PARTICIPATORY MANAGEMENT STRUCTURE AND PRINCIPLES OF MUANG FAI IRRIGATION SYSTEMS IN NORTHERN THAIALND[1]

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Summary

Irrigation management is a complex applied science that is always challenged by diverse conditions in real life. To optimize irrigation management, temporal and spatial information on diverse crop types, growth stages and irrigation requirement, farming schedules, weather condition, and irrigation schedules and farm conditions like land formations, soil, locations and access to irrigation in the entire irrigation system is needed. In particular, open channel gravity irrigation for small farms demands more time and place information than any irrigation manager can solely handle unless he/she has expensive technology and absolute power in dictating water users to follow his/her management plan. Hence, participatory approach has a high potential in optimizing irrigation management for efficiency and effectiveness as well as sustainability of irrigation systems and related life aspects. This is well recognized but there is still a gap of knowledge as to how to induce participation especially in government-funded irrigation projects. Understanding farmers-managed irrigation systems existing in many parts of the world in which members of the systems are successful in sustaining their irrigation systems over a long period of time can be useful. This paper has a purpose to extract the participatory management structure and principles that farmers in the Muang Fai irrigation systems in northern Thailand use in developing, operating, and maintaining their irrigation systems and managing their organizations. This study uses an empirical method in understanding the management practices in the selected cases of small and large scale Muang Fai systems. Facts on their historical development, physical conditions, structures, water distribution and maintenance practices as well as organizational management were obtained from field surveys and interviews.

The study reveals that the Muang Fai irrigation systems were developed and maintained for decades or centuries by farmers who voluntarily identified themselves as members of the systems. Additional membership in post-development was subject to acceptance of the pioneering members and bore the previous investment costing. The Muang Fai irrigation systems were developed in areas endowed with adequate water resources, and their developments were relating to land owning. The headwork of the systems were located in higher elevation where water could be easily augmented and diverted down to the end of the main canal by gravity without checking up the canal water level. The cost for Muang Fai system development, especially the headwork, was too high for any individual farmer to afford. Thus, social organization became necessary and the Muang Fai organizations were very sensitive to maintaining a sizeable membership to dissipate the cost. As a result, this determined the capacity of the main canal by simply summing up all

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members' water requirements.

The Muang Fai organization members decided their water management plan through exchange of information, directly or through their delegates depending on the scale of the systems. The actual operation of the plan strictly followed the plan with deviations being allowed only after being proved as inevitably necessary to enable all members to get irrigation water. Generally, Muang Fai irrigation systems distributed water by a continuous and simultaneous method. When some of the members could not, the Muang Fai organizations primarily opted to increase the irrigation supply capacity, an expensive choice, rather than adopting the complicated time-based water distribution which was a cheaper choice but might raise internal conflicts.

The maintenance of the Muang Fai systems was costly, and might not be affordable if all costs were monetized. The Muang Fai organization distributed maintenance cost in cash and in kind. The treatment of each category of cost was clear-cut, allowing no reallocation across categories. The small scale system used the sizes of the irrigation farm intakes chosen by respective farmers as the criteria for sharing the cost while the large scale system used the expressed and monitored farm sizes as the criteria. The distribution of the canal maintenance cost was skewed towards the area with larger number of members. Hence, in the small system case which had a long feeder canal above the most upstream farm, the members shared the cost of the entire length of the canal while in the large system case, in which most of the farms were located in the upper reach, the members maintained only the canal sections that were relevant to them.

The organizational management of the Muang Fai irrigation systems was led by the managers who came into the positions for an unspecified term through direct election. The management of the small scale case was handled briskly by the manager with support from the members while that of the large scale case was participated by the delegates nominated by each village group with the mechanisms for accountability check and balance to maintain the integrity of the system, for building consensus on the method of joint management based on local and aggregated information, for practically synchronizing the system operation, and for penalizing members who defy the consensus. Village irrigation groups affiliated themselves with village administrations to gain coordination and social sanction support.

The common principles of the Muang Fai systems was their observance of the equality of the members and their efforts to make all their management process transparent to the members even though this sometimes meant higher cost. An equal treatment in distributing irrigation water and costs based on the agreed criteria made the members confident in maintaining their participation and the transparency of the water demand and supply information, the water distribution method, and the organizational management made the members confident that they were truly equally treated and thus willing to participate and sustain the Muang Fai systems.

Key Words: Participation in irrigation management, Muang Fai irrigation systems, water management, irrigation institution, indigenous intelligence in irrigation

Introduction

Irrigation management is a complex applied science that is always challenged by diverse conditions in real life. To optimize irrigation management, temporal and spatial information on diverse crop types, growth stages and irrigation requirement, farming schedules, weather conditions, and irrigation schedules and farm conditions like land formations, soil, locations and access to irrigation in the entire irrigation system is needed. In particular, open channel gravity irrigation for small farms demands more time and place information than any irrigation manager can solely handle unless he/she has expensive technology and absolute power in dictating water users to follow his/her management plan. Hence, participatory approach has a high potential in optimizing irrigation management for efficiency and effectiveness as well as sustainability of irrigation systems and related life aspects. This is well recognized but there is still a gap of knowledge as to how to induce participation especially in government-funded irrigation projects. Understanding farmers-managed irrigation systems existing in many parts of the world in which

members of the systems are successful in sustaining their irrigation systems over a long period of time can be useful.

In Thailand, the exemplary farmers-managed irrigation systems are the Muang Fai irrigation systems built in the mountainous northern region. Weirs and canals were constructed and managed to divert water to paddy fields by the farmers themselves. As the investment of the weir was beyond the capacity of an individual farmer, communal cooperation was necessary and the orderly water uses had to be developed with some rules and regulations. The so-called Sanya Muang Fai were promulgated in many localities and in their top form, the rules were developed into the Mangrai Satre of the Lanna Kingdom. Today, there are still some remnants of the Muang Fai systems, some of which are still maintained by farmers, some are improved by government agencies and some are incorporated into the service areas of larger scale national irrigation systems. Unfortunately, no total statistics are available on their number, location and coverage.

Several studies have been conducted on the Muang Fai irrigation systems. Their structural arrangement and management were described (Moerman, 1968; Calavan, 1974; Potter, 1976; and Sirivongse, 1983) and their historical development and management was investigated in search for the most efficient means of water management for agricultural development (Surarerks, 1986). The *Muang Fai* cooperation mechanisms are appreciated in the studies on their customary rules and regulations (Surarerks, 1991), their technological-ecological relations (Tanabe, 1994, Falvey 2001), their cooperation factors (Nimmanhaeminda, 1989), and their resources mobilization in upland and lowland *Muang Fai* systems (Tan-Kim-Yong, 1995a). Transformation of *Muang Fai* in new environment is one of the Muang Fai issues that gains high interest as reflected in the studies on the necessity to integrate *Muang Fai* with national irrigation systems (Surarerks, 1991), the adaptation of *Muang Fai* organizations to public intervention and the necessity to amend the People's Irrigation Law to suit local culture and present day situation (Atharn, 1995), and the alternative approaches for *Muang Fai* adaptation amid social changes which include *Muang Fai* networking, self-determination or joint management with agencies, and the role of local organizations in monitoring government action on *Muang Fai* (Tan-Kim-Yong, 1995 b, c, and d).

This paper has a purpose to extract the participatory structure and principles of Muang Fai irrigation operation, maintenance and organizational management. By using an empirical method, the study analyzed the irrigation management practices of the small scale Pongsak Muang Fai system in Pai District of Mae Hong Son Province and the large scale Soprong Muang Fai system in Sanpatong District in western Chiangmai Province. The definition of large scale Muang Fai irrigation system in the thematic participation issue is a system in which the irrigation manager cannot afford the time and money to directly contact every farmer in the system because of their large number and the vast and widely dispersed irrigation service areas. These two cases were selected qualitatively based on the clarity of their rational practices after extensive reconnaissance surveys of numerous Muang Fai systems in Chiangmai, Chiangrai, Lampang, Lamphun and Mae Hong Son provinces. Facts on their historical development, physical conditions, structures, water distribution and maintenance practices as well as organizational management were obtained from field observations, documentary reviews, questionnaires and interviews of farmers and managers of the Muang Fai systems.

