Assisting sustainable irrigation management transfer: Case studies of good practices in West Africa

Soutenir le transfert durable de gestion de l'irrigation: Etudes de cas de bonnes pratiques en Afrique de l'ouest

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Abstract

Twelve irrigation systems in five West African countries were monitored, in order to identify good practices that appear to be related to better performance. Most of these systems were small, the range being from 20 to 3,295 ha. Most had been externally planned and designed but have since been transferred to farmers' organisations for management of operations and maintenance. Overall, the study identified 26 good practices that seem to contribute to enhanced performance. Six of these practices, concerning organisational processes, are presented here. The success of these practices is dependent on local contexts, and further research will be needed to evaluate the conditions appropriate for replication. From these studies, the authors provide recommendations in four areas: organisational strengthening; integration of irrigation activities with pre- and post-production actions; promoting the emergence of new service-providers; and new support roles of government agencies after management transfer.

Résumé

Douze périmètres irrigués dans cinq pays de l'Afrique de l'ouest sont suivis en vue d'identifier les bonnes pratiques qui conduisent à de meilleures performances. La plupart de ces périmètres sont de petite taille avec des superficies allant de 20 à 3295 ha et ont été conçus et réalisés par des organisations externes. Depuis, les responsabilités d'exploitation et de maintenance ont été transférées à des organisations paysannes. L'étude a identifié, au total, 26 bonnes pratiques qui semblent contribuer à des performances améliorées. Six d'entre elles, afférentes à des processus organisationnels, sont décrites dans cette communication. La réussite de ces pratiques dépend des contextes locaux et il faudra poursuivre la recherche pour évaluer les conditions aptes à une large diffusion. A partir de ces études les auteurs font des recommandations couvrant quatre domaines: le renforcement organisationnel; la nécessaire intégration des activités d'irrigation avec des activités pré et post production; la promotion de l'émergence de nouveaux fournisseurs de services; de nouveaux rôles que doivent jouer des organisations gouvernementales après le transfert.

1. Introduction

The period 1960 to 1990 witnessed the development of irrigation in response to drought and famine in the Sahel. Since then, governments in the region and their donors have targeted huge investments at irrigation development, with a priority for rice production. Initially, irrigation development was exogenous, but after three decades of state interventions in irrigation, the 1990s witnessed major and rapid changes: market liberalisation, state withdrawal from irrigated schemes, CFA franc devaluation, and transfer of irrigation management to farmers' associations. Irrigated schemes which were planned initially to satisfy social objectives (food security, and limiting rural migration) now had to prove their competitiveness and financial sustainability. Large irrigation schemes for rice involving pumped irrigation have been much criticised because of poor performance, especially due to the non-competitiveness of rice and poor maintenance of schemes.

In a project conducted by IPTRID,¹ 12 irrigated schemes in sub-Saharan Africa were compared. This comparison yields a more positive picture that contrasts with the often-pessimistic vision of irrigated agriculture in Sahelian Africa and shows that the identification and dissemination of good practices could improve the performance of irrigated schemes. However, even if technical progress

¹A list of acronyms is at the end of the paper.

is possible, the real lever is organisational change. Schemes where irrigating farmers adopt more of a professional approach, along with the emergence of new private-service providers, appear to be better organised and more productive.

2. The project

The project "Identification and dissemination of good practices on irrigated schemes in West Africa" was financed by the French Ministry for Foreign Affairs and conducted by IPTRID. The project was undertaken in partnership with EIER, PSI-CORAF, AFARtct, AMVS, SPFS and SENAGRHY.

Twelve irrigated rice schemes in five West African countries (Burkina Faso, Mali, Mauritania, Niger and Senegal) were studied during one, two and three cropping seasons. On all the schemes studied, water is pumped and distributed by gravity. The schemes vary in their levels of complexity and in size from 20 to 3,295 ha. They are smallholder collective schemes. Most have been transferred to farmers' associations, but were exogenous (externally planned and designed). This means that farmers' associations (usually co-operatives) are responsible for their operation and maintenance.

The project aimed at forming a picture of rice production in the region. The objective was to identify, assess and disseminate efficient practices to improve irrigated production performance. The overall study resulted in 26 case studies of good practices. These good practices are varied — some are at farm and some at scheme level; some are technical and some organisational; and they deal with agronomic, hydraulic and economical themes. We classified them into five main categories (see annex 1).

