



Research and Technological
Exchange Group

■ FINAL REPORT

Irrigation Sector Review – Water Management Organisation – Final Report

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*National Study on Participatory Irrigation Management and
Development in Cambodia - Technical Working Group on
Agriculture and Water*

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I. INTRODUCTION

The general objective of the Irrigation Sector Review was to produce reliable information on the conditions of viability and sustainability of ongoing irrigation experiences in Cambodia. In order to do so, a team of national and international experts was built. The team was divided into two components, the first one working on the process, limits and perspectives of water management organization of irrigation schemes, the second one concentrating on the economic return of irrigation. Additionally, a third input was provided on the assessment of irrigation schemes users and managers main issues and opportunities, through the organization of a SWOT analysis.

The specific objectives of the first component were (i) to provide an overview of the surveyed irrigation scheme regarding their organization and capacity to fulfil their objectives, and (ii) to come out with a set of questions/proposals on the process, limits and perspectives of water management, with a specific focus on FWUC implementation.

The present report presents the final results of the first component's work. The methodology followed to select the 21 surveyed irrigation schemes and to collect the information needed, was presented in the previous report provided in November 2005 (See Annex 1 of the present report). The results are extracted from the 21 case study reports that were written by the team leader of the national consultant team, Mr. Sok Bun Heng. These reports are provided in Annex 2 of the present report.

The present report is divided into three parts. The first one presents an overview of the surveyed irrigation schemes, with a description of their specific characteristics. The second part details the main results that can be figured out from the survey. Finally, the third part proposes a set of questions and perspectives on the further development of participatory irrigation in Cambodia.

II. OVERVIEW OF THE SURVEYED IRRIGATION SCHEMES

A set of 21 case study reports was written for each of the 21 surveyed irrigation schemes. These case study reports are provided in Annex 1.

The main characteristics of the 21 surveyed irrigation schemes are presented in the following Tables 1, 2, 3 and 4.

1. Scheme profile

The localisation, origin, type and provided support of surveyed irrigation schemes are presented in Table 1 with the following information:

- Irrigation scheme number (“N”).
- **Name**
- **Province** of location
- **Type** of water control: pumping system (from a stream, a prek, a lake), reservoir (with a dyke or a dam) and polder.
- Level of **canal** network development: from the situation where there is no distribution canal implemented (code “0”), to the situation where there is a network of primary (“I”), secondary (“I+II”), tertiary (“I+II+III”) and drainage (“+D”) canals implemented.
- **Period** of implementation: the five periods of “Angkor”, “colonial administration”, “Sihanouk”, “Pol Pot” and “after 1979” have been identified.
- **Origin** of the external support provided to the irrigation scheme if any: with the name of the involved organizations or “local” if there is no external support provided.
- **Dates** of the successive supports.
- Main **objective** of the external support provided to the scheme: “ER” for emergency relief, “CB” for capacity building, “IR” for infrastructure rehabilitation, “FS” for food security,...
- Main **components** of the external support provided to the scheme: “CB” for capacity building, “IR” for infrastructure rehabilitation, “AE” for agricultural extension, “RC” for rural credit and “LT” for land titling.

Table 1: Type, origin and support of surveyed irrigation schemes

N°	Name	Province	Type	Canal	Period	Origin	Dates	Objective	Components
1	Norea	Battambang	Pumping	I+II	PP.	Local		-	-
2	Kamping Pouy	Battambang	Reservoir	I+II+III+D	PP.	Italy/JICA/ADB 1445/MOWRAM	81/86-99/03	IR/FS/CB	IR + CB + AE + RC
3	5 February (1445)	Kampong Cham	Reservoir	I+II	PP.	ADB/MOWRAM	97/03	CB	CB
4	5 February (commune)	Kampong Cham	Reservoir	I+II+III	PP.	Local	2004-05	IR	IR
5	Prey Nup	Kampong Som	Polder	D	Col.	AFD/MOWRAM	PP/98-07	FS	IR + CB + AE + RC + LT
6	O Rokar	Kampong Speu	Reservoir	0	Sih.	Local	PP	-	-
7	O Treng	Kampong Speu	Reservoir	I+II+III	Sih	PRASAC/ADB 1445	98-03	CB	IR + CB
8	O Snor	Kampong Thom	Reservoir	0	After PP.	World Vision/PDOWRAM	98/02/05	FS	IR + CB
9	Roluos	Kampong Thom	Reservoir	I	Sih.	WFP	PP/04	ER	IR + CB
10	Hun Sen Pumping Station 45	Kampot	Pumping	I+II	PP.	CPP/PDOWRAM	2004	IR	IR
11	Boeung Nimol	Kampot	Reservoir	I+II+III	Sih.	CBRDP/MRD	2004	IR	IR
12	Prek Ong Pan	Kandal	Pumping	0	Sih.	AFD/MOWRAM	2002-03	FS	IR + CB + AE
13	Prek Chan	Kandal	Pumping	0	Sih.	Local	2002	IR	IR
14	Ches Chor	Odar Meanchey	Reservoir	I	PP.	ZOA NGO	2004-05	ER	IR + CB + AE
15	Sdau Kaong	Prey Veng	Pumping	I+II	Sih.	French Embassy/MOWRAM	PP/02	FS	IR + CB + AE
16	O Amporn	Prey Veng	Reservoir	I+II	Sih.	PRASAC/MOWRAM	PP/96/01	ER/FS	IR + CB
17	Kampang	Pursat	Reservoir	I+II	PP.	FERP-WB/MOWRAM	2003	ER	IR + CB
18	78 Dam	Siem Reap	Reservoir	I+II	PP.	Seila	98/02	IR	IR + CB
19	Baray	Siem Reap	Reservoir	I+II+III	Ang.	ILO/ADB 1445/MOWRAM	92-97/02/05	ER/FS/CB	IR + CB
20	Kilo 8 Dam	Stung Treng	Reservoir	I	PP.	Seila	2004-05	IR	IR + CB
21	Kbal Por	Takeo	Pumping	I+II	PP.	Local (private investor)	90-93/2002	IR	IR

2. Agricultural use

Water agricultural characteristics of surveyed irrigation schemes are presented in Table 2 with the following information:

- Irrigation scheme number (“N^o”).
- **Name.**
- Theoretical/designed **command area** in hectares.
- **Irrigated area** per season of cultivation in hectares.
- Cultivated **crops** per season: “WSR” for wet season rice, “DSR” for dry season rice, “RR” for reseeded rice, “FR” for floating rice and “veg” for vegetables.
- **Soil** quality from users point of view: “good”, “medium”, “poor”.
- Estimated average **yields** for the main crop cultivated on the scheme (in t/ha)
- Estimated level of **inputs** use (chemical fertilizer, herbicides, pesticides): intensive (“int”) or extensive (“ext”).
- Estimated average **price** of paddy (in Riels/kg of paddy).
- Estimated market **land** price in USD.

Table 2: Water agricultural characteristics of surveyed irrigation schemes

N°	Name	Command area	Irrigated area	Crops	Soils	Yields	Inputs	Price	Land
1	Norea	Small	108/70	WSR/DSR		3 to 5	Int.		
2	Kamping Pouy	Large (9000)	2850/1000	WSR/DSR	medium	2 to 3	Int.	450-800	1500 to 3000 (70000)
3	5 February (1445)	Medium	315	WSR	good	2 to 3	Ext.	500	1000 to 2000
4	5 February (com.)	Medium	600/100	WSR/DSR	good	3 to 5	Ext.	500	1000 to 2000
5	Prey Nup	Large (10500)	10400	WSR	good	2 to 3.5	Int.	500-700	1500 to 2000
6	O Rokar	Small	100/20	WSR/DSR	medium	2.5 to 3	Int.	500	500 to 1000
7	O Treng	Medium	1500/500	WSR/DSR	medium	2 to 2,5	Int.	500-700	1000 to 2000
8	O Snor	Medium	455	FR	medium	1 to 2	Ext.	450	300 to 500
9	Roluos	Medium (1200)	1200	WSR	medium	1 to 2	Ext.	450	500 to 700
10	Hun Sen P.S. 45	Small	50	WSR	medium	2.5 to 3	Int.	500	1000 to 2000
11	Boeung Nimol	Medium	800/50-10	WSR/DSR-veg.	medium	2.5 to 3	Int.	500	1000 to 1500
12	Prek Ong Pan	Small (50)	15	3 to 4 Veg.	good	-	Int.	-	2000 to 2500
13	Prek Chan	Medium	470/40	RR/veg.	good	2.5 to 3	Int.	500	1000 to 2000
14	Ches Chor	Medium	350	WSR	medium	1 to 2	Int.	450	300 to 500
15	Sdau Kaong	Medium (400)	302	DSR/RR	good	3 to 4	Int.	500-550	1000 to 2000
16	O Amporn	Medium (2000)	300/10	WSR/DSR	medium	3 to 5	Int.	500	300 to 700
17	Kampang	Medium	949/50	WSR/DSR	medium	2 to 3	Int.	400-500	500 to 2000
18	78 Dam	Medium	300	RR	good	2 to 3	Int.	500	300 to 500
19	Baray	Large (10000)	6000/4000	WSR/DSR, RR	good	3 to 4	Int.	500	2000 to 5000 (70000)
20	Kilo 8 Dam	Small	60	WSR	medium	1 to 2	Ext.	500	300 to 500
21	Kbal Por	Medium (1586)	800	WSR/DSR	medium	3 to 4	Int.	500-700	1000 to 2000

3. Water management

Water management organization characteristics of surveyed irrigation schemes are presented in Table 3 with the following information:

- Irrigation scheme number (“N^o”).
- **Name.**
- Existence of a registered Farmer Water User Community (**FWUC**).
- **Year** of registration.
- Quality of **organization** of the management body
- Main **reason** given to justify the level of quality of organization.
- Quality of the institutional relation established between the management body, users and local authorities (“**institution**”).
- Quality of the **operation** provided by the management body.
- Presence of a functional **operation plan**.
- Quality of the **maintenance** provided by the management body.
- Presence of a functional **maintenance plan**.
- Presence of formal **rules** and regulation.
- Quality of rules **enforcement**.

Table 3: Water management organization characteristics of surveyed irrigation schemes

N°	Name	FWUC	Date	Organization	Reason	Institution	Operation	OP	Maintenance	MP	Rules	Enforcement
1	Norea	Coop										
2	Kamping Pouy	Yes	2003	Poor	Politician influence	Poor	Poor	Yes	Poor	Yes	Yes	No
3	5 February (1445)	Yes	2003	Poor	Uncomplete infrastructure	Poor	Poor	Yes	No	No	Yes	No
4	5 February (com.)	Comm	-	Poor	Commune chief alone	Poor	Poor	No	Poor	No	No	No
5	Prey Nup	Yes	2000	Good	Enough time and resources to build capacity	Good	Good	Yes	Good	Yes	Yes	Yes
6	O Rokar	Comm	-	Poor	upstream decides	Poor	Poor	No	Poor	No	Not clear	
7	O Treng	Yes	2000	Good	Enough time to build capacity	Good	Good	Yes	Good	Yes	Yes	Fair
8	O Snor	Yes	2005	Poor	Chairman influence	Poor	Poor	No	Fair	No	No	No
9	Roluos	Yes	Under reg.	Poor	Chairman influence	Poor	Poor	No	Once	No	Yes	No
10	Hun Sen P.S. 45	PDWRAM	From district	Poor	Nothing organized	Poor	Poor	No	No	No	No	No
11	Boeung Nimol	Yes	2003	Fair	Chairman influence	Fair	Fair	Yes	Good	Yes	Yes	No
12	Prek Ong Pan	Yes	2002	Good	Enough time and resources to build capacity	Good	Good	Yes	Good	Yes	Yes	Yes
13	Prek Chan	Comm	-	Fair	Pumping system	Individual	Fair	No	Some	No	No	No
14	Ches Chor	Yes	Not reg.	1 year	1 year mandate	Poor	Poor	No	No	No	Yes	No
15	Sdau Kaong	Yes	2004	Good	Enough time to build capacity	Good	Good	Yes	Good	Yes	Yes	Yes
16	O Amporn	Yes	2002	Poor	Chairman	Poor	Poor	No	No	No	No	No
17	Kampang	Yes	2005	Poor	Theoretical	Poor	Poor	No	No	No	No	No
18	78 Dam	Yes	2002	split in 3 groups	Autonomy	?	Poor	No	Some	No	No	No
19	Baray	Yes	2003	Poor	Chairman and PDOWRAM	?	Good	Yes	Poor	No	Yes	No
20	Kilo 8 Dam	Yes	Under reg.		Chairman influence	Poor	Poor	No	No	No	No	No
21	Kbal Por	No	-	Fair	Pumping system	Poor	Fair	No	Fair	No	No	No

4. Finances

Financial characteristics of surveyed irrigation schemes are presented in Table 4 with the following information:

- Irrigation scheme number (“N^o”).
- **Name.**
- Existence of an Irrigation Service Fee (“**ISF**”).
- **Amount** of the ISF asked to users: in kg of paddy/ha/season, in kg of paddy/ha/year, in Riels/ha/season, in Riels/ha/year, in Riels/household/year,...
- Quality of ISF **collection** by the management body.
- **Rate** of collection when available
- Presence of detailed information on **finances**, regarding ISF collection, operation and maintenance expenditures,...
- **Quality** of the provided financial information,
- General **remarks** on the scheme.

Table 4: Financial characteristics of surveyed irrigation schemes

N°	Name	ISF	Amount	Collection	Rate	Finances	Quality	Remarks
1	Norea							
2	Kamping Pouy	Yes	10,000 to 20,000 R/ha/S, on yield	Poor	63%	Yes	Good	Lack of water, low governance, ISF based on yield
3	5 February (1445)	Yes	40,000 R/ha/S	Poor	0%	Yes	Poor	Lack of water and gates, low governance
4	5 February (com.)	No	-	No	-	Yes	Poor	Commune chief manages alone
5	Prey Nup	Yes	36,000 R/ha/Y	Good	78%	Yes	Good	5 years already with detailed annual plans, paid FWUC staff, local authorities close collaboration, O&M village meetings,...
6	O Rokar	No	-	No	-	No	No	Managed by commune chief and upstream village's chief
7	O Treng	Yes	10,000 to 40,000 R/ha/DS	Good	100%	Yes	Good	7 years already, ISF for dry season area only
8	O Snor	Yes	10,000 R/ha/Y	Poor	0%	No	No	FWUC chairman is alone, maintenance of the dam/road by the commune
9	Roluos	Yes	5,000 R/ha/Y	Poor	?	Yes	Poor	3 successive chairmen, upstream/downstream competition
10	Hun Sen P.S. 45	No	-	No	-	No	No	Managed by PDOWRAM, commune and village
11	Boeung Nimol	Yes	20,000 to 40,000 R/ha/DS	Good	90%	Yes	Poor	ISF for dry season only
12	Prek Ong Pan	Yes	150,000 R/ha/Y	Good	100%	Yes	Good	Truck tole fee for road maintenance, new pump borrowed from the commune
13	Prek Chan	Yes	10,000 R/30l + 1 l oil + 1000 R/HH	Good	?	No	No	Individual operation system, first arrived first served
14	Ches Chor	Yes	2400 riels/HH	Poor	0%	No	No	Chairman assumes all, ISF stopped and FWUC mandate expired
15	Sdau Kaong	Yes	50,000 to 70,000 R/ha/Y	Good	100%	Yes	Good	Property of the pumps is not clear, meetings with users organized, a new physical rehabilitation is planned in 2006-07
16	O Amporn	Yes	9,000 to 24,000 R/ha/S	Poor	0%	No	No	FWUC activity is theoretical, commune manages but water competition
17	Kampang	No	-	No	-	No	No	This FWUC is not active (condition to get funds for rehabilitation), PDWORAM manages the dam, no water distribution
18	78 Dam	Yes	30 kg / paddy / ha /Y	Good	?	No	No	System divided by secondary dam and village
19	Baray	Yes	10,000 R/ha/Y	Poor	43%	Yes	Poor	No flexibility in management, double accounting system to get flexibility, PDOWRAM responsibility not clear, poor ISF rate
20	Kilo 8 Dam	No	-	No	-	No	No	No election, choice by PDOWRAM, nothing much done
21	Kbal Por	Yes	120,000 to 220,000 R/ha/ S	Good	95%	Yes	Fair	Private entrepreneur, operation is fine but no transparency and unreliable water supply

III. MAINS RESULTS OF THE SURVEY

The results presented in this report should be taken with some caution. Actually, the research team faced difficulties to get reliable and stabilized information. These limits are linked (i) to a general deficit of formalized and transparent management procedures, and (ii) to a lack of relevant experience of the management body in irrigation, on most of the surveyed irrigation schemes.

Therefore, the information provided hereafter tends to characterize some of the major trends that can be foreseen from a picture taken at a moment of the starting existence of the surveyed irrigation schemes. And some additional research investment, such as a continuous monitoring process, would be required to consolidate the hypothesis taken in this report.

1. Scheme profile

- There are 13 provinces concerned by the survey, out of the 24 existing provinces. This selection presents a good dispersion which allows taking into account different situations which prevail in the country.
- The type of water source creation is rather diverse with 14 reservoir/dam systems, 6 pumping systems and 1 polder system. Reservoir/dam systems, which collect flood and runoff water from streams, rivers and lake, are the most available systems in the survey as well as in the country.
- The canal network ranges from 0 to a full set of canals, from the primary to the tertiary canals and drains. There are 4 schemes without any canal (more water management infrastructures than real irrigation schemes), 3 with primary canals only, 8 with primary and secondary canals, and 5 with primary, secondary and tertiary canals (including one scheme with drains). The polder scheme, which does not have any irrigation canal but drainage canals only, was not included in this classification. 75% of the surveyed irrigation systems are characterized by a very limited set of water distribution canals, ranging from 0 to primary and secondary canals only. This is a specificity of Cambodian irrigation schemes.
- Ten of the surveyed schemes were created before or during Sihanouk period in the 1960s. Ten other schemes were created during Pol Pot time, at the end of the 1970s. Finally, only one scheme was created recently in the 1990s. All these schemes, except one, are more than 30 years old. They went through several historical periods and present alternative collapse and revitalization sequences.
- The latest revitalization programs were recorded with the origin, dates, objective and components of the provided support. 19 of the 21 surveyed schemes benefited or still benefit from a support in the 2000s. Some supports were Cambodian ones (5 out of 19),

from political party, commune, private entrepreneur,... But a large majority of schemes benefited from foreign project supports. Moreover, many schemes present a succession of several revitalization projects, sometimes very closed to each other, every 3 to 5 years.

- The objectives of the provided support differ from a scheme to another. It can be an infrastructures rehabilitation project (7 cases), an emergency project (3 cases), a food security project (5 cases), or a capacity building project (4 cases). In each case, one to several components can be established. Six schemes only have a simple component support project. A majority of schemes present the combination of infrastructures rehabilitation and capacity building components (8 cases). Five schemes present more than these 2 components, with an additional agricultural extension component (3 cases), and a rural credit component (1 case), and a land titling component (1 case).

2. Agricultural use

- The selection intended to offer some diversity in term of the scheme command area extension. There were 3 large (above 5000 ha), 13 medium (from 200 to 5000 ha) and 5 small (below 200 ha) irrigation schemes selected in the review.
- There is a lack of information regarding the size of the command area. The comparison between the theoretical or designed command area, and the effective irrigated area, showed differences in almost every scheme with available data. In 3 recorded cases, the actual irrigated area does not reach half of the designed area.
- A majority of surveyed schemes presents a double cropping agricultural system (12 cases), mainly combining a wet season rice with a following dry season rice. Eight schemes secure a single irrigated crop, for a wet season rice (6 cases), a floating rice (1 case) or a receding rice (1 case). One scheme allows a turnover of 3 to 4 vegetable crops a year.
- Soil quality ranges from medium (12 cases) to good soil types (8 cases). This information was collected during the interviews, but the team could not find any available detailed soil study report. Actually, soil suitability to irrigation does not seem to be addressed in a systematic way by the support projects.
- Estimated average yields range from 1 to 2 tons per hectare (4 cases), 2 to 3,5 (10 cases), 3 to 4 (3 cases), to 3 to 5 tons per hectare (3 cases). These values are often higher than the national average yield which is equal to 1.8 t/ha. It shows that irrigation secures agriculture, decreases the impact of natural calamities such as floods and droughts, and allows in average a better land productivity.
- However, irrigation alone does not explain the agricultural results. Intensive agriculture practices, with high external inputs such as chemical fertilizer, herbicides and pesticides, have also their impact on agriculture results. In the surveyed schemes, there are 5

recorded extensive agriculture cases for 16 intensive ones. In a large majority of cases, intensive agricultural practices are combined with irrigation.

- From an economic point of view, rice market price seems to depend from rice quality. In a large majority of cases, cultivated rice have an average price of 450 to 500 Riels per kilo of paddy. In only 4 cases, reference is made to quality perfumed rice varieties, with prices ranging from 700 to 800 Riels per kilo of paddy.
- Irrigation allows agriculture intensification which increases land economic value. In 13 cases, the average price of one hectare of irrigated rice field is above 1000 USD. However, some irrigation schemes (6 cases) do not seem to present a very good return, with land prices around 500 USD per hectare. We also noticed that urbanization can impact irrigated schemes, with land prices reaching peaks of 70,000 USD per hectares (2 recorded cases).

3. Water management

- There are 15 FWUC in charge of the management of the 21 surveyed irrigation schemes, 11 already registered and 2 shortly registered, following Circular N°1 and PIMD guidelines. Other 6 schemes can be managed by the commune authorities (3 cases), a cooperative, a private entrepreneur, PDOWRAM.
- FWUC official registration is very recent, after 1999 Circular N°1. Registered FWUC have official statutes with rules and regulation, management and maintenance plans and a bank account. The two oldest FWUC were registered in year 2000, but the majority of them are only 2 years old.
- The young age of the FWUCs means that they are still in a learning process and that their activity is not stabilized yet. A consequence of this specificity is that their organization is not very clear or even quite poor for a majority of them. The links between FWUC and the locale authorities and, to a lesser extend, the personality of the FWUC chairman appear to be key points which impact the overall capacity of the FWUC. The organization of the FWUC fits with the formal requirement, but the assumed responsibilities appear quite vague.
- Four of them only, do present a strong organization with a board of representatives able to describe in details their activity and responsibilities. These four FWUCs benefited from a strong support in term of capacity building.
- In other systems, managed without a FWUC, the organization is weak, except for 2 pumping systems which require a rather effective organization to fulfil their task.
- The overall quality of the water management organization can be assessed through several indicators such as (i) the institutional link between the management body, users, and local authorities, (ii) the assessment of the operation process, with or without an op-

eration plan, (iii) the assessment of the maintenance process, with or without a maintenance plan, and (iv) the assessment of the rules and regulation settled on the scheme and the capacity of the management body to enforce them.

- Institutional link between the management body, users and local authorities is often weak. A competition between upstream and downstream users often appears for water distribution. Many systems show weaknesses on this matter. Local authorities relationship with the management body is a key point which can explain the good capacity of a FWUC to fulfil its tasks. For instance, fee collection and conflict resolution, which are subjects of schemes' general regulation, require the support of local authorities to the FWUCs, as State local representative in charge of public policies and law implementation. But on the other hand, local authorities sometimes interfere in a way that does not allow a young FWUC to build its own management capacity.
- The weakness of water management observed on many schemes can be explained by the fact there is no real operation plan organized (12 cases). But on the other hand, the presence of an operation plan does not mean that it is applied in reality. Poor organized systems show differences between formal and real operation. In these cases, water is managed on daily basis, and the service quality differs from a user to another. As a matter of fact, little activity is done in term of operation on reservoir schemes due to the small development of the canal network (primary and secondary canals only) and, in several cases, the insufficient number of distribution structures (gates, stoplogs, culverts).
- As many schemes face difficulties in term of operation, they also show weaknesses in terms of maintenance (11 cases). There is often an important gap between the theoretical maintenance plan that should be followed and the reality. However, it seems that maintenance remains a concern for irrigation management bodies. Some work is actually done in most of the systems, but it is often limited to canal cleaning and small repairs mobilizing users' participation. Nothing is done in term of heavy maintenance works, which are often considered to be the responsibility of the State except on one scheme where provisions are kept on a bank account. In other cases, heavy work are said to be the responsibility of the MOWRAM or PDOWRAM by users and managers.
- At last, rules and regulation seem to be the most difficult part of the job for many management bodies. Written rules often exist but enforcement remains often theoretical. Main difficulties concern water distribution (upstream/downstream), irrigation service fee payment, and infrastructures protection.

4. Finances

- An irrigation service fee is supposed to be paid by users on 15 of the 21 surveyed schemes. However, the amount asked to users differs a lot from a scheme to another. Pumping systems are the more expensive systems with high ISF amounts asked to users (up to 220,000 Riels/ha/season). As far as water availability directly depends from the capacity to purchase petrol for the pumps, these systems show a good capacity to collect

money. In gravity systems, the fee can be limited to a symbolic payment (2400 Riels per household per year), but some systems collect enough funds to cover their operation and small maintenance costs. There is only one scheme where ISF payment includes provisions for heavy maintenance works.

- Although an ISF is often asked and its amount is often low, several schemes show real difficulties in ISF collection, due to insufficient quality of the irrigation service. Four schemes do not collect any fee at all, although they are supposed to do so. Eight schemes only present a good collection rate. It seems that payment conditions and amounts are negotiated individually in most cases (yields, personal situation).
- Finances records can be presented in many of the surveyed schemes with some details on maintenance expenditures which can come from ISF, but also from subsidies (MOWRAM, projects,...), communal budgets and private donations. However, the transparency in record keeping is not always the rule and five schemes only present a rather good standard in this matter. Finally, one or two schemes only do have a detailed provisional budget.
- In many schemes, available funds seem to cover in priority operation costs, then running costs, small repairs and manager allowances.

IV. QUESTIONS AND PERSPECTIVES ON THE FURTHER DEVELOPMENT OF PARTICIPATORY IRRIGATION MANAGEMENT

1. Support to PIMD

Several main issues could be raised from the present work on participatory irrigation management.

First of all, it appears that PIMD, through FWUC development, constitutes a good way to build local management capacities of the numerous irrigation schemes existing in Cambodia.

Keys of success are not linked to the size of the scheme command area, as good and poor managements could be observed in large, medium and small schemes as well.

Actually, the feasibility of PMID depends on time, resources and type of support devoted to FWUC establishment.

Surveyed schemes show that FWUC capacity building requires time so that leaders and users capacity can be increased. Actually, statutes should not be considered as the end of the capacity building process but as the beginning of it. Statutes registration brings FWUC the permit to operate but they do not provide the know-how. Therefore, above all, long term, continuous capacity building process is needed.

However, if FWUC capacity building is a prerequisite to PIMD, other inputs are needed to secure FWUC activity. Some of the inputs are linked to the skills that need to be developed by FWUC leaders. Others are linked to the additional components that need to be implemented to secure PIMD process.

Skills that need to be developed by FWUC leaders concern their irrigation scheme operation capacity (how to control water, to share it amongst users with equity,...), their maintenance capacity (what job should be done and when, how to make a contract with an entrepreneur, how to control the quality of the maintenance work,...), their accounting capacity (how to keep clear accounts of fee collection and expenditures), their financing capacity (how to build the fee amount, how to collect a good rate,...), their enforcement capacity (what and how to enforce,...),...

Components which support PIMD are infrastructures rehabilitation as **no FWUC can expect success on a system that can not fulfil its duties in terms of water allocation to farmers**. But, in order to ensure users' capacity to bear operation and maintenance costs, some **additional inputs** are need in terms of **agricultural extension** and **rural credit**. Such components bring opportunities to users to develop their agricultural activity.

2. Reality of social water management

The observation proposed in this study brings a lot of information on the main achievements and issues observed on 21 irrigation schemes. However, these information remains on a superficial level due to the kind of short term survey which was undertaken. Better understanding of local dynamics could be obtained through the implementation of a monitoring process that would allow getting a better idea of FWUC progress and constraints. Several issues can already be pointed out.

2.1. Leaders capacity

First of all, it appears that the personality of FWUC leaders is a crucial aspect that leads to FWUC management difficulties or success. Therefore, the method and the time allocated to leaders choice is a first importance.

As a consequence, it appears that leaders will be able or not to manage the scheme and enforce the rules on the basis of their own capacity and not on the basis of the existence of formal documents. Formal documents such as statutes bring FWUC leaders the official legitimacy to manage the scheme, but they do not give them the capacity and the willingness to do so.

Connected to this aspect of leaders' capacity, one should be concerned with the economic capacity of leaders to invest their time in collective activity. Water management is time consuming when it is done properly. Therefore, when financial resources are devoted to leaders works allowances, it decrease economic pressure on leaders and provide them the conditions to invest their time in collective water management.

2.2. Users participation

If time is needed to FWUC establishment and empowerment, some attention should be given to the direct environment of the FWUC. As an organization, the FWUC, by its creation, will have relations with different institutions, organized or not, which can make its activity easier or not.

First of all, FWUC is supposed to be the users organized body that manage water on their behalf. However, the simple existence of the FWUC creates a border between FWUC own interest and users primary interests. In other words, the individual interest of the FWUC is not the sum of the individual interests of users. In order to keep this border as thin as possible, some attention should be given to participatory meetings on the subjects of operation, maintenance, ISF, finances, enforcement. Every year, a minimum of two series of meeting is needed (i) to decide about the operation and maintenance plan, to decide about the amount of the fee that allows to cover operation and maintenance costs, and (ii) to detail the results of the operation, maintenance, fee collection and accounts to users. FWUCs need some support to organize these meetings during the first years of their existence, before FWUC leaders get the adequate knowledge to do it on their own. The support will be provided on subjects such as meeting facilitation and decision making. The objective is both to increase the organisational and technical reliability of the FWUCs and their social accountability as well.

2.3. Local authorities support

Additionally, close relationship with local authorities are also some important point that should be worked on. Actually, the FWUC is a production tool that aims to fulfil a policy. Local authorities are in charge of controlling policy implementation and law enforcement in their administrative limits. Therefore, for all questions that relate to policy implementation and law enforcement, FWUC and local authorities should find ways of a direct and strong collaboration. On the other hand, as long as production and policy are different subjects, one should care to avoid that local authorities interfere with FWUC operation and maintenance responsibilities, including financial management, or directly bear the management responsibility of irrigation schemes, as it is the case in some places.

2.4. MOWRAM control

Finally, FWUC are created to fulfil MOWRAM policy, and MOWRAM should be able to monitor FWUC activity to get the guaranty that its investments are secured. In order to do so, some technical and financial control was created. For instance, some FWUCs need to get an official agreement from PDOWRAM or/and MOWRAM before opening a gate (control of operation plan) or retrieving money from the bank for their maintenance work (control of maintenance plan). The difficulties of such measures are that they do not concentrate on the general objective of the FWUC (the provision of a good quality service), but on the procedures only (the respect of administrative rules). On the one hand, it is clear that FWUCs, although they are private organizations, have to respect MOWRAM administrative procedures. On the other hand, such procedures could be adapted to FWUC operational constraints and concentrate more of the final purpose of the FWUC, the provision of a service, than on the administrative organization only. It should be reminded that if FWUCs get

their existence from MOWRAM support and official recognition, their sustainability depends from their capacity to provide a good quality service to users who, in return, will bear operation and maintenance costs as initially planned between them and MOWRAM. Therefore, we believe that more strength could be awarded to quality control procedures, aiming at characterizing the effectiveness of water management, together with lighter process control procedures, aiming at securing a formal administrative process.

V. SYNTHESIS

Irrigation scheme management capacity is still new and weak. However, PIMD, through FWUC creation, represents a real opportunity for improving water management.

PIMD could strengthen its capacity if enough time and resources would be put in constant monitoring and support of newly created FWUC, until they get experienced enough to work on their own. In any case, MOWRAM should also develop its capacity to control technically and financially FWUC activity on a permanent basis.

More attention could be awarded to FWUC everyday work in order to craft their effective management capacities. Formal statutes participate to FWUC empowerment but do constitute a condition of FWUC success. FWUC success depends from leaders own capacity and motivation, FWUC and users relationship, FWUC and local authorities collaboration, FWUC and MOWRAM/PDOWRAM collaboration.

There can not be PIMD success without irrigated agriculture success, and therefore, capacity building efforts should be reinforced by infrastructures rehabilitation, agricultural extension, rural credit efforts. Capacity building should however remains a central objective, as projects centred on infrastructures, such as emergency relief projects, do not achieve great results in terms of water management. Moreover, they often need additional physical rehabilitation after few years.

If PIMD appears to be a key issue and orientation, further investigation could be done on the way FWUC social sustainability could be secured. These investigations should allocate attention on the FWUC implementation process such as registration of membership and land, leaders' selection and renewal, initial training (admin, O&M, conflict, communication,...),...

If more support should be allocated to PIMD, there is a need to think about PIMD implementation. Up to now, irrigation was more considered as "administration" oriented than "resource management and production" oriented. This does not favour the management flexibility that is required for operation and maintenance. This point could be questioned on the basis of case study results presented in this report.

This is linked to the understanding commonly shared about the PIMD concept. Actually, concentrating PIMD activity on FWUC creation and registration, means to delegate operation, maintenance, enforcement,... to local leaders own capacities. This is a community based approach that takes for granted the existence of a local capacity to manage and share water resource with equity. Our expertise proposes to consider PIMD **from a service oriented approach** more than from a community oriented approach.

A **service oriented approach** concentrates its inputs on the definition of the service and of the responsibilities that every one takes in it. Such an approach means for instance (i) to characterize the limits of the scheme in order to decide who are the users, (ii) to negotiate between users and the FWUC the service that can be provided, (iii) to organize an informa-

tion system in order to monitor and assess the service quality, (iv) to establish collective working sessions between the FWUC and users in order to organize the operation and the maintenance to secure the service, and to collectively assess the quality of the service from the analysis of the information collected,...

By doing so, a direct attention is provided to the different elementary tasks that need to be undertaken for operation, maintenance, fee calculation and collection, accounts and finances management, rules enforcement. Some tasks will be achieved by the FWUC only. Some may require users, local authorities, PDOWRAM/MOWRAM direct involvement.

We believe that this approach would secure FWUC future capacity to manage its scheme on a sustainable basis and would strongly benefit to PIMD success.