The Pongsak Small Scale Muang Fai System

General Features of the Irrigation System

The Pongsak *Muang Fai* Irrigation System is situated in a rugged terrain in the north of Pai District, Mae Hong Son Province which is 130 km northwest of Chiangmai City as shown in Figure 1. The system relies on the flow of the Pai River, a tributary of the international Salaween River which originates in the mountains to the east of Mae Hong Son Province and runs westerly through narrow valleys into Myanmar territory before draining into the Andaman Sea at Moulmein. The arable land of the 3,119 km^2 river basin is very limited, with only one major patch each in the north of Muang and Pai districts. Distinctly, farms are scattered in numerous small

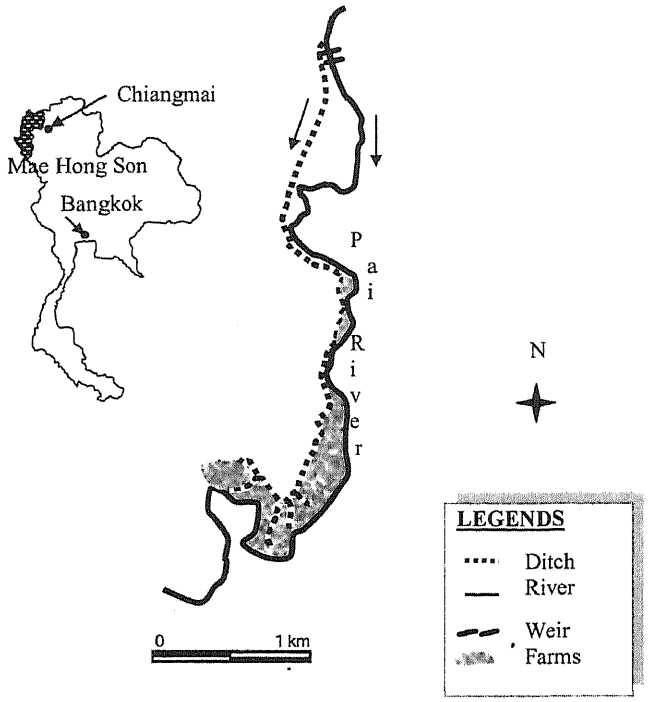

Figure 1: The Pongsak Small Scale *Muang Fai* Irrigation System

valleys; hence the importance of small scale *Muang Fai* systems in the basin. Reconnaissance surveys confirmed that the Pongsak system can well represent small-scale *Muang Fai* systems of which *Muang Fai* managers are in direct contact with farmers.

Physically, the system includes a weir, a main supply canal, three branch canals, and a wasteway. The Pongsak weir comprises two 37-m rows of boulders framed by teakwood crosses, which are located 51 m apart along the river. The inlet to the main canal is 45 m upstream of the upper row. This so-called *Fai Khokmoo* (literally pig sty weir) or crib weir is fabricated with locally available materials, i.e. boulders in the river and trees in the nearby forests, in a rather straight rock-banked river section to avoid fast river bank erosion that is common in earth-banked weirs. The weir that stands 3-4 meters tall checks up the water head for diversion to all farms. In case of water insufficiency in the dry season, a simple 45 cm tall bamboo barrier is built to intercept river flow into the main canal. The crib weir is relatively sturdier than other types of weir, but its maintenance still involves annual replacement or reinforcement of the wooden frames and boulders.

The main canal carries water along a 2.5 km feeder on the right bank of the river and continues onto the main supply canal. The canal gradient control clearly required hard work at the construction and maintenance time as elevation drops by 10 m, drastically in the middle section that is walled on one side with cliffs and on the other side with only a thin embankment which can easily collapse during high flow. A wasteway is installed in the upper reach of the canal to lessen the surplus flow that may be harmful to the canal. The width of the canal tapers on average from 1.5 m in the head-end to one meter in the tail-end before draining into a small natural stream that drains back to the Pai River. The canal cross section is not totally uniform and is clearly constrained by difficulty in construction in the rocky areas. Each of the 24 *Muang Fai* members is provided with a farm intake, including three members who receive water from branch canals. At the construction time, it was estimated that a 20 cm wide intake could supply an area of 0.55 ha (4 *rai*). However, members could decide their intake width, depending on their water need assessment that may take into account, *inter alia*, the quality of soil, the availability of alternative water sources, and the possibility of getting return flow for recycling use. There are three intake width choices in the system, i.e. 20, 15, and 10

cm. The capacity of the main canal was large enough to provide irrigation supply to satisfy every member's expressed needs. When additional members join the system, the canal capacity was enlarged to accommodate the expanded needs.

The catchment of the Pongsak weir is 338 km², which is more than 2,000 times of its service area. According to the farmers, the river flow itself is clearly abundant in every season although no flow rate record is available. With no river flow limitation, the system diverts and distributes water to farms on a continuous and simultaneous supply basis. With a fixed width of intake, every member is susceptible rather equally proportionally to the fluctuations of the river and canal water levels since checking up of the water level in the main canal to divert water to a particular paddy farm is forbidden. If water is not adequate for anyone, actions will be taken to fill the weir gaps, if any, or to increase the weir crest if necessary, or to set up a small bamboo barrier to intercept the low flow into the canal. Every member farmer has a role in monitoring water distribution and seeking solutions. It is very rare that the group faces a critical water shortage and when it happened, members would discuss and, with the coordination of their elected irrigation manager, develop a rotation schedule starting from upstream to downstream. The so-called *Kae Fai* irrigation manager was given the ultimate power to decide if water conflicts arise.

Cropping Pattern and Intensity

Farming areas in the system covers 15.84 ha comprising 24 ownership plots which range from 0.3-1 ha in size. Each plot is divided into 15-65 cultivating plots for better water control in the high-slope area. Farmers are landowners who are related as relatives or village neighbors. Their household sizes ranged from 2-6 members, with the average of 3.4 per household. They professed that their occupation was only farming and they put an effort to cultivate all the year round with the cropping schedule as shown in Figure 2. The wet season paddy is grown in permissible areas or relatively lower elevation from May to November. Farmers use irrigation supplement for six months from May to October, particularly in June-July when water is needed everyday for land preparation. Originally, the wet season paddy was for household consumption but presently farmers have some surplus for sale. Farmers grow soybean in slightly higher elevation with difficult water diversion in the wet and dry seasons. Garlic is grown in the dry season from December to March and farmers use irrigation water around 5-10 days per month, especially in the period before harvesting in early March. Soybean and garlic production is for commercial purpose. The

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Average Rainfall* (mm)	50	180	185	213	252	199	115	37	15	8	2	5
Number of Rainy Days*	4	13	18	20	22	16	10	3	1	1	0	1
Cropping Schedule												
Rice	1	2	3			4						
Soybean	3					4						
Garlic						5		3		4		

* Source Hong Kong Observatory 1961-1990 rainfall data

1 = Nursery Preparation
2 = Paddy Field Land Preparation
3 = Crop Growing Stage
4 = Harvesting
5 = Preparation of Garlic Bulbs

Figure 2: The Rainfall Pattern and Cropping Schedule in the Pongsak System

annual cropping intensity of the system is remarkable at 200% of the farm area, with 93%, 93% and 14% for paddy, garlic and soybean, respectively.

Investment Cost and Right to Use Water

The Pongsak System was initiated approximately 30 years ago by lowland farmers who wished to change from rain-fed upland crops to wet season paddy for household consumption. Each of the 11 Pongsak pioneers paid an equivalence of US$100-125 as investment cost to construct the weir across the 37-meter wide river channel with fast flow and high slope. Late comers were required to pay approximately US$ 450 for a 20 cm wide farm intake when they join the system. By using the joining fee as the basis for calculation, the total investment cost for the irrigation system is approximately US$ 7,300. Presently the service area of the system cannot be expanded further due to topographical constraint of the small valley. When an ownership plot is split through familial inheritance, tenancy or purchase, the original agreement on the farm intake width and the rate for cost-sharing for the two new ownership plots is maintained.