These case studies proved efficient on site, but need further confirmation in time: they are not to be disseminated as such, but can illustrate possible ways to build a local solution.

In accordance with the theme of the seminar, we have chosen to focus this paper on case studies of organisational good practices. They illustrate the extension of the private sector in sub-Saharan irrigation, in order to show how irrigation management transfer may be assisted.

Table 1 summaries these **organisational good practices at scheme level**. They all illustrate solutions and strategies developed by farmer groups in order to undertake the new functions transferred to them, namely:

- management of agricultural production;
- operation and maintenance of the irrigation scheme;
- integration of actions upstream and downstream of production;
- crafting their own institutions.

Transferred function	New challenges for co-operative	Identified good organisational practices
Management of agricultural	1 To reconcile individual and collective interests;	 Co-operative involvement in quality seeds production;
production	2 To ensure an operational link	 Locally centralised rice nurseries;
	between farmers and their technical and economic environment.	 Organisational practices for agricultural planning;
		 CalCul : software to elaborate an estimated cropping calendar for irrigated rice.
Operation and maintenance	1 To meet irrigation requirement and assure the equity of water supply;	 Externalisation of hydraulic function on irrigated schemes;
of the irrigation	2 To reach a sufficient maintenance and assist a sustainable system;	 Contract for pumping-station maintenance;
scheme	3 To lower pumping costs and save	 Collective works for maintenance;
	water.	 Quality control of maintenance works.
Integration of	1 To regain control of the production system and break the vicious circle:	 Reserve funds for special expenses;
actions system and break the vicious selling difficulties \Rightarrow credit production of production		 Creation of working capital;
	selling difficulties → credit problem → delay in input supply → poor	 Credit / supply / sale / reserve funds contract;
or production	agronomic performance;	 Local post-harvest processing;
	2 To strengthen post-production activities and sell paddy at a suitable price;	 Integrating post-production actions through a quality rice policy.
	3 To manage short and long term financial aspects of production, with integration of the notion of risk.	
Crafting institutions	To craft farmers' own institutions and to change from an externally- promoted organisation (co- operatives often are official but useless associations) to sustainable collective dynamics.	 Water fees : transparency, real cost, clear collection rules;
		 Rules and sanctions clearly defined and actually applied;
		 Support for co-operative self-management;
		 Sharing of responsibility and decentralisation towards grass-roots organisations;
		 Supra-scheme organisation for small schemes.

Table 1. Summary of good scheme-level organisational practices.

Note: The six practices reviewed in this paper are shown in bold italics.

3. Illustrations of successful practices—six examples

We have selected six examples of these organisational practices at the scheme level (shown in italics in the table above). They illustrate three issues of collective irrigation schemes: planning of production at scheme level, scheme maintenance and processing of production. They all show different ways for co-operatives to acquire new skills and to face challenges from transfer.

The summary below follows a standardised format: objectives, description, context, assessment and evaluation. Detailed implementation and complete economic evaluation are not provided here, since they would be too long.²

² For more information, please contact the IPTRID Secretariat.

3.1 Good practices in production planning at the scheme level

Practice 1-1: Organisational practice for agricultural planning

Location

This practice was observed on two irrigated schemes very different in size, but tackling the same principle:

- Nakhlet, a small basic scheme in Mauritania.
- Boundoum, a large sophisticated scheme in Senegal.

Description

The co-operative aims to create favourable production support for the farmers, by:

- reconciling individual and collective interests;
- ensuring an operational link between farmers and the technical and economic environment.

Before the cropping season, farmers are informed of the advised cropping system (by parastatal agencies like SAED in Senegal). They collectively decide on production planning. The levels at which producers' meetings are held must be such as to allow real commitment by the producers to the decisions reached. For this, meetings should consist of no more than 50 producers. In Nakhlet, PSI-CORAF used the software "CalCul," which gave an approximate cropping calendar for both scheme and farm levels. This facilitates reconciliation among users sharing the same resources (water, labour, agricultural equipment, etc).

Before the cropping season, the farmers' association controls the hydraulic system and negotiates a maintenance contract with service providers. In Senegal, SAED helps to write the invitation to tender. For mechanised operations, the co-operative centralises demands for service, negotiates prices, tests the service quality, and organises planning of operations (e.g., soil preparation planning is adapted to irrigation planning). Farmers remain responsible for direct payment to the enterprise. In the same way, the co-operative centralises input demands, negotiates with providers and controls delivery and distribution of inputs. The co-operative helps to find financial resources: it negotiates credits for the grass-roots organisation to create working capital. In Boundoum, the farmers' association owns a milling machine to process the paddy, which in turn improves sale of rice and cash flow.

