains (Table 9). These issues are:

- 1- Identify different levels of land rights. It is not simply a question of identifying the *jom leydi*, *jom ngesa*, and *remoobe*, but also indicating the degree of involvement and interest each group has in the basin. In the case of the *Mutul* basin, the *jom ngesa* were important, whereas in the Kaskas basins it was the *jom leydi*.
- 2- The study of non-agricultural uses of a basin which is not used solely for agricultural production is important.
- 3- It is important to identify sociopolitical groups and internal social organization, as well as the degree of social integration between the different groups within the village, and the nature of existing political and economic relations.
- 4- It is necessary to study previous irrigation experience in a village.
- 5- The population sample should not be based solely on numbers, but should include individuals according to district,

Table 9: Framework of sociological research for a feasibility study of irrigation schemes

Stages	Type of study	Information researched	Methods
Process of identification of sites and users	Historical	Process of founding villages, settlement of groups, acquisition of agricultural land	Interviews with heads of villages, information, documentary research
	Identification of sites	Use of sites and groups involved	Observation of and interviews with informants
	Assessment of land rights	Availability of land suitable for an irrigation scheme according to village and group	Interviews with heads of villages, heads of districts and heads of village assemblies
	Opinion poll	Whether groups are interested in an irrigation scheme on their traditional lands	Survey at village assembly level
Design process	Demographic study	Available work force, migrant work force likely to return; population size of villages, groups and family units; flow of work force	Use of administrative censuses followed by a direct census based on a sample, focused on the household and section of lineage
	Study of local political networks	Relationships between groups and villages	Interviews with informants, heads of villages, districts, lineage, production groups, local political parties
	Study of village schemes	Organizational aspects affecting or facilitating water management and the infrastructure. Technical aspects affecting or facilitating organization	Observation and monitoring of a campaign
	Study of the farming system	Grain balance of villages and households; degree of competition between the different activities of production and irrigation; importance of other activities in the production goals of farmers; characteristics and constraints of women's activities	Survey based on a questionnaire/household based on a sample
	Opinion poll	On what basis do farmers want to be organized? According to what criteria should allocation be arranged?	Survey based on a questionnaire/household based on a sample

lineage, sections of lineage, statutory groups, etc, in order to produce a more representative sample.

- 6- Historical research should be used solely as a means of situating existing groups within the context of traditional, functional units, and not as a means of reconstructing political events, institutions, etc.
- 7- Demographic research should not be limited to an assessment of available labor, but should include all variations in the work force.
- 8- Studies of soil and topography should ideally be conducted at the same time as sociological research. The association gives social science research a degree of credibility in the eyes of the population, which it lacks if the more technical studies are carried out in advance.
- 9- Migrant workers should be included in all decisions relating to irrigation schemes because of the strong bonds which often exist with their native villages.
- 10- While observing national frontiers, it is important to be aware of the social ties which may unite the groups in different countries who are members of the same lineage, as in the case of Senegal and Mauritania.
- 11- It is important to consider socioeconomic research as a means to encourage participation and active involvement of the population.

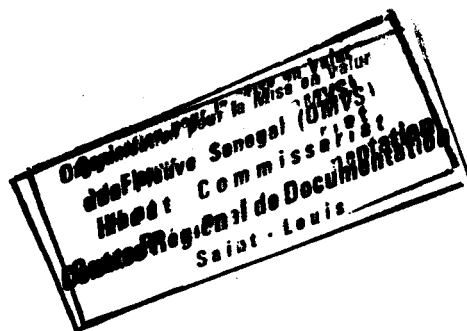
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Glossary

Ardo	Title of a pullo chief
Asakal	Koranic tithe, equivalent to one tenth of the harvest, that the farmer has to pay to the head of the lineage which owns the land
Baylo	Member of the caste of blacksmiths
Capato	Moorish ethnic group
Ceddo	Member of the warrior caste
Cuballo	Member of the caste of fishermen
Eliman	Imam of a mosque
Fedde	Group, association
Fondé	Type of sandy soil
Foyre	Unit of consumption and production (household) which includes a man, his wife or wives, their unmarried children and their dependents
Galle	Concession, section of lineage
Haalpulaar	A tribe living in the middle valley. Also known as the Toucouleur
Jeeri	Land above water level, levee
Jom foyre	Head of a household
Jom galle	Head of a concession
Jom leydi	Head of an agricultural-fishing-grazing zone, administrator of the flood plain
Jom ngesa	Holder of rights for an area of land
Jowre	Indivisible property - family management group for an inherited piece of land held in common
Kinde	Section of lineage. Group of families belonging to the same caste.
Kolangal	Drainage basin in a flood plain
Leegal	District
Lənol	Caste or statutory group
Leydi	Agricultural-fishing-grazing zone, land

Mawdo	Senior, eldest
Mabo	Member of the caste of weavers
Maccudo	Prisoner, used to designate the group descended from former slaves
Mawdo galle	The eldest of a section of lineage
Mutul	The name of a <i>kolangal</i>
Nayngal	Open grazing after the harvest on the flood plain
Pel	Group of farmers-herdsmen, known as the pullo
Pel Siranab	Name of a section of the pullo lineage
Remoobe	Active farmers. Singular: demoowo
Suudu	House, the central unit of a <i>foyre</i> which consists of a woman and her children
Toorobe	Plural of <i>toorodo</i>
Toorodo	Dominant statutory group of literate farmers
Waalo	Areas of the flood plain. Used to designate the whole valley as opposed to the <i>jeeri</i> , the levee areas





The reports of the Water Management Project are available in English and French and are distributed free of charge. They can be obtained by contacting WARDA's Regional Station at Saint-Louis, or the Wageningen Agricultural University.

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