Operation for Equal Water Access

The Pongsak group arranges for a continuous and simultaneous water distribution system in which every member in the run-of-the-river irrigation system is subject equally to fluctuations in the river water level. This arrangement is done by members deciding and the group endorsing the size of their farm intakes and constructing the main canal with the capacity to satisfy every member of water supply. With this arrangement, every member is ensured of equality in accessing and utilizing the water. When any member does not get enough water at needed time, the group would promptly take action to rectify the situation by augmenting the diversion, or clearing the conveyance canal. Under the given condition, i.e. abundant river water availability, water shortage problem occurs mainly and only by insufficient facility capacity, not by water scarcity in the river. Thus, when it occurs, the group manager organizes additional maintenance activities on the weir, not trying to adjust water sharing among member farmers, which may open the group to internal water conflicts.

To distribute adequate water, the group needs to know the water requirement of each member and the total water requirement. This information gives them a clue how wide and deep the main canal must be dredged and how wide the farm intake should be. In cognizance that the farm condition may vary, they leave it to the farm owner's discretion in deciding his own water requirement and farm intake width and the group will simply build the canal with an adequate capacity to supply water on continuous basis without canal water level check-up to all farms. The water and cost sharing based on relative intake capacity, not on the area, or the household as in other Muang Fai systems found in the reconnaissance surveys, or on the total volume of applied water as used in some modern irrigation systems, is directly related to the water condition and water management method of the Pongsak system. Figure 5 illustrates that this sharing method is slightly different from the area-based method as seven members would share slightly different cost or require slightly different water requirements when the two systems are compared.

Maintenance

Annually, members of the Pongsak System gather at the house of their irrigation manager to discuss the magnitude of irrigation management work, estimate costs and make an agreement on cost sharing. The group classifies maintenance costs into two categories, i.e. weir maintenance, and canal maintenance. These costs are distributed based on the intake width of each member expressed in relative terms, i.e. 20, 15, and 10 cm intakes are treated as 100%, 75% and 50%, respectively. The number of members in each percentage group is 6, 6, and 11, respectively, as shown in Table 1. One member whose farm is situated above the canal elevation and needs to lift water to his farm is specially treated as 25%.

Weir Maintenance

The irrigation manager organizes weir maintenance activities in April when the river flow is at its lowest. He schedules each session by avoiding conflicts with important farming schedules. An initial assessment of costs is based on the pre-

Table 1: Distribution of the Annual Cost in the Pongsak System in 2005

Farm Intake (%)	No. of Members	Weir Maintenance					Ditch Maintenance	Remuneration to *Kae Fai*
		Wood Stake Length (pieces)			Labour	Cash	Labour	Cash
		2 m	1.5 m	0.5 m	(man-day)	(US$)	(man-day)	(US$)
100	6	40 x 1.0 x 6	80 x 1.0 x 6	100 x 1.0 x 6	10 x 1.0 x 6	12.5 x 1.00 x 6	10 x 1.00x 6	5 x 1.00 x 6
75	6	40 x 0.75 x 6	80 x 0.75 x 6	100 x 0.75 x 6	10 x .75 x 6	12.5 x 0.75 x 6	10 x 0.75 x 6	5 x 0.75 x 6
50	11	40 x 0.5 x 11	80 x 0.5 x 11	100 x 0.5 x 11	10 x .5 x 11	12.5 x 0.50 x 11	10 x 0.50 x 11	5 x 0.50 x 11
25	1	40 x 0.25 x 1	80 x 0.25 x 1	100 x 0.25 x 1	10 x .25 x 1	12.5 x 0.25 x 1	10 x 0.25 x 1	5 x 0.25 x 1
Total	24	650	1,300	1,625	163	203.13	163	81.25
Cost in monetary terms (US$)		113.75	227.50	284.38	1,015.63	203.13		
						1,844.38	1,015.63	81.25

Remarks: Rates applied: penalty rates of 0.175 US$ per wood stake and labour wage of 6.25 US$ per day.

vious years' costs and the water condition in the past year, e.g. heavy floods in the past year may mean a need for intensive maintenance, hence higher costs. The group members discuss and conclude the cost for the year in the categories of wood, labor, cash and tools. Wood contribution is based on the intake percentages. Each year, the members discuss and decide the cost for a 100% intake. In the 2005 weir maintenance, the following was agreed.

Wood cost for a 100% intake =
40 pieces of 15 cm x 2 m stake,
80 pieces of 7.5 cm x 1.5 m stake, and
100 pieces of 5 cm x 0.5 m stake

Based on such agreement, a total of 3,575 stakes in three sizes were mobilized by the members for the weir maintenance as shown in Table 1. In some years, when there was a need to add sleeping foundation logs, they went to the forest to cut trees together.

Labor contribution for weir maintenance is also based on the intake percentages. In 2005, like in the past, the labor cost for a 100% intake was set at 10 days, thus 162.5 man-days were available for the purpose as shown in Table 1. On average, there were three weir maintenance sessions and each session used approximately 54 man-days. About 18 members were scheduled to work on the same day. The irrigation manager adjusted the man-day according to the type and magnitude of work, and kept a working roster as illustrated in Table 2. It was not necessary that all members came to work together everyday.

Cash contribution for weir maintenance is estimated based on the scale of maintenance work and the necessity of expenses such as purchase of

Table 2: An Example of the Man-Day Management Records for Weir Maintenance in the Pongsak System

Percentage	Name	Day 1	Day 2	Day 3
100%	Mr. A	✓	✓	✓
	Mr. B	✓	✓	✓
75%	Mr. C	✓		✓
	Mr. D		✓	✓
50%	Mr. E	✓		
	Mr. F		✓	
Total Daily Manpower		4	4	4

cement, rock breaking tools, transportation and organization of a simple ritual ceremony to pay respect to the land spirit. The total cost is distributed to members based on their intake percentages. In 2005, the members agreed to fix the rate for a 100% intake width at US$ 12.5 per year and they collected US$ 203.13.

Tools for weir maintenance including axes, hammers, hoes, and shovels are usually brought on the weir maintenance days. There is no fixed type and number of tools that the members have to bring, but there is a common understanding that specific people would bring specific kinds of tool that they have.

Canal Maintenance

Canal maintenance is scheduled twice a year in mid March (before weir maintenance) and mid November. The canal maintenance costs include labor and tools. Labor contribution for canal maintenance is based on the farm intake percentage. The members fixed labor contributions for a 100% intake at 10 days in 2005, hence the availability of 162.5 man-days for canal maintenance activities as shown in Table 1. The March session

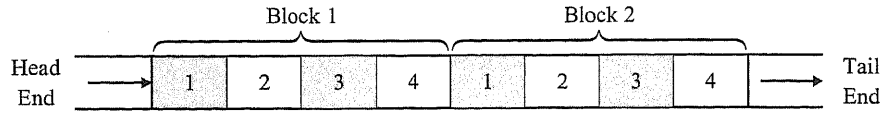

Figure 3: Movement of Canal Maintenance Teams in the Pongsak System

takes a bit longer time (3-5 days) than the November session (2-4 days). There may be additional sessions as necessary. The working schedule and roster is finalized by the irrigation manager and informed to members a few days prior to the appointment dates.