Objectives

The objectives of these practices are:

- at the farm level: to increase yields by better respect of agronomic recommendations;
- at the scheme level: to reduce operation costs and to allow double cropping when possible, through a better spreading of the cultivation calendar.

Context and operating conditions

On the two schemes, the following success factors were observed:

- schemes in good condition (new or recently rehabilitated);
- some social cohesion in the farmers' association, and experienced leaders and farmers;
- presence of support providers (parastatal agency like SAED, or project like PSI-CORAF).

On the other hand, failure factors were also present:

• Farmers have difficulties in selling their paddy quickly, so as to pay back credit and place a timely new order for inputs: this fact may induce delay in starting the following cropping season.

• Credit constraints are more present in Boundoum than in Nakhlet, which finances the cropping season with its working capital.

Assessment/evaluation

The respect of a cultivation plan allows better yields and farm incomes. In 1999, the PSI- CORAF support and the use of CalCul in Nakhlet gave significant results: better planning and respect for the outcome resulting in increased yields (Table 2).

Table 2. Improved performance with cultivation planning, Nakhlet, Mauritania, 1998–99.

NAKHLET	Average delay for the first input	Average yield (kg/ha)
Rainy season 1998, planning less respected	14 days	4,500
Rainy season 1999, planning more respected	6 days	7,200

Practice 1-2: Externalisation of hydraulic function on the irrigated scheme

Location

Toula, a medium-scale transferred scheme in Niger.

Practice description

In Toula, hydraulic functions are externalised and delegated to a private design office. A contract is signed between the co-operative and the private operator. The terms of reference describe the sharing of operations between the various stakeholders. Water supply, maintenance monitoring, hydraulic supervision and financial management of irrigation are delegated to a RGE (Water Manager). The RGE is employed by the design office. He presides over a Water Management Committee and is responsible for irrigation operations.

(Note: This delegation takes place within the context of a European project and is still <u>at the test</u> <u>stage</u>. It has been identified as a good practice from the results that already show, but it has not existed long enough to prove sustainable.)

Objectives

To improve maintenance, sustainability, pumping, equity of water supply, respect of irrigation rules and financial management.

Context and operating conditions

Medium or large-scale schemes appear more relevant, because a minimal cropping area is required to pay the RGE. In Toula, the scheme has been rehabilitated and the financial situation was reorganised (reimbursement of arrears, etc). It is now self-managed by a co-operative. However, the training level of farmers does not allow a total commitment in their scheme management.

Assessment/evaluation

Initial observations are that:

- (a) there is more equity in water supply;
- (b) abandoned irrigated fields are cropped again;
- (c) maintenance is better;
- (d) conflicts about water sharing decreased.

Water fee collection reaches 95 percent. The lower pumping duration allows electricity savings. Consumption decreased by 16 percent, i.e., 3,000 CFA francs (US\$4.3) per hectare, between 1998 and 2000.

Table 3. We	ater consun	ption at i	two sc	hemes i	in Nige	er, wet	season	2000.
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Toula and Lata are two nearby schemes with similar equipment. In the rainy season of year 2000, a clear difference appears in their water consumption.

Today, the costs of delegating water management to an external manager are still difficult to estimate. They certainly exceed 10,000 CFA francs (US\$14.30)/ha/season, but the project aims to decrease this sum.

Conclusion 1: Externalising water services and organising agricultural planning

The PSI-CORAF approach in Nakhlet and the European Project in Toula follow some common objectives: (i) to organise production at scheme level, (ii) to reconcile individual and collective interests, and (iii) to facilitate sharing of common resources (water, labour, equipment). Nevertheless, they show differences in their implementation:

Table 4. Comparison of management practices at Nakhlet, Mauritania, and Toula, Niger.

	Organising agricultural planning in Nakhlet		Externalising water services in Toula
-	focus on agronomic aspects	-	focus on hydraulic aspects
-	advice on an ad hoc basis	-	externalisation of the function
-	association of functions: multidisciplinary	-	separation of functions: hydraulic function
	approach		separated and delegated
-	use of CalCul more adapted to small and	-	economically viable for big or middle-sized
	middle-sized schemes		schemes

3.2 Good practices in scheme maintenance

Practice 2-1: Contract for pumping station maintenance

Location

Kotaka and Diantakaye, small schemes (< 35 ha) in Mali (Mopti).

Practice description

Two partners sign a maintenance contract for the pumping station:

- the committee, representing seven small nearby schemes in the Mopti area,
- the mechanic, trained and recognised by the pump provider.

The 5-month contract defines the responsibilities of each partner:

- The mechanic has to visit each scheme twice a month to assure current maintenance operation. In case of breakdown, he is obliged to move to the scheme the day he is informed.
- The mechanic advises the co-operative to buy fuel, oil, spare parts and teaches the motor-pump attendant to use the equipment (motor cleaning, control of gauges, etc).
- Each co-operative pays the mechanic 15,000 CFA francs (US\$21.40) per month (without implicating the supra-scheme committee). It supplies spare parts and other consumable goods.

Objectives

To ensure regular and preventive maintenance and rapid intervention in case of breakdown.

Context and operating conditions

The contract is facilitated by the fact that many nearby and similar small schemes are combined in an association. It could be improved further by the standardisation of pumping equipment.

The free training of mechanics by the equipment seller (HATZ in the Mopti area) is a real advantage. On the other hand, the co-operatives have the necessary skills to manage themselves, thanks to NGO support. For example, they command reserve funds for special expenses.

Assessment/evaluation

The following facts are noted: (a) better maintenance, (b) decrease of breakdown number and (c) reduction of repair costs. The maintenance contract costs about 2,000 CFA francs (US\$2.90)/ha, i.e., 2–3 percent of total irrigation charges. For the mechanic, the minimum salary reaches 105,000 CFA francs (US\$150)/month, which is relatively attractive.

Practice 2-2: Quality control of scheme maintenance works

Location

Pont Gendarme, 200 ha, Senegal.

Practice description

Maintenance works require different operators: specialised mechanics for the pumping station and service providers using special equipment for the main canal (public or private), collective work for the secondary network and individual producers at farm level.

Diagnosis, supervision and finished work inspection are often neglected. In Pont Gendarme, a small topographic unit (private operator) ensures these functions.

Objectives

To avoid maintenance deficiency, particularly canal degradation due to inadequate cleaning out by inexperienced farmers, and to maintain the hydraulic specifications of the network.

Context and operating conditions

- Appropriation by producers: they are ready to pay for the sustainability of their scheme.
- Presence of private operators for topographic operations.

Assessment/evaluation

The co-operative adopted this practice because deficient canal cleaning by farmers had led to degradation of the hydraulic network. Over-excavation and counter-slope disturbed the water distribution. The intervention of the topographic unit has permitted restoration of the characteristics of the network and assured equity in water supply.

Conclusion 2: Contract for pump maintenance and quality control of maintenance works

The common objective of the two previous case studies is to reach a sufficient level of maintenance in quantity as well as in quality, in order to guarantee the sustainability of the scheme. The main differences found are presented in Table 5.

Quality control of scheme maintenance works	Contract for pumping station maintenance
 focus on scheme infrastructure 	 focus on pumping equipment
 audit and diagnostic: short-term contracts 	 maintenance completely delegated during
 contract between one team and one 	one season
scheme	 contract between one mechanic and a
	group of schemes (economic viability)

Table	5.	Comparison	of	Practices	2 - 1	and	2-2.
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3.3 Good practices in production processing

Practice 3-1: Integrating post-production through a policy to promote quality rice

Location

Pont Gendarme, 200 ha, Senegal.

Practice description

The co-operative owns post-harvesting processing machines: mini-rice-mill, screening and bagging machines. It uses a variety that is easy to decorticate and gives its whole attention to the drying and screening conditions. The equipment chain allows the processing of big volumes. Different rice qualities are obtained: 100 percent raw broken, melting or whole rice (without bran, with low broken rate and good polishing). Different packagings exist: 5 or 50 kg sacks.

These various products have different target markets. The 100 percent whole rice in 5-kg sacks is directly sold to groceries in Dakar, where it supplies the market demand for quality rice.

Objectives

- The co-operative takes on the post-production to gain the processing added value and to derive benefit from milling residues (rice bran).
- The mini-rice-mill allows good processing yields and low raw broken rate. Operation costs remain similar to those of small milling machines.
- Thanks to the different rice qualities, the co-operative diversifies its market outlets. It can quickly sell part of the harvest (at least fees in kind) and finance a new cultivation season.

Context and operating conditions

- Medium to large-scale scheme (> 200 ha) with sufficient production in terms of quantity and quality (homogeneity of variety), and a large part of this production sold;
- a reliable electric network;
- spare parts supply and qualified mechanics;
- equipment credits (in this case, they are not always easy to obtain).

Assessment/evaluation

- Mini-rice-mills allow production of better quality rice than small milling machines;
- The marketing strategy facilitates product sale and credit reimbursement;
- The co-operative gains the added value of processing;

• To recover the initial investment (7,000,000 CFA francs (US\$10,000) for the complete installation), the co-operative must mill 1,200 tons of paddy. This is feasible in 5 years if the co-operative processes only the paddy received as fees. In reality, it also provides processing services to farmers, which allow the co-operative to reimburse its credit in less than 3 years.

Practice 3-2: Local post-harvest processing

Location

Kotaka and Diantakaye, small schemes (< 35 ha) in Mali (Mopti).

Practice description

- In the Mopti area, rice-growing is characterised by small schemes with low input intensity, mechanised or manual cropping and numerous varieties. A cheap paddy, with heterogeneous quality, is produced in low volumes on each scheme.
- Small milling machines, despite low output, allow cheap processing thanks to low investment and operation costs. Manifold operators (rural associations, women's groups, and private promoters) allow proximity processing in a competitive market, which decrease transport charges. They produce low-quality rice.
- Production is sold on small nearby rural markets, where cheap low-quality rice is demanded.

Objectives

Compared to industrial rice mills, local post-harvesting processing is characterised by better processing yields (pre-processing treatment allows for 10 percent increase of processed yield) and lower costs. The processing scale is more compatible with the small volumes produced on small collective schemes. The local community assumes responsibility for post-production and gains processing added value. For women, local processing is a remunerative activity, which relieves them from housework. It also improves availability of husked rice on the local market.

Context and operating conditions

Deficient industrial post-harvest processing, rice market liberalisation, CFA franc devaluation, and NGOs' support promoted local processing. On the other hand, milling machine owners sometimes meet difficulties in finding spare parts and qualified mechanics. They must obtain supplies in distant towns, which increases maintenance charges.

In Mopti, food preference is oriented to low-quality rice (Variety RM40 with 40% raw broken).

Assessment/evaluation

For processing operators, decorticating local paddy is attractive and profitable.

For co-operatives, low processing costs facilitate competition with cheap imported rice, and allow easier sale of paddy. Moreover, these lower processing costs result in a better added value of rice production. Negotiation that is facilitated between farmers and processors, who often belong to the same community, results in more equitable sharing of this added value. Therefore, the paddy price paid to farmers increases.

After devaluation of the CFA franc in 1996, the paddy price increased from 71 to 125 CFA francs/kg (10 to 18 US cents/kg). This rise was partly due to the rise of rice price from 129 to 183 CFA francs/kg (18 to 26 US cents/kg), but also to lower processing costs and facilitated negotiations between farmers and downstream stakeholders (Tandia 1999).

Conclusion 3: Local post-harvest processing and quality rice policy

These last two good practices aim at the following common objectives: (i) to integrate post-production activities, (ii) to lessen processing costs in order to reach a correct selling price, and (iii) to fix locally the added-value of processing. However, they differ in their implementation.

Table 6: Comparison of Practices 3-1 and 3-2.

Integrating post-production operations through a quality rice policy in Pont-Gendarme		Local post-harvest processing in Mopti
 Production and processing strategies oriented towards urban market and demand for high-quality, more expensive rice Post-production internalised Co-operative do the processing and sale Minimal dependence of the co-operative on external downstream stakeholders 	-	Production and processing strategies oriented towards small market and demand for cheap low-quality rice Post-production externalised Local communities do the processing Strong social links between farmers and processing stakeholders

4. Recommendations

The 26 good practices identified by the project should not be considered as recipes to improve scheme performances. A "good practice" is strictly linked to a scope of application, where it was designed for the context and showed good results. Even if a good practice is not to be directly disseminated, some lessons, or principles, can be extracted and applied to other schemes, provided they are adapted to these new local conditions. The added value of such good practices is that they illustrate these well-known principles with successful case studies and give further ideas about their implementation and results on the field.

The four recommendations presented below illustrate some of the principles that contribute to sustainable management transfer. Defining the role of each stakeholder and their co-ordination is essential in order to improve irrigated schemes' performance. In particular, farmers' associations have to become efficient in their negotiations with private-sector and public institutions, but also have to become active partners in agriculture extension. This requires maturity and skills, which can only be learned with assistance. This introduces the question of transfer without abandonment, and the role remaining with the State.

4.1 Principles towards organisational maturity of farmers' associations

Few schemes, in spite of their different organisational and institutional set up, demonstrate a relative organisational maturity, and manage to reconcile individual and collective interests to ensure the irrigated schemes' sustainability. This requires the following various principles:

- dialogue and transparency;
- rules and sanctions actually applied;
- clear sharing of responsibilities;
- decentralisation toward financially independent grass-root organisations;
- different levels of organisations, including supra-scheme organisation.

Dialogue is required in current management as well as in extraordinary situations. In Nakhlet, three general assemblies per season are planned to organise cultivation. To reduce organisational constraints, producers can however delegate part of their decision power to the co-operative board, which in turn reports all actions. Transparency is also essential, particularly in financial aspects. Accounts have to be discussed after each season. That implies that producers are educated enough to understand the calculation. For example, in Mali, the VRES project proposes concrete basic training (writing, reading, counting), directly usable by farmers in the management of their scheme.

A clear institutional framework is essential and responsibilities must be clearly defined: sharing of decision, execution and control functions between individuals, grass-root organisations, technical

committees, co-operative boards, and supra-scheme organisations (see Figure 1). The subsidiarity principle consists in delegating tasks to the lowest level of organisation that is technically and financially viable. The co-operative must also decide the tasks to be delegated to external professional services and the ones it should carry out. Among these latter tasks, it has to define which are paid and which are not.

The example of Boundoum (Senegal) is particularly relevant (see Table 7). Despite a scheme of 3,100 ha with 2,300 farmers, the co-operative manages to reach a recovery rate of 100 percent for hydraulic fees and a cropping intensity of 150 percent, while the co-operative management costs remain under 6,000 CFA francs (US\$8.60) per ha per cropping season.³ The organisation of the farmers is certainly a major factor explaining these good results. Decentralisation of dialogue, credit access and fee collection toward grass-root organisations is an important point. Farmers gather in small groups (fewer than 30 persons) according to common interests (not necessarily according to hydraulic sectors). These groups constitute the counsel level, which allows a real producer's commitment. They are financially independent: they contract joint credits and are liable for fee collection. Therefore, financial difficulties in one grass-root organisation do not affect the whole co-operative.

Irrigating farmers have to craft their own institutions and should not simply copy existing models. This requires a strong commitment of producers, but it is essential for ensuring sustainable transfer of irrigated schemes.

Figure 1. Principles guiding the sharing of functions among stakeholders.



Table 7. Sharing of functions in the co-operative of Boundoum (Senegal).

STRUCTURE	COMPOSITION	FUNCTION
Grass-root	About 30 farmers with	Level for discussion and decision
organisations	common interest	 Inputs supply, joint credit, fee collection
Technical	Representatives of each	Level for execution
committees	grass-root organisation	 Cropping and irrigation planning
		 Operation and maintenance of agricultural / processing / hydraulic equipment
		 Assistance to grass-root organisations in negotiation with service providers, inputs
		suppliers, credit agencies
Co-operative	President, secretary,	Level for control
board	treasurer, accountant elected by farmers	Account follow-up
		 Control of decision execution
		Arbitration

³Co-operative management costs include salaries, telephone, transport, mission stationery etc. On the 12 studied schemes, they vary between 1,000 and 85,000 CFA francs (US\$1.4–121.4)/ha/cropping season, with an average of 20,000 CFA francs (US\$28.6)/ha/season.

4.2 Necessary integration and professionalisation upstream and downstream of production

In West Africa, after the sudden withdrawal of the State from irrigated production, a few farmers' associations have tried to influence the decision-making process at all production levels, regaining control of their production systems and getting actively involved in input supply, financing and marketing networks.

In the field, co-operatives experience good organisational and financial practices, which allow decreasing upstream and downstream production constraints. These practices follow different principles:

- Up- and down-stream (or commodity chain) integration and active involvement of farmers in production. In reality, two strategies were observed:
 - The co-operative directly ensures new tasks, downstream or upstream of production. Thus, it becomes more independent from external constraints. For example, in Pont-Gendarme, the co-operative processes and markets its paddy by itself.
 - The farmers' association strengthens its negotiation abilities with its partners, for example, through contracting their dealings. On the small schemes in Mali, negotiations with processing stakeholders are facilitated because they come from the local community. In Toula (Niger), a contract was signed between the different partners of the production system: farmers' group, bank, input providers, and paddy trader.
- Different organisational levels. When the supra-scheme level is representative of grassroot organisations, it can be a single interlocutor which exerts weight in decisions. In Mopti area (Mali), a supra-scheme organisation deals with inputs supply and pump maintenance. In Senegal, they have lobbying functions and can influence national policies.

4.3 The need for new service providers, including extension workers

After State withdrawal from scheme management, farmers' associations have to implement some tasks, but they lack the required competence. The maintenance of the pumps and of the hydraulic network, the planning of cropping calendar at scheme level, financial management and accountancy, and negotiation of contracts are various examples of these new tasks, which are sometimes different from the previous work of a farmer. New capacities are, therefore, needed in the irrigation system. This requires the establishment of external services, which can be provided in two different ways:

- The necessary tasks requiring skills that farmers lack, can be totally delegated to an external partner. This is the case of the externalisation of hydraulic functions to a private design office, as has been tested in Niger.
- The external partner can act as an extension worker, providing advice, training, diagnosis
 or control to assist farmers' associations in acquiring necessary skills. These training
 and extension services need to be demand-driven and to encompass agronomic,
 hydraulic, and socio-organisational aspects.

Various experiences are being conducted in the sub-region, either in the form of advice on an *ad hoc* basis or by the externalisation of certain irrigation tasks. They have already led to interesting results, even if it is still too early to draw conclusions.

PSI-CORAF (Legoupil et al. 2000) has developed various tools to facilitate decision-making and management as regards agricultural and hydraulic planning at the scheme level (see the example of Nakhlet above). The PGI-FED (Ducret 2001) is currently testing in Niger a new approach to hydraulic management, whereby most hydraulic functions are delegated to a private body (see the example of Toula above). The PCPS (Traore 2001) in Mali has mostly focused its intervention on accounting and juridical back up and the structure in charge is directly under the control of farmers' associations (farmers recruit their agents).

Most of these experiences have proven their interest either through higher yields, reduced water consumption, higher hydraulic fees recovery rate, higher transparency and mostly farmers' empowerment, since they pay for the service they need. They have also learnt that the emergence of service providers, particularly private ones, is strongly linked with the capacities of farmers. Farmers, whether organised or not, have to learn to drive the demand for advice and to negotiate the services provided by their new partners. The definition of roles and links of these two new partners, farmers' associations and private service-providers, need therefore to be assisted, by NGOs or projects (as in the three previous examples) or, why not, by the State.

4.4 Government policy and new roles of parastatal agencies

The State withdrawal from irrigated schemes means a redefinition of the tasks of Government and parastatal agencies in a new institutional framework.

The first role of government policy will certainly be to set up a favourable framework for these new actors to emerge. For example, legislation should recognise and establish the existence and rights of farmers' associations. The notion of "transfer without abandonment" is also important. Farmers are confronted by new challenges, for which they were not prepared. They lack the required capacities to manage non-agricultural functions. When they deal with external partners, they do not always control negotiations. The State could facilitate the transfer to users in different ways:

- Education: The VRES project, in Mopti area (Mali) gives a successful example of selfmanagement initiation of farmers. But education also concerns new private actors, who will support farmers in the future.
- Legislation: Official contract recognition, conflict resolution (between farmers and cooperative, or co-operative and private partners, etc.).
- Institutional support: to set-up co-operatives, to draft regulations and contracts. For example, in Senegal, the SAED, a parastatal agency for irrigation along the Senegal River, helps to write the invitation to tender.

5. Conclusions

In sub-Saharan countries, the transition from public to private management of irrigation has been very quick, and actually quicker than in many Western countries (France, for instance). Although irrigating farmers are facing many problems, the dynamism characterising some of these schemes must be highlighted, be it either from individual farmers, co-operatives, projects or some parastatal agencies. Breaking with a pessimistic vision of irrigated agriculture in Sahelian Africa, some irrigating farmers demonstrate their ability to fit into a fast-changing institutional and economic environment.

Disseminating these success stories will certainly accelerate the development of private irrigation. But the emergence of new actors, able to use this information on the schemes, has not been achieved. Many projects are testing the implementation of service-providers with different approaches: delegation of hydraulic functions, multi-disciplinary support, and accounting audit. It will be interesting to follow these experiences, and to evaluate and disseminate their results during the coming years.

Bibliography

- **Ducret, P. 2001.** Présentation de la Cellule Riz. In: Actes des Journées de l'irrigation en Afrique de l'Ouest et du Centre, 23 au 26 avril, Ouagadougou.
- Legoupil, J. C.; B. Lidon; M. Wade; B. Tangara; and I. Mossi Maïga. 2000. Le PSI : une recherche d'accompagnement à la professionalisation de la gestion paysanne des aménagements hydro-agricoles. In: Legoupil, J. C., Dancette, C., Godon, P., Maïga, I. M. and Ndiaye, K. M. (eds.): Pour un développement durable de l'agriculture irriguée dans la zone soudano-sahélienne. Actes du séminaire de synthèse des résultats du Pôle Régional de Recherche sur les systèmes irrigués, Dakar, 30 Nov – 3 Dec 1999.
- Tandia, B. M. 1999. Analyse des coûts de production du paddy dans le Trarza. Atelier amélioration de la gestion des aménagements hydro-agricoles, 27-29 juin, Rosso.
- Traore, B. 2001. Les maisons qui éclairent. In: Actes des Journées de l'irrigation en Afrique de l'Ouest et du Centre, 23 au 26 avril, Ouagadougou.

Acronyms

AMVS	Autorité de Mise en Valeur de la Vallée du Sourou (Burkina Faso)
AFAR ^{TCT}	Action pour la Formation et l'Autopromotion Rurale, Technique, Conseil pour l'autogestion du Terroir (Mali)
CFA	Communauté Financière Africaine
EIER	Ecole Inter-Etats des Ingénieurs de l'Equipement Rural (Burkina Faso)
IPTRID	International Programme for Technology and Research in Irrigation and Drainage
NGO	Non-Governmental Organisation
PCPS	Projet Cellule de Prestation de Service (Mali)
PGI FED	Programme Grande Irrigation (Niger) – Fonds Européen de Développement
PSI-CORAF	Pôle Régional de Recherche sur les Systèmes Irrigués soudano sahéliens – Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricole
RGE	Responsable Gestion de l'Eau (Toula, Niger)
SAED	Société nationale d'Aménagement et d'Exploitation des terres du Delta du fleuve Sénégal et des vallées du fleuve Sénégal et de la Falémé (Sénégal)
SENAGRHY	Société d'Etudes en Environnement, Agriculture et Hydraulique (Niger)
SPFS	Special Programme For Food Security of FAO
VRES	Proiet de Valorisation de la Ressource en Eau de Surface (Mali)

Annex 1

Practices that can enhance yields and incomes (Summary from draft final report)

Agronomic practices at farm level

- 1 Weed control by pre-irrigation and soil preparation
- 2 Low-labour intensive technique to compost rice straw on farm
- 3 Land preparation and levelling with a rotary harrow
- 4 Banana trees on irrigation plot borders

Agronomic practices at scheme level

- 5 Co-operative involvement in quality seeds production
- 6 Locally centralised rice nurseries
- 7 Eucalyptus plantation on rice-oriented schemes
- 8 Organisational practices for agricultural planning
- 9 CalCul: software to formulate an estimated cropping calendar for irrigated rice

Hydraulic practices

- 10 Controlling weeds in canals with herbicides
- 11 Automatic hydraulic regulation
- 12 Externalisation (Out-sourcing) of hydraulic functions on irrigated schemes
- 13 Contract for pumping station maintenance
- 14 Collective works for maintenance
- 15 Quality control of scheme maintenance works

Practices for better integration of pre- and post-production (inputs, processing, marketing, finance, etc)

- 16 Reserve funds for special expenses
- 17 Creation of working capital
- 18 Credit / supply / sale / reserve funds contract
- 19 Local post-harvesting processing
- 20 Integrating post-production through a quality rice policy

Social organisation

- 21 Water fees: transparency, real cost, clear collection rules
- 22 Rules and sanctions clearly defined and actually applied
- 23 Support to co-operative self-management: functional education
- 24 Organisation and management principles: sharing of responsibilities, decentralisation toward grass-root organisations
- 25 Supra-scheme organisation (Federation) of small schemes
- 26 Physical, organisational, financial rehabilitation of irrigated schemes