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CU CHI IRRIGATION SYSTEM

Background

In almost all Asia countries, the development and management of the irrigation system has been the major item of expenditure in the irrigation budget. In Vietnam today, and in many Asian countries in the 1970s and 80s, irrigation and flood control for more than half of the agricultural budget. Most of the funds have been for capital expenditure with operation and maintenance being ten percent or less.

There is a general consensus that the publicly managed irrigation systems in Asia have not performed well, that too much is spent on the *hardware* and too little on the *software* to insure good management, that delivery of water is often not related to crop needs, that systems must be subsidized because fee collection is not adequate to cover maintenance, and that lack of funds for proper maintenance results in rapid depreciation and need for frequent rehabilitation. Yet given the size of the investment, there have been surprisingly very few studies to document in detail irrigation system performance.

In the face of growing scarcity and competition for water, there is mounting pressure to find ways to increase irrigation water productivity and to divert water from agricultural to non-agricultural uses – industrial, municipal, and hydro-power. There is a severe shortage of water in many of the semi-arid regions of Asia, but even in the monsoon regions shortages occur in the dry season and due to growing urban demand.

There is discussion about the need for institutional reforms that would: (i) give more responsibility to farmer/users in the operation and maintenance of the system, (ii) facilitate the transfer of water to non-agricultural uses, and (iii) facilitate volumetric pricing. The World Bank has been promoting "irrigation management transfer" or "participatory irrigation management" involving the creation of "water user associations" and this is being tested in some areas in Vietnam.

Meanwhile, farmers in many locations have adjusted to ineffective management of public irrigation and to increasing water shortages by investing in tube wells and pumps and micro-irrigation technologies, developing on farm pond storage, shifting cropping patterns etc.

The Cu Chi Irrigation System

Scientists in Australia and Vietnam undertook a recent study: "System-wide water management in publicly managed irrigation schemes in Vietnam" funded by the Australian Centre for International

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Agricultural Research. The study involved three subprojects. One of these subprojects focused on the performance of the Cu Chi irrigation system.[1]

The Cu Chi Irrigation System is located in the East Branch Canal of Dau Tieng Reservoir in Tay Ninh Province. The Cu Chi Irrigation Management Company (IMC) provides irrigation service to approximately 8,500 ha which includes 12 communes in the northern part of Cu Chi District.[2] The main canal is 11 km long. The IMC provides irrigation for three distinct cropping seasons: Summer-Autumn (Aril-July), Main Crop (August-November) and Winter-Spring (December-March) with rice crop in the first two seasons and peanuts, vegetables, and corn in the winter-spring.

The system was completed in 1995. Before that farmers did not have enough water to grow rice. But for the farmers irrigation has been a mixed blessing. Before irrigation farmers planted a larger area to crops such as peanuts and vegetables with higher returns than rice.

The Issues

There are three key stakeholders in the system:

Ho Chi Minh City Government. HCMC needs more water for industrial and municipal purposes. HCMC currently subsidizes the operation of the Cu Chi IMC.

IMC. The IMC pays a fee to Dau-Tieng Reservoir for bulk delivery of water. It sets the delivery schedule of water to 19 service areas. It is responsible for the overall maintenance of the system. It collects fees from farmers, but more than half do not pay.

Farmers. Farmers complain that the water deliveries are not related to crop demand. Irrigated rice accounts for a little over a third of gross farm income but less than 20 percent of farm household income.

Operation

The *research team* examined the past record of IMC irrigation water supply and demand to the 19 service areas through four seasons (Table 1). They concluded that there was a considerable excess of supply in all four seasons but that the excess was highly variable across seasons. The disparate deviations between supply and demand support the farmers' claim that the systems operation is carried out without consideration of the actual crop water demand and proper canal regulation to achieve supply equity.

The *research team* modeled the scheme to determine how much water could be saved by changing the IMC operational rules and lowering the supply-demand ratio from 1.7 or more (Table 1) to approximately 1.2. The study concluded that the system could deliver to HCMC three times more than the currently proposed 150,000 cubic meters/day with minimal impact on the supply security of the system. That is to say, with the reduction in irrigation water, farmers would not suffer a loss in income, and with proper management of water deliveries they might even be able to shift out of rice to higher valued crops.

[1] The case study presented here is based on data obtained in the proceedings of a workshop held in HCMC on 28 November 2003. Copies of the workshop proceedings are in FETP Library in both English and Vietnamese. ACIAR Project 9834, "System-wide Water Management in Publicly Managed Irrigation Schemes in Vietnam", *Workshop Proceedings*, Ho Chi Minh City, 28 November 2003.

[2] Located approximately 45km northwest of Ho Chi Minh City, Cu Chi is a rural district covering an area of 434 km^2. In 2003, the district population was 266,000. Devastated by the war, Cu Chi remains one of the two poorest districts of Ho Chi Minh City.

Financial Management

The *research team* conducted an asset management analysis. In estimating the actual cost of irrigation and drainage services, the cost of operation of the IMC was grouped into eight categories as shown in Figure 1. The major expense category was for depreciation of irrigation infrastructure. For operation and maintenance, the major expenditures were for staff and for bulk purchase of water from the Dau Tieng Reservoir. Repairs and maintenance was only a small fraction of total operating expenditures and even this showed a sharp decline from 1999 to 2002. Why is so little money spent for maintenance? Many governments seem to operate on an unwritten policy to let the irrigation systems deteriorate and then obtain a soft loan for rehabilitation from one of the multilateral lending agencies such as the World Bank.

Tables 2a and 2b show the revenue, expenditure and performance measures for the Cu Chi IMC during eight years from 1996 to 2002. In terms of the source of revenue, about one quarter to one third of the revenues come from farmer payment of water fees, and the rest is subsidy from the HCMC government.

Sources of Farm Income

Table 3 reports on the analysis of farm income based on a survey of 44 farms in the Cu Chi irrigation system. The gross income from irrigated rice is a little over a third of the gross farm income. But income from irrigated rice is probably less than 20 percent of the total household income and income from cropping only about 30 percent of farm income. Returns to crop production are higher at the head of the Cu Chi system than at the tail, and the difference is more striking when one compares household income at the head, middle and tail. However, the sample size is too small and the information too sparse to draw conclusions about location. Water fees paid for irrigation were a small fraction total farm costs.

Volumetric Pricing of Water

The *research team* undertook a study to explore the potential for volumetric pricing to facilitate water saving. They proposed a scheme similar to that practiced in China where water is sold volumetrically to the village/commune or to the *water user association* (WSU) and the WSU then prorates the cost to farms on the basis of area irrigated. If the WUA purchases less water, then reduction in water fee is passed on to farmers, thus giving farmers an incentive to save water. The proposed change in structure shown in Figure 2 involves the creation of a WUA.

Table 1: Supply-Demand ratio and its variation in different seasons

SA	Supply-Demand Ratio			
	W-S 2001	**S-A 2001**	**M-M 2001**	**W-S 2002**
1	1.52	1.15	1.23	1.31
2	2.80	1.58	0.53	2.15
3	2.61	0.46	1.04	1.03
4	0.82	0.67	0.94	2.16
5	3.42	3.63	4.70	5.98
6	1.21	1.03	1.16	1.47
7	1.93	2.98	2.67	1.56
8	1.17	1.14	1.09	1.04
9	1.59	1.51	1.80	2.05
10	1.28	1.09	1.54	3.15
11	1.78	4.63	3.64	1.59
12	1.54	1.36	0.82	3.48
14	0.96	3.84	0.79	3.73
18	0.87	1.28	2.12	-
19	-	-	-	4.43
Average	1.68	1.89	1.72	2.51
CV	0.43	0.65	0.66	0.57

Table 2a: Summary of Measures of Financial Viability

No.	Name	Ratio	Units
	Revenue measures		
1	Average total revenue	Gross revenue collected / Volume of water delivered	VND / cubic m
2		**Gross revenue collected** / Area serviced	VND / ha
3	Average water fee revenue	**Gross water fee revenue** / Area serviced	VND / ha
4		**Gross water fee revenue** / Volume of water delivered	VND / cubic m
5	Average subsidy	**Government subsidy** / Area serviced	VND / ha
6		**Government subsidy** / Volume of water delivered	VND / cubic m
	Expenditure measures		
7	Average total costs	**Total expenses** / Area serviced	VND / ha
8		**Total expenses** / Volume of water delivered	VND / cubic m
9	Individual costs as a percentage of total expenses		
9a	power electricity	Power costs / Total expenses	%
9b	wages and salaries	Wages & salaries / Total expenses	%
9c	repairs and maintenance	Repairs & maintenance / Total expenses	%
9d	administration	Administration costs / Total expenses	%
9e	insurance	Insurance / Total expenses	%
9f	payment of loans	Bank loans / Total expenses	%
9g	water supply costs	Water supply costs / Total expenses	%
9h	water collection fee costs	Water collection costs / Total expenses	%
9i	taxes	Taxes / Total expenses	%
9j	summation		
	Performance measures		
10	Maintenance cost to revenue	**Maintenance cost** / Gross revenue collected	ratio
11	Cost recovery	**Gross revenue collected** / Cost of management, operation, maintenance	ratio
12	MOM to area	**Cost of management, operation, maintenance** / Area serviced	VND / ha
13	Personal cost per employee	Salary costs / Number employed	VND / ha

14	Revenue collection performance	Cost of collection / Gross revenue collected	ratio
15	Revenue collection efficiency	Gross revenue collected / Total leviable fees	ratio
16	Balance, exc. Subsidy	Gross revenue – govt. subsidy – total expenditure / Area serviced	VND / ha
17	inc. subsidy	(Gross revenue - expenditure) / Area serviced	VND / ha

Table 2b: Results of Cu Chi Balance Sheet

No.	Item	1996	1997	1998	1999	2000	2001	2002
Revenue measures								
	Average total revenue							
1	by area (VND/ha)	263,868	383,249	427,404	452,140	461,131	476,387	513,529
2	by volume (VND/cubic m)	5.36	7.45	7.91	8.37	9.80	10.66	15.59
	Average water fee revenue							
3	by area (VND/ha)	69,750	106,778	142,019	168,219	166,299	159,488	188,235
4	by volume (VND/cubic m)	1.42	2.08	2.63	3.12	3.53	3.57	5.71
	Average subsidy							
5	by area (VND/ha)	194,118	276,471	264,118	273,616	293,870	314,176	319,412
6	by volume (VND/cubic m)	3.94	5.37	4.89	5.07	6.24	7.03	9.70
Expenditure Measures								
	Average total costs							
7	by area (VND/ha)	294,521	425,244	477,287	470,509	509,351	537,007	583,964
8	by volume (VND/cubic m)	5.98	8.26	8.84	8.71	10.82	12.01	17.73
	Individual costs as a percentage of total expenses							
9a	power electricity	0.00	2.89	5.00	2.07	0.00	1.25	1.19
9b	wages and salaries	33.77	42.61	42.94	43.62	50.47	54.89	54.09
9c	repairs and maintenance	5.52	3.51	7.82	7.25	3.65	3.48	2.52
9d	administration	10.55	9.30	10.16	10.94	11.15	7.27	9.51
9e	insurance	0.00	2.37	3.47	3.90	4.81	6.88	6.94

9f	payment of loans	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9g	water supply costs	43.94	29.22	25.05	25.00	20.79	19.72	19.14
9h	water collection fee costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9i	taxes	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9j	Summation	93.79	89.89	94.45	92.79	90.87	93.49	93.38
Performance measures								
10	Maintenance cost to revenue	23.31	13.98	22.86	19.11	11.13	11.53	7.58
11	Cost recovery	0.48	0.45	0.56	0.61	0.50	0.46	0.50
12	MOM to area	146,803	235,643	290,805	290,818	332,499	352,530	386,081
13	Personal cost employee	2,966,477	5,403,508	6,113,062	6,120,958	7,667,719	8,791,277	9,420,554
14	Revenue collected/ extraction		na	na	na	na	na	na
15	Revenue collection efficiency	21	23	36	47	56	55	53
	Balance							
16	excluding subsidy	-224,770	-318,465	-314,001	-291,985	-342,090	-374,797	-389,846
17	including subsidy	-30,653	-41,995	-49,884	-18,369	-48,219	-60,620	-70,435

Table 3: Results of analysis of Cu Chi data – selected averages

Item	**Units**	**Top** (n=21)	**Middle** (n=14)	**End** (n=9)	**All farms** (n=44)
Farm size	m^2	5,048	6,577	7,611	6,059
Yield					
Winter/Spring rice	kg/ha	3,694	3,417	3,111	3,472
Summer/Autumn rice	kg/ha	3,472	3,028	3,222	3,278
Monsoon short-season rice	kg/ha	3,893	3,611	2,944	3,667
Monsoon long-season rice	kg/ha	4,139	2,972	2,750	3,222
Gross Crop Income per hectare					
Winter/Spring rice	mill VND	4.6	5.7	3.8	4.8
Summer/Autumn rice	mill VND	5.4	4.7	1.7	4.4
Monsoon short-season rice	mill VND	4.6	3.1	1.7	3.5
Monsoon long-season rice	mill VND	2.1	2.7	3.9	2.6
Dry crops	mill VND	10.9	0.9	6.2	6.8
Gross Livestock Income per hectare	mill VND	25.2	6.7	17.4	17.7

Total Gross Farm Income per hectare	mill VND	52.8	23.8	34.7	39.9
Net Farm Income					
Total per farm	'000 VND	18,446	8,562	12,327	14,050
per hectare	mill VND	39.7	15.3	25.4	29.0
Total Net Household Income	'000VND	27,078	16,818	20,761	22,521
Of which: % income from cropping	%age	29	34	19	28
% income from livestock	%age	39	17	41	34
% income from other	%age	32	49	41	38
Water Fees per hectare	'000VND	372	380	286	357
As: % of gross cropping income	%age	2.9	4.5	3.1	3.3
% of total farm costs	%age	1.4	2.2	1.7	1.6

Figure 1: Operation Cost of Cu Chi Irrigation Management Company

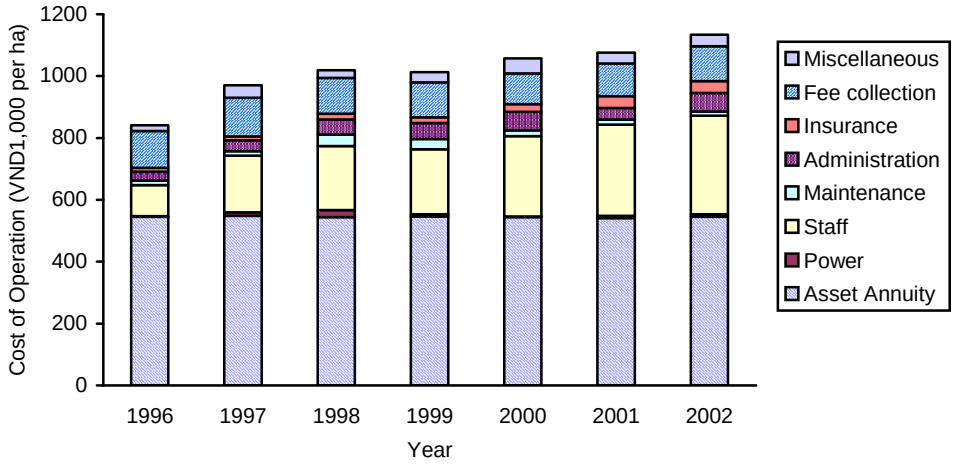
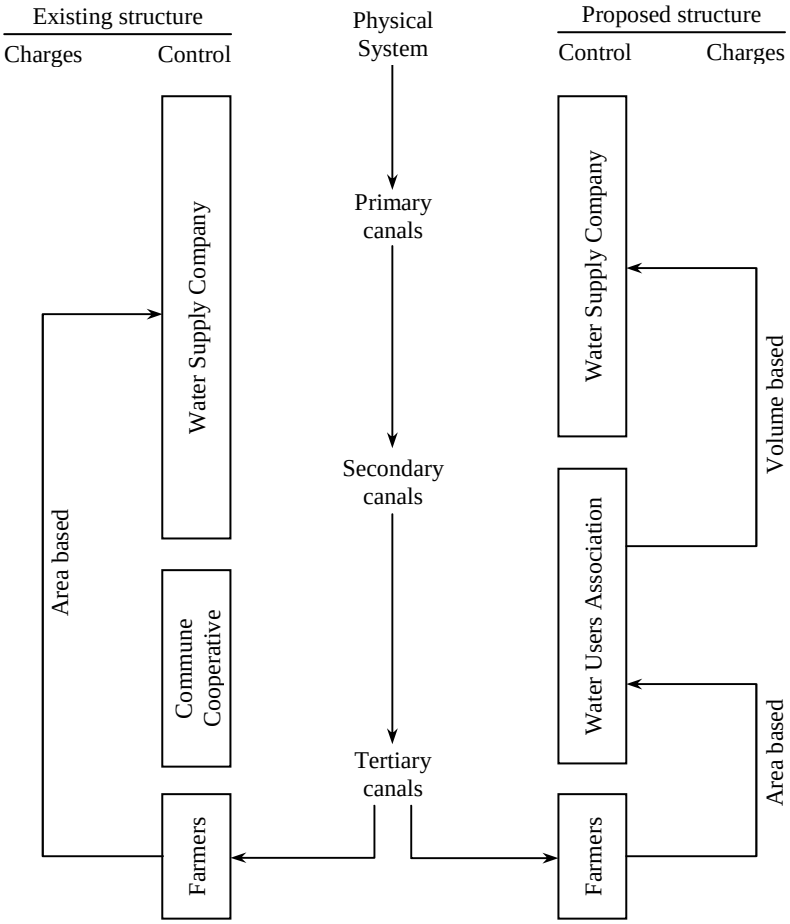


Figure 2: Existing and Proposed Pricing Structures



Source: The tables and figures in this case study are taken from various studies in the ACIAR's workshop on "System-wide Water Management in Publicly Managed Irrigation Schemes in Vietnam"