Attendance is strictly checked by the irrigation manager. On the maintenance day, the members who brought with them some tools such as knives, hoes, shovels and sacks, are organized into 3-4 teams. Each team, with 5-6 members, work on an assigned section of approximately eight meters in the first block until completion and move to work in the next section in the second block until the end of the canal as shown in Figure 3. Both the length of the canal and the difficulty of the work are considered for an even distribution of the workload. The opportunity to work in all reaches makes it possible for every member to monitor the farm intake width and elevation of others as well as the capacity of the main canal in the entire length. The maintenance of branch canal is the responsibility of related users and there is no common schedule for those who share the branch canals. The group makes it clear that not only the weir but also the canal is their common facility. It is very easy to accept that the burden of weir maintenance should be shared by all members based on their intake percentages. However, head-enders use a shorter section of the canal. The capacity of the canal downstream of their farms is not related to their water requirement. An addition of users at the tail-end necessitates an increase in the capacity of the whole length of the canal. However, should the tail-enders be left to take the burden by themselves, they would not be able to afford it and decide not to take part in the system, hampering the possibility to actualize the system (Shinzawa, 1975). Thus, the head-enders have to accept the entire length of canal as a common facility and by being able to clearly demarcate the boundary of the common facility the group can be robust (Ostrom, 1990). This the head-enders accepted with no difficulty because of the difficulty in maintaining the long feeder canal and the higher number of members in the lower reach.

Annual Maintenance Cost and Profitability

To get an image of the annual maintenance cost and profit in the Pongsak system, rough estimation is made as shown in Table 3 by applying interview data and penalty rates in 2005. Results indicate the annual maintenance activities cost the member farmers approximately US$ 2,965 per ha, or 41% of the investment cost. This is because the system is constructed with locally available primitive technology which degrades fast. To sustain the system creates a larger burden than a beneficiary can take individually. There is a need to spread cost to a larger number of beneficiaries. For sustainability of the system, the group cannot take the risk of letting any member leaving the system. If the membership declines, remaining members must absorb higher cost and such cost may exceed their capacity, resulting in the collapse of the system.

From the wet season cultivation, which is the original reason for their system development, the farmers earn a profit of US$ 42.87 and -108 per ha from paddy and soybean, respectively. They also earn additional profit of US$ 5,330 and 79 per ha of garlic and soybean in the dry season. Annually, they earn more than US$ 5,200 profit per ha per year or US$ 2256.75 after monetized water cost.

Management

The manager of the irrigation group was elected for an unspecified term. In this compact size system, he worked directly with member farmers; hence no assistant was appointed. The group had no written rules or committees, so agreements and all collective activities were transacted verbally. Major agreements of the group including those on water and cost sharing are made as a pubic commitment in their own rhetoric at their annual meeting. Regarding water

Table 3: Costs and Profits of Irrigation and Cultivation in the Pongsak System

		Unit		Unit Rate	Total (US$)
ANNUAL WATER COST					
Weir Maintenance					
Wood	3,575	pieces	0.18	$ per piece*	625.63
Labour	163	man-day	6.25	$ per day*	1,015.63
Cash	1,625	per cent	12.50	$ per 100%	203.13
Tool	24	pieces	0.50	$ per piece*	12.00
Ditch Maintenance					
Labour	163	man-day	6.25	$ per day*	1,015.63
Tool	24	pieces	0.50	$ per piece*	12.00
Remuneration	1,625	per cent	5.00	$ per 100%	81.25
Annual Water Cost	***15.84***	***ha***	***187.20***	***$ per ha***	***2,965.25***
RICE CULTIVATION COST & PROFIT PER HA					
Land Preparation	3.13	man-day	8.75	$ per man-day	27.34
Seed	43.75	kg	0.35	$ per kg	15.31
Transplanting	6.25	man-day	3.00	$ per day	18.75
Fertilizer	1.56	sack	12.50	$ per sack	19.53
Harvesting, hauling, thrashing	43.75	man-day	2.50	$ per day	109.38
Cultivation Cost					***190.31***
Yield Price	***3,406***	***kg per ha***	***0.13***	***$ per kg***	***425.78***
Profit Per Ha (After deducting annual water cost)					***48.27***
GARLIC CULTIVATION COST & PROFIT PER HA					
Land Preparation	1	ha	585.94	$ per ha	3,662
Furrow Making	6.25	man-day	3.00	$ per day	19
Hay purchase	5,625	bunch	0.03	$ per bunch	141
Bulb Preparation	187.50	kg	0.10	$ per kg	19
Planting Labour	56.25	bins of bulb	3.00	$ per bin	169
Weed Control Solution	6.25	unit	93.75	$ per unit	586
Weed Control Labour	62.50	times	3.75	$ per time	234
Fertilizer	12.50	sacks	13.75	$ per sack	172
Harvesting	62.50	man-day	3.00	$ per day	188
Cultivation Cost					5,189
Yield Price	***23,375***	***kg per ha***	0.45	***$ per kg***	***10,519***
Profit Per Ha (Without deducting water cost)					***5,330***
SOYBEAN CULTIVATION COST & PROFIT PER HA					
Seed	50.00	kg	0.28	$ per kg	13.75
Planting	18.75	man-day	2.50	$ per day	46.88
Fertilizer	6.25	unit	3.13	$ per unit	19.53
Harvesting	18.75	man-day	2.50	$ per day	46.88
Shelling	750	bin of 15 kg	0.25	$ per 15 bin	187.50
Production Cost Per Ha					315
Yield Price	***1,125***	***kg per ha***	***0.35***	***$ per kg***	***394***
Profit Per Ha in Wet Season (After deducting annual water cost)					***- 108***
Profit Per Ha in Dry Season (Without deducting water cost)					***79***
Annual Profit Per Ha Per Year (Paddy and Garlic)					***5,378***
Annual Profit Per Ha Per Year (Soybean and Garlic)					***5,222***

Remarks: * Penalty rates are applied.
Conversion rate: 40 Thai baht/US$, 6.25 rai/ha

sharing, they agreed to a less management intensive water management method which is workable in their water abundant environment. Regarding cost sharing, in their own way and own words, they divide necessary cost into three categories, namely the weir maintenance, canal maintenance and remuneration to the irrigation manager. Such division is slightly different from modern division of irrigation work in which construction, operation, maintenance and management are often treated as major divisions. Their expression also reflects that the weir maintenance task in the Pongsak system actually covers construction, operation and maintenance divisions. It is a construction work in the sense that the annual maintenance of wooden-rock crib weir is nearly a

reconstruction because the wooden weir degrades rapidly, and without maintenance they would soon lose the weir totally. It is an operation work in the sense that when water diversion is not adequate, the members prefer to take actions to divert more by filling up weir gaps, augmenting weir crest, or setting up an intercepting bamboo weir during low flow, instead of changing their water distribution unless there is extreme necessity. Thus, such maintenance is in itself an operation work. Likewise, the canal maintenance covers the construction, operation and maintenance. It is a construction and operation work in the sense that the canal capacity must be adjusted to be able to serve every *Muang Fai* member. Regardless of the rhetoric, Pongsak members understand what cost they are referring to, what scope they cover, how much necessary they are, and what cost they require. Their understanding makes them willing to make a public agreement in the words that they understand.

The irrigation manager had a vital role as the focal point in coordinating, informing members when to maintain the system, keeping accounts and working rosters, handling logistics, monitoring and policing the system. He contributed money, labor, construction materials and equipment for maintenance activities like other members. He was remunerated based on the farm intake percentages. In 2005, the members agreed to pay the manager after wet season paddy harvest at the rate of US$ 5 for a 100% intake width as shown in Table 1. The irrigation manager was not remunerated after the dry season crop harvest even though all member farmers grew dry season crop for commercial purpose and the manager took action for irrigation even in the dry season. The irrigation manager is accountable to the group and demonstrates a clear principle in keeping group agreements. His book-keeping de-aggregates costs of each work category in a clear way. For weir maintenance, the classification includes labor, wood, tools and cash. For canal maintenance, it includes labor and tools. For irrigation manager remuneration, it includes cash only. After classifying them, the members distribute them categorically to each member. Each category or sub-category of costs is handled in a clear-cut way, e.g. the cost of wood stakes in different sizes is distributed categorically. A re-allocation across one cost category or sub-category to another is not allowed because of the difficulty in setting up acceptable exchange ratios, and the risk of failure in mobilizing adequate costs in each category. Affordability is also a sensitive issue for this group. In contrast to other modern systems in which users just pay money and a management team will take care of the work, the Pongsak system is situated in a remote region where costs are more affordable in kind. Acquisition of local materials and contribution of own labor and time makes it possible to realize this system. Difficulty of work is well considered in work distribution, as clearly illustrated by their division of canal maintenance work under which each canal team is given a portion of work with various difficulty levels instead of just any portion of work, and the joint effort to acquire foundation wood logs which member farmers cannot contribute individually. In brief, the Pongsak members participate in a cross section of work and cost categories. With this clearly de-aggregated cost-sharing and book-keeping system, the members are more willing to take part than in a single combined rate which might raise fear of unfair transfer of burden.

The Soprong Large Scale Muang Fai System

General Features of the Irrigation System

The Soprong rock-filled weir is located in Soprong Village Moo 5 in the Nongtong Municipality of Amphoe Hangdong, west of Chiangmai City. The weir height varies from 1.5 to 2.8 m. Its length is 80 m spanning the Ping river. Originally, there were two traditional wooden weirs, the Soprong and Ronkruakham, which had been in existence at least 300-400 years, but they were merged 29 years ago and formed the present Soprong weir. The merger and strengthening of the weir was implemented under a state-funded project on the condition given by the members of the wooden weirs that the state does not assume the management of the system.

The Soprong system serves irrigation water to 936.48 ha on the right bank of the Ping River in Sanpatong District in the south of Hangdong District. Most of the service area is in Tambon

Table 4: Average Monthly Rainfall in Sanpatong District

Rainfall	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	Total
Max (mm)	158.2	306.8	204.9	290.4	352.9	514.0	272.8	338.1	119.4	84.2	43.9	136.0	2821.6
Average (mm)	37.2	119.4	83.5	123.1	146.9	178.3	102.1	40.5	9.7	6.8	4.3	8.5	860.2
Min (mm)	0.0	0.0	0.0	13.5	20.6	47.4	8.5	0.0	0.0	0.0	0.0	0.0	526.1

Remarks: 49 year average (1952-2004)
Sources: Upper North Hydrological and Water Management Center, 2004

Table 5: Villages Names, Irrigation Areas and Membership of the Soprong System

No.	Village	Tambon	Village Area (ha)[1]	Irrigation Area (ha)[2]	Irrigation Members (persons)[2]
1	Sanpong	Maeka	73	45	42
2	Saimul	Maeka	119	41	49
3	Sankhokchang	Maeka	112	49	55
4	Mae Khongtai	Maeka	253	287	158
5	Mae Khongklang	Maeka	73	87	77
6	Rongkhut	Maeka	106	39	54
7	Mae Khongnua	Maeka	48	78	40
8	Maeka	Maeka	140	40	24
9	Pakluay	Maeka	107	82	77
10	Mae Kungnoi	Thungtom	103	40	37
11	Dong Khilek	Makhamluang	118	68	57
12	Dong Pasang	Makhunwan	184	81	70
	Total		1,436	937	740

Remarks 1: Source: Tambon Maeka Administrative Organization 2007
2: Source: Chiang Mai Provincial Irrigation Office 1999

Maeka, with a few in nearby tambons. Tambon Maeka communities expanded extensively after residents of Ban Nongtong in Hangdong District, where the weir is located, migrated and settled permanently in the farming area in 1948 and built the first community temple in 1949. As it is situated in a rain shadow area, local natural rainfall is insufficient for agricultural purposes. Table 4 shows that, based on the 49-year rainfall statistics, the average monthly rainfall in the Sanpatong District is very limited, with only August and September having an average rainfall above the average monthly evaporation rate of 135.16 mm. However, the area has a catchment that brings in abundant river flow through the Ping and small streams on the west. At the weir, the river has the annual discharge of 760 MCM (Chiangmai Provincial Irrigation Office, 1999). Prior to the construction of the Mae Ngat reservoir, located upstream of the Soprong system, farmers can practice farming only after floods receded. The Mae Ngat dam has lessened flood problems and stabilized water availability, making it possible to farm during both the wet and dry seasons.

The Soprong irrigation system distributes water through its 7.8 km-long main canal that traverses 12 villages in Tambon Maeka, Tambon Thungtom, Tambon Makhamluang and Tambon Makhunwan of Sanpatong District, Chiangmai Province. See Table 5 for village names, irrigation areas and membership. The main canal fans out into nine lateral canals, each of which serves one or more villages. Local farmers are very careful to provide sufficient drainage capacity in this former flood-prone area. There are a number of waste ways to drain both the excess flow in the main canal and side flows from the western mountains down to the Ping River in the upper reach section of the main canal to prevent damage to the irrigation system.

Farming is the major occupation in the area, with 89% of farmers being land owners with an average land holding of 0.74 ha (Chiangmai

Provincial Irrigation Office, 1999). In low farmland, paddy can be cultivated twice a year. Crops are being extensively diversified into longan, mango, papaya, and many kinds of upland and vegetable crops over approximately 35% of the service area (Chiang Mai Provincial Irrigation Office, 1999). The extensive crop diversification reduces irrigation water demand and introduces the furrow and lifting irrigation methods in the areas, allowing farmers to keep water stock in their furrows and ponds, lessening irrigation time conflicts among users. Now that the system starts to have high water surplus, farmers in the former service areas of Soprong in the tail reach, such as Ban Rongwua, who left the Soprong system in 1981 have expressed their interest in re-joining the system in the dry season to supplement their irrigation water from the public Mae Taeng irrigation system of which irrigation rotation schedule is not well publicized and realized in the area located 50 km from its headwork.

Management Structure

Organizationally, the management of the Soprong irrigation system is led by the Muang Fai manager who is directly elected by irrigation system members. The major difference in the management of small and large scale systems is how the manager and the members cope with the scale. In a large scale system, the manager cannot afford to directly contact every member and it is difficult for every member to see and understand what he is doing. It is also difficult for the manager to obtain accurate information about the members and their farms, as well as the time and place information needed for irrigation water management. As a result, the probability of information asymmetry among members is very high and can easily lead to distrust among members and the collapse of the Muang Fai group. To handle this problem, the Soprong group has members of each village nominate their own representatives to work with the Muang Fai manger. The twelve village irrigation delegates are endorsed by their respective village headmen. In the villages where the number of irrigation water users is not substantial, they are entrusted to the irrigation delegates of a nearby village. The Muang Fai manager appoints an assistant and the group employs a villager residing near the weir to look after it. The official term of the management team is indefinite as they are expected to continue throughout their lifetime or until they resign for personal reasons.

These village irrigation delegates compile information in their villages for the Muang Fai manager. However, as the first duty of the village irrigation delegates is to defend the water rights of irrigation members in their villages, the Muang Fai manager is faced with the problem of whose information is to be used when they are in conflict. To solve this problem, the Muang Fai manager requests all village irrigation delegates to meet and exchange information, a process under which checks and balances are also done, in order to reach public consensus about how the Soprong can be integratedly managed by the village groups. The consensus building process of this Muang Fai system is different from a state irrigation public hearing or announcement by the state irrigation management plan because it is a process of joint decision-making, not one of decision announcement or public relations. The trust that the Maung Fai manager has gained from their members through the direct election ensures his accountability to every member regardless of their villages. He is mandated to declare the final agreement for all members, giving the Muang Fai group a common goal and plans. Through this method, the management system can meet the needs of all members in the Soprong system through synchronized management of the village irrigation groups.

The annual inter-village irrigation management planning is a crucial management instrument. Only through information exchange, negotiation, mediation, and consultation with village irrigation delegates can the information be pieced together and information asymmetry among the delegates reduced and a common information ground created for formulating a joint irrigation management plan and cost distribution. The Muang Fai manager declares the consensus of the meeting to be the final agreement, which every village irrigation group has to abide by. This agreement is announced at the general assemblies, which are held once or twice a year, in January and/or June, at the residence of the Muang Fai manager or at a temple in the village where the manager resides. In the assemblies, the

water and irrigation facilities conditions assessment report, annual working schedule and group fund status are delivered to the members, and the water distribution method confirmed. Ideas, if any, are exchanged on how the system can be improved. However, as the water allocation and resources mobilization plans have become stabilized over the years, an increasing number of members prefer to leave matters to their village irrigation delegates to handle. This has resulted in a decline in the number of persons attending the assemblies. The members obtain information on the contents of the agreement through their village irrigation delegates, and on the days they congregate at the weir to perform maintenance activities.

Village Irrigation Delegates: Intermediaries and Beyond

The village irrigation delegates do not act merely as intermediaries between village groups, but as the authorized delegates of the village irrigation members to defend their rights to the irrigation water in the inter-village irrigation water management planning. To effectively perform this work, the delegates must have accurate information on farming conditions, water requirements and irrigation facilities in their villages. The delegates come to the meetings as mediators wanting to build a consensus, or win-win solutions, which is a rational approach important for participation (Vattanasap 2001, Phanthasen 2001). After the final water management agreement is declared by the Muang Fai manager, the delegates have to monitor the implementation of the system-wide water management plan, especially during water shortage periods, and seek justice from the Muang Fai manager if violations occur. They are also obligated to mobilize resources from their villages for maintaining and repairing the irrigation system together with other villages.

The village irrigation delegates play a crucial role not only in the inter-village management, but also inside their own villages. They are committed by the inter-village irrigation management agreement to organize water management in their villages in compliance with the system-wide plan. Their ability to understand the hydraulic, farming and social dimensions of the system is the key to making the intra-village irrigation management process work, as it must not alienate any members, and at the same time must not undercut the inter-village irrigation management process. They must have a thorough knowledge of both the members and their individual water needs, and the skills to combine the individuals' water needs so that every member can obtain the necessary water. In some villages, the delegates are also in charge of operating major irrigation and drainage structures, operation of which would create conflicts if individual members were allowed to freely operate them. They have to oversee the intra-village operation and mediate conflicts or constraints that may occur from time to time. Their tasks are rather tedious, comprising both daily and annual tasks. Managers performing this type of management must be more responsive than managers working in a bureaucratic system during office hours.

The village irrigation delegates have many tasks to perform, but their remuneration is not substantial. What, then, motivates them to accept the tasks and what makes them successful in performing their tasks? The claim that leaders of tertiary and secondary irrigation canal groups in national irrigation systems cannot be so effective because they are not paid is not necessarily true. In this case study, the social recognition that the village irrigation delegates gained in their society is considered as having great value and their success also comes from their status as the delegates of village irrigation members, who are endorsed and supported by village headmen in performing inter and intra village irrigation management planning. Their status comes from the social system, unlike that of canal leaders in state irrigation systems that is created under the hydraulic system, and thus all village irrigation members are obligated to cooperate with them. If they are not cooperative, the village irrigation delegates can impose penalties on any member who violates the intra- and inter-village irrigation rules, or can choose to abandon the job and leave the village irrigation members without delegates to defend their rights, an event that other irrigation members will not allow to happen.

The cross social ties between the village irrigation delegates and village irrigation members, and between the members and the top Muang Fai manager, are hard to cultivate. As a result, irri-

gation members try to keep their village irrigation delegates and the Muang Fai manager in position as long as they can, and thus the term of these positions is long or even life long. The social sanction relationship between the village irrigation delegates and village irrigation members is very distinct from the relationship between the state irrigation officers and the farmers in state irrigation systems, in which there is no such mechanism for social sanction because the farmers consider the officers their free service providers, not their delegates. The decline in the number of attendees in the general assemblies due to the stability of water management plans that have been in place for years may harm the momentum of the three-level, cross relationship between the Muang Fai manager, village irrigation delegates and village irrigation members.

Village Social Relations Support Hydraulic Management

The use of the village as the basic unit of irrigation management reflects the fact that the Soprong Muang Fai group has placed people and the communities they live in at the heart of the hydraulic management system. This practice coincides with a school that believes in the village potential as the key to improving people's livelihood (Nartsupha and Lertvisha 1994, Nozaki and Baker 2003). In the case study, villages are still fairly strong, as proven by the frequency of village meetings. For example, the Mae Khongtai village held over ten formal village meetings during the past year to consider many important issues. Irrigation systems serve people. However, people naturally have diverse attributes or motivations. There is thus a need to unify them in some way so that they can work together on agricultural water problems. Instead of using one of the irrigation facilities, such as the tertiary, secondary, primary canals or headwork as the basis for organizing people as in some state irrigation systems, the Soprong Muang Fai group uses the village, a social unit, to organize the members. Details of their joint hydraulic management plan come after they get organized. When an irrigation management plan is developed through a social process such as the one in this system, it is effective and sustainable because it is respected by the people who create it. The efficiency of the plan is influenced by the quality of the information on hydraulic conditions that the people, or their representatives, possess and/or comprehend and the technology in use.

Presently, the management team of the Soprong group tends to seek more assistance from the local government for the repair and improvement of their irrigation facilities. Under the present country-wide administrative reform, local governments are gaining greater authority in charting their local development plans and are able to obtain a larger proportion of their development budgets from the state government. This new channel will increase the visibility of the irrigation management to the local community, and enhance the integration of irrigation with other related sectors such as agriculture and water resources management. However, the relationship between the Muang Fai group and the local government must be clarified so that the irrigation system can continue to render the highest and equitable benefits to all irrigation members in a long run.

Financially, the management team is authorized by the members to collect irrigation assessments from members at the rate of US$ 0.72 (at the exchange rate of 35 Thai baht per US$) per 0.16 ha or one rai. This rate has been increased periodically from US$ 0.43 to US$ 0.57 in 2005, and to US$ 0.72 in 2006 to cover maintenance necessities and improvement plans. The assessment payment has a nominal importance because it signifies the membership of the payer and guarantees him the right to share irrigation water from the Soprong system. As crop diversification is generating higher income, there have been discussions between paddy farmers and high value crop farmers whether the assessment is too low or too high. The assessments are collected by the village irrigation delegates and brought to the Muang Fai manager, who allocates the amount in the following way.

- US$ 0.17 for the Muang Fai group fund to be used for maintenance of common facilities including lateral canals
- US$ 0.20 for the Muang Fai manager
- US$ 0.20 for the village irrigation delegate
- US$ 0.12 for the assistant to the Muang Fai manager

• US$ 0.03 for the weir tender

Irrigation Operation and Monitoring

As a weir does not require intensive operation, the Soprong group simply employs a nearby resident to look after and report problems, if any, to the Muang Fai manager. Normally irrigation water is supplied continuously. Members are not allowed to check up the water level in the main canal. When there is water scarcity, the Muang Fai manager decides, after consulting with village irrigation delegates, on a fixed rotation schedule which starts from the tail reach villages and moves upwards. The village irrigation delegates monitor whether the rotation is practically and strictly followed in the field. Violations of the water management agreement are handled publicly by the Muang Fai manager himself with the highest penalty of 2,000 baht.

Generally, the secondary canals, some of which are shared by two or more villages, supply irrigation water on continuous and simultaneous basis. When water becomes scarce, related village irrigation delegates negotiate for a weekly rotation, which is subject to a confirmation by the Muang Fai manager. For example, the Mae Khongtai and Mae Khongklang villages, which share a lateral canal, agreed that the former would use the irrigation water from Tuesday to Friday while the latter would use it on other days. Normally, no member is allowed to check up the water level in the lateral canal. However, members can be permitted to check up the water level in the lateral canal to divert water into their field after the related village irrigation delegates have confirmed that they need to do so due to geographical constraints. The special permission is limited to a one-night water check-up from 5.00 p.m. to 5.00 a.m the next day. The presently extensive crop diversification, and the furrow and lifting irrigation methods have changed the irrigation water demand pattern and reduced the necessity for irrigation rotation.

At the on-farm level, farm owners determine the size of and operate the irrigation inlets to their farms by themselves. Normally, the sizes are four to six inches, a size which was originally determined by using a traditional match box as the measuring instrument. Larger sizes are not always preferable even though the irrigation cost is not related to the farm inlet size. The Soprong system has mo constraints in terms of water availability and irrigation system capacity; larger size farm inlets would only result in the necessity for frequent inlet adjustments. Paddy farm inlets are in the form of simple cuts in the earth bunds. Inlets in other kinds of farms are in the form of pipe inlets.

Maintenance Arrangements

To maintain the rights to use the irrigation water, every Muang Fai member must pay an irrigation assessment and contribute labor to maintain the weir, main canal, and common lateral canals. The village irrigation delegates are in charge of fulfilling the commitments of their village irrigation group. Members who fail to contribute labor for maintenance purposes are subject to a 200 baht per man-day penalty. The village irrigation delegates can use these penalties to employ other labor for the Muang Fai group maintenance activities and for the internal village irrigation activities.

The arrangement for the maintenance of the Soprong Muang Fai irrigation system is not strictly analogous to the arrangement in the small-scale Pongsak Muang Fai irrigation system. In principle, at the individual level, every member is required to work for the maintenance, but not all members are practically required to participate in the main irrigation system maintenance as in the small scale Pongsak system. This is because not much labor is required for maintenance work. The effect of the economy of scale has led the large scale Muang Fai group to make it a rule that every village must send one laborer for every 10 rai (1.6 ha) of service area. Members who have less than 1.6 ha are allowed to combine their acreage with other members through personal arrangements to form a unit and send one laborer on their behalf with acknowledgement from their village irrigation delegates. Members sometimes make agreements with more than one fellow member. This personal arrangement can be considered as strengthening the social cohesion among the members. However, some members do not or cannot make any agreement with other fellow members and thus have to work more than

those who can. In this case, the number of laborers will be higher than required from the village group, and village irrigation delegates may consider setting the extra labor aside for other internal village maintenance occasions.

The weir maintenance work is normally scheduled in April, when the river flow is at its lowest. The appointment date and time is disseminated through the village irrigation delegates with support from their respective village headmen. The weir maintenance work is allocated to each village irrigation group in proportion to the service area in their village and the scale of damage to sections of the weir. In the past, members were required to contribute two wooden stakes and two sand-filled bags per 0.16 ha (one rai), but nowadays the work does not require any additional materials. Only equipments to pull the fallen rocks back to the weir are needed. The problem of how to decide which village should perform work on the most difficult part, i.e. the mid-section of the weir, is solved by distributing work sections by drawing lots.

The canal maintenance is conducted twice yearly in January and May, before the start of the cropping season. The maintenance work on the 7.8-km long 2-3-m wide main canal is allocated to each village in the upper reach down to the lower reach based on a one meter per 0.16 ha irrigation area. Once Muang Fai members finish the allocated work up till the end of their village territories, they do not have to continue working on the remaining canal section. Members in the lower reach villages must continue the work until the end of their village territories. The canal maintenance work allocation as illustrated in Figure 4 is different from the small-scale Pongsak system, in which all members work together in the entire length of the canal. This apparent unfair arrangement is influenced by three factors. First, the historical merger of the two traditional wooden weirs, which served villages in different reaches bore influence on the arrangement. Before the merger of the two traditional wooden weirs into the Soprong weir, the downstream villages used to clean the long canal from their weir down to their villages on their own. This may make them regard the agreement by the upstream villages to work with them in the upper sections as assistance to them on those sections, hence their agreement to the arrangement. Second, the fact that the majority of the members concentrates in the upper reach has influence on how the group manage their maintenance activities. The downstream villages may request the upstream villages to clean the upper section while the downstream villages clean the lower section. However, if the downstream villages had proposed this, then it would not have given the downstream farmers confidence that the upper sections would be cleaned sufficiently enough to facilitate the water flow to their villages. Thus, they were willing to participate in the maintenance of the upper sections. Also, the quality of the work that they are sharing in the upper sections is not arduous, because the upper villages have larger service

Sections of the main canal in the territory of village No.	The villages where the canal maintaining teams working on the sections come from											
	1	2	3	4	5	6	7	8	9	10	11	12
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4				✓	✓	✓	✓	✓	✓	✓	✓	✓
5					✓	✓	✓	✓	✓	✓	✓	✓
6						✓	✓	✓	✓	✓	✓	✓
7							✓	✓	✓	✓	✓	✓
8								✓	✓	✓	✓	✓
9									✓	✓	✓	✓
10										✓	✓	✓
11											✓	✓
12												✓

Figure 4: Illustration of Canal Maintenance Work Allocation in the Soprong System

areas than theirs, and hence greater work portions than those assigned to them. Thus, they agreed to participate in maintaining the upper section, which gave them the opportunity to monitor the quality of the maintenance work in the upper sections. The downstream villages could have requested the upstream farmers to work with them down to the tail-end. However, since the acreage and membership of the upstream villages are larger than those in the downstream villages, this naturally biased economy of scale does not necessitate the upstream villages to seek an increase in membership to share the heavy workload, as in the small-scale Pongsak Muang Fai system. Thus, the downstream villages have to accept the present agreement. Third, the fact that the maintenance work is mainly weeding using only knives is not so tough as in the difficult terrain of Pongsak system. The number of days each village irrigation member works on the canal maintenance varies according to his village location, but generally all the work can be finished within 1-2 days.

From the perspective of an outsider, the rule that upstream villages can stop working on the remaining canal section beyond their villages appears unfair to the downstream villages. However, from the viewpoint of insiders, equality can be acceptably translated into differentiated levels of participation that outsiders may view as inequality. Understanding why there is a deviation from the strict principle of equality, at least as perceived by an outsider, requires knowledge of the local conditions, history and situations of the village irrigation delegates. As long as the delegates know and accept these, they can establish an agreement that they and their village irrigation members are prepared to abide by. The inter-village irrigation management planning meeting is the arena where such common knowledge is accepted and a consensus is reached.

Such differentiated levels of participation, or apparent inequality, in a self-reliant, or in other words, a private, large scale irrigation system like the Soprong system, are accepted through the social processes. Can this social process take place in a government irrigation project and fairly treat irrigation beneficiaries? Should it be allowed to take place in the project, which is invested, fully or partially, by taxes collected from all tax-payers and partly allocated to the irrigation sector under the expectation that the investment will improve the livelihood of the people and the economy of the country? Or should the project be considered as a juncture in historical developments that lever up all irrigation beneficiaries to an equal status for further participation for the success of the government project? This is an important issue that irrigation bureaucrats have to understand in creating a sustainable participatory structure.

The arrangements for maintenance of secondary canals in each village vary according to the agreement within the village irrigation group. For example, the Pa Kluay village irrigation members are allocated to maintain two meters of canals or drains per 0.16 ha until their farm inlets. For the supply canal they work from the head-end to the tail-end, but for the drain canal they work from the tail-end upwards to the head-end. The supply and drain canals are of comparable lengths. Therefore, this arrangement is fair to the members because it ensures that the sections of supply and drain canals that they depend on have been properly tended. This arrangement is not the same as that of the Mae Khongtai village irrigation group. In this village, the members clean their village lateral canal together, without allocating work portions to individuals or smaller groups. For the lateral canal that this village shares with another village, the two villages allocate a 30-m section to each village up until the end of Mae Khongtai territory.

Presently, the Muang Fai group is facing with the problem of reduced labor contribution for maintenance activities. The problem stems from the method for calculating the labor requirement which allows for a rounding-off of land units below one rai (0.16 ha). Since familial inheritance is fragmenting land into smaller pieces, more rounding-offs are occurring. Every 3-4 years, the Soprong Muang Fai group sought and obtained assistance from the Tambon Sanpatong Administrative Organization for major maintenance and repair. Some Tambon Administrative Organization leaders had an opinion that the Soprong Muang Fai system should be managed by the Tambon organization, but faced resistance from the present Soprong management team, who believe the organization does not have

the capacity to thoroughly manage the irrigation system, as many tedious tasks are required. Their opinion coincides with comments that irrigation service contracts may not work because the contractor's staff cannot successfully solicit farmers' cooperation, as in the Muang Fai systems (Natsupha and Lertvicha, 1994).

Conclusion

The study reveals that the Muang Fai irrigation systems were developed and maintained for decades or centuries by farmers who voluntarily identified themselves as members of the systems. The Muang Fai irrigation systems were developed in areas endowed with adequate water resources, and their developments were relating to land owning. Additional membership in post-development was subject to acceptance of the pioneering members and bore some costing. The headwork of the systems were located in higher elevation where water could be easily augmented and diverted down to the end of the main canal by gravity without checking up the canal water level. The capacity of the main canal was a simple summation of all members' water requirements because this run-of-the-river system has no river flow limitation. When water becomes scarce, an increase in the system capacity, not a time-based water distribution rotation, is preferable. The cost for Muang Fai system development was too high for any individual farmer to afford. The major cost of the Muang Fai group come from weir and canal maintenance. These reflect two major problems that the group has to solve, i.e. how to get water and how to distribute water. To get the water, the group members must decide how high and firm or less permeable, the weir should be maintained and they need to know the total water requirement, which they get through summation of self-expressed water needs of each member farmer. The two systems used different bases for expressing water requirement. The small scale system used the farm intake size as the basis while the large scale system used the farm area. These bases are also used as a basis for distributing cost. Because of high cost, social organization became necessary and the Muang Fai organizations were very sensitive to maintaining a sizeable membership to dissipate the cost. The small scale system exercised extreme effort to keep their limited membership while the large scale system submitted to the majority.

The Muang Fai organization members decided their water management plan through exchange of information, directly or through their delegates depending on the scale of the systems. The actual operation of the plan strictly followed the plan with deviations allowed only after being proved as inevitably necessary to enable all members to get irrigation water. Generally, Muang Fai irrigation systems distributed water by a continuous and simultaneous method. When some of the members could not, the Muang Fai organizations primarily opted to increase the irrigation supply capacity, an expensive choice, rather than adopting the complicated time-based water distribution which was a cheaper choice.

The maintenance of the Muang Fai systems was costly, and might not be affordable if all costs were monetized. An agreement on cost estimation and sharing is a public process that uses understood terminologies for cost classifications and kinds, making it clear to cost-sharers the purpose of the cost. The small scale system used the sizes of the irrigation farm intakes chosen by respective farmers as the criteria for sharing the cost while the large scale system used the expressed and monitored farm sizes as the criteria. The distribution of the canal maintenance cost was skewed towards the area with larger number of members. Hence, in the small system case which had a long feeder canal above the most upstream farm, the members shared the cost of the entire length of the canal while in the large system case, in which most of the farms were located in the upper reach, the members maintained only the canal sections that were relevant to them.

The organizational management of the Muang Fai irrigation systems was led by the managers who came into the positions for an unspecified term through direct election. The management of the small scale case was handled briskly by the manager with support from the members while that of the large scale case was participated by the delegates nominated by each village group. The participatory management structure of the large-scale system comprises three-level components of individual members, village irrigation

delegates and the Muang Fai manager, all of whom have cross relations. The Muang Fai manager is related to all members regardless of their villages and has the duty to check and balance the cost and benefit to each village irrigation group by adhering to the principle of equality. The manager must work with the village irrigation delegates, as they have the common duty of achieving consensus on how to jointly manage irrigation matters based on the information on local conditions and needs which the village irrigation delegates provide. The village irrigation delegates must cooperate with their members as the delegates defending their water rights in exchange for remuneration and social recognition. In seeking water rights for their members, the delegates must promise, on behalf of their members, to share the costs of maintaining the system, which their members have to provide. The delegates need cooperation from their members in implementing the intra- and inter village irrigation management and maintenance plans, and have the social sanction instruments, as supported by their delegate status and by the village headmen, as well as the monetary penalty rules, as supported by the Muang Fai manager, to bring this cooperation about. The effectiveness of this management structure comes from four major factors, i.e. its principle of equality, the accountability of the Muang Fai manager and village irrigation delegates to their members, the availability of a platform for information exchange and joint decision-making, and the reliance on the social system over the hydraulic system for the institutional arrangements.

The common principles of the small and large scale Muang Fai systems was their observance of the equality of the members and their efforts to make all their management process transparent to the members even though this meant higher cost. An equal treatment in distributing irrigation water and costs based on the agreed criteria made the members confident in maintaining their participation and the transparency of the water demand and supply information, the water distribution method, and the organizational management made the members confident that they were truly equally treated and thus willing to participate and sustain the Muang Fai systems.

THAILAND: DISCUSSION

Question: What government measures are taken to promote/support Muang Fai Irrigation system in Thailand?

Answer: Before answering this question, I would like to re-confirm that the scope of my presentation today is on the investigation of the participatory management structure and principles of participation used in peoples' irrigation management. It is not about what the government would do to support the Muang Fai systems. However, I will try to supply you with the present situation of MFs. Of course, the government is trying to support in whatever way they can to manage their own systems. For other MFs groups, which can relatively weaken, they are integrated into the service area of state irrigation systems. There are also attempts to strengthen the capacity of the MF groups through networking effort facilitated by the academician.

Question: What is the difference between the tertiary group and the Integrated Management Group in state irrigation systems and your study cases?

Answer: At a first look, the small MF system may appear similar to the tertiary canal group while the large MF system may appear similar to the secondary or integrated water users' group. However, at a closer look on their management, you will find that in most national systems, farmers' managed only at the tertiary and/or secondary canal level. But the small and large MF irrigation systems manage all levels of irrigation facilities from the main system down to the farm irrigation system.

Question: Is the operation and maintenance cost being collected by the user of the resources in your country?

Answer: In Thailand, under the National state irrigation systems farmers do not pay for the operation and maintenance cost. However, they participate in the collective maintenance activities. This is despite the fact that such collection is allowed by the existing laws.

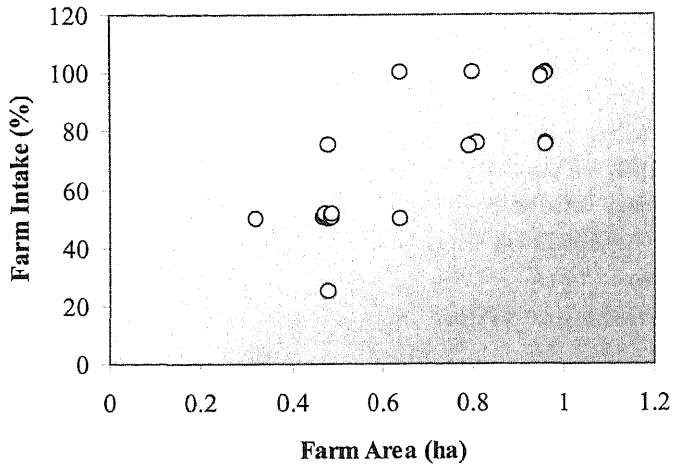

Figure 5: Intake Percentage-Based Cost-Sharing as Compared with the Area Based Cost Sharing in the Pongsak System

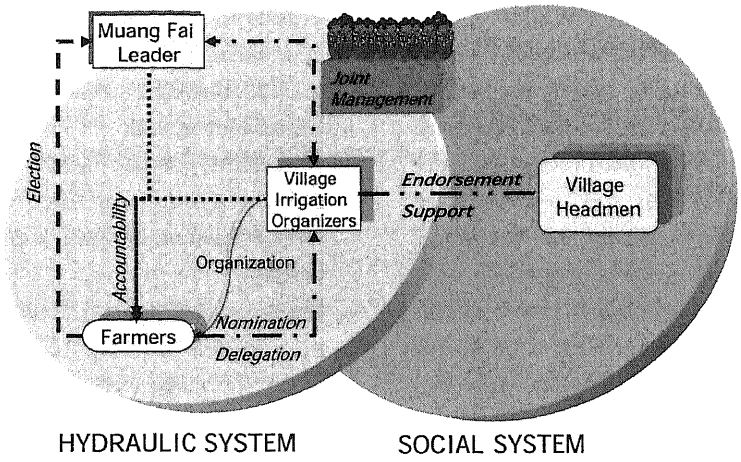

Figure 6: The Participatory Management Structure of the Soprong System