STUDY ON ROLE OF FARMER'S ASSOCIATION IN MANAGEMENT OF THA NGON IRRIGATION PROJECT IN LAO PDR

A DISSERTATION

submitted in partial fulfillment of the
requirements for the award of the degree
of
MASTER OF ENGINEERING
in
IRRIGATION WATER MANAGEMENT

By

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CANDIDATE'S DECLARATION

I hereby declare that work which is presented in this Dissertation entitled, **"Study on role of Farmer's Association in Management of Tha Ngon Irrigation Project in Lao PDR",** in partial fulfillment of the requirement for the award of the degree of MASTER OF ENGINEERING IN IRRIGATION WATER MANAGEMENT, submitted in Water Resources Development Training Centre, Indian Institute of Technology, Roorkee, is a record of my own work carried out during the period from July 16th, 2001 to December 5th, 2001 under the supervision of **Prof. Raj Pal Singh,** Emeritus fellow, WRDTC, and **Prof. V.K. Bairathi,** Visiting Professor, WRDTC, Indian Institute of Technology, Roorkee (India).

The matter embodied in this dissertation has not been submitted by me for the award of any other degree or diploma.

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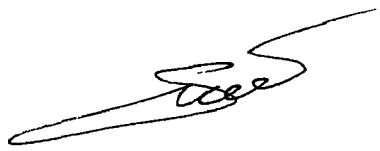

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S Y N O P S I S

The programme of agriculture and forestry development planned through irrigation development scheme in Lao PDR, emphasized. ***"The objective of the programme are to increase rural incomes and stabilize rice availability by expanding irrigated area in both the wet and the dry season and to improve the operation and maintenance of exiting irrigation schemes".***

Hence, here an attempt is made ***to study the Role of farmer's Association in management of Tha Ngon Irrigation project,*** Thoulakhom District, Vientiane province Lao PDR. This project with 400 ha command area started in 1991-1996 showed on encouraging result of farmer's organization. It would reveal that the results of association in irrigation management is much essential viz, farmers participation in water distribution, establishing the regulation of project, to hand over the completed construction to water users group property and into their full right and the interest in the operation and maintenance of the farmer's managed irrigation system.

Water is an important and costly input in irrigated Agriculture. Therefore, its wastage reflects upon the poor operation and maintenance of the system. Equitable distribution of water is a difficult task in almost all irrigation projects, generally in Lao P.D.R. the water distribution is not equitable and efficient. One important reason may be due to non-involvement. The farmer is the actual beneficiary who uses water and therefore, his involvement is necessary. Hence, farmer's involvement right from the stage of planning, designing, execution and operation system is most crucial, and help to improve communication between the irrigation officers and the farmers, and consequently efficient O&M, equitable distribution.

The proposed study is intended to demonstrate that cooperation among farmers is necessary for efficient use of irrigation water and to suggest the new concept of formation of irrigation farmers association in the command area to construct field channels, operate and maintain the irrigation system beyond outlet.

Such farmer's association can play a great role in educating and upliftment of the farmers also.

The analysis of the farmer's reaction showed that the farmers of the tail are less satisfied with the water availability. Therefore, the new management should focus more attention to these areas by proper water management and physical system maintenance. The proper distribution of benefits to the farmers would have significant impact on the performance and participation by the farmers.

This suggests that farmer's association to manage irrigation projects should be tried in other parts of the country as well. The achievements or positive result of the transfer through was considerable comparing almost non-functional canal system before the transfer, there are still for more work to be done to achieve the perceived goal to long-term sustainability of the irrigation system.

The study proposes to critically examine and compare the performance of farmer's participation in five other countries on similar system and scale and to search for adaptable strategies for Lao PDR, on other projects.

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CHAPTER I

PROFILE OF LAO PEOPLE'S DEMOCRATIC REPUBLIC (LAO PDR)

CHARPTER – I

PROFILE OF LAO PEOPLE'S DEMOCRATIC REPUBLIC (LAO P.D.R.)

The Lao People's Democratic Republic (Lao PDR) is a small landlocked country with a landed area of 236,800 sq.km stretching more than 1,700 km from North to South and between 100 km and 400 km from East to West. The Lao PDR has an Eastern border of 1,957 km with the Socialist Republic of Vietnam, a Western border of 1,730 km with the kingdom of Thailand a Southern border of 492 km, with the kingdom of Cambodia, and Northern border of 416 km with the peoples' Republic of China and 230 km with the Union of Myanmar. (Map 1-1).

1.1 Density of population

The population of the Lao PDR in 2000 is 5.2 million, and projected to grow at 2.6% per year. Population density remains one of the lowest in the region, ***with 19 persons per square kilometre.***

Lao PDR is a land lock country of relatively low population surrounded by heavily populated countries, which have already made heavy in roads into their resource endowments.

1.2 Geography

Geographically, two features dominate the Lao PDR: the mountains of the North and East, and the Mekong river and its East-bank tributaries. Extensive mountain ranges with an average eight of 1,200 meters cover an area of 70% of the territory, and fertile flood Plains embraces 30% of the territory, stretching along the left bank of the Mekong River. More than 40% of the land is covered by forests (it can be said that the Lao PDR has a highest forest coverage ratio in Asia) it is estimated that the total cultivated area for agricultural purposes is 710,000 ha.

Lao PDR consists of three major topographical regions: the Mekong flood Plains, the mountainous areas, and the high plateaus. Each region has irrigation opportunities and limitations. Irrigation systems consist of small, medium and large-scale irrigation Wells, water reservoirs and pumping Stations. The emphasis is currently on building and rehabilitating small and medium-size schemes. Past schemes have had s high failure rate, especially large schemes due to lack of technical maintenance and community involvement. Traditional Lao farmers have tried to control water for rice paddy by diverting streams and catchments, creating holding ponds and using other methods to provide water for rice crops.

1.3 CLIMATE

The country experiences a tropical monsoon climate with alternating wet (monsoon) and dry season. Typically, **the wet season extends from April to October** and is dominated by a South West monsoon with high rainfall, temperature and humidity. The distribution within this season is nevertheless uneven, varying respectively to location topography and other factors. **The annual rainfall ranges from 1,300 mm/year in the northern valleys to over 3,700 mm/year in the South.** The heaviest annual rainfall is in August. **The dry season extends from November to March,** a period that typically includes both coolest month (January) and warmest month (March). Average maximum and minimum temperature varies from 16.4° to 30° Celsius.

1.4 Agro-Economic Environment

The situations mentioned in above Para renders Lao PDR comparatively disadvantaged economically in the export of the products of traditional arable agriculture. However, there are emerging comparative advantages in respect of tree products, large livestock and organically grown foods for processing and export.

The Lao Government Forestry plantations and stabilization of shifting cultivation programme has three components:

- The reduction of shifting cultivator by assisting in the development of

alternative agricultural practices (driven by community based irrigation) and other opportunities for farmers;

- **Reduction of forest fires and illegal logging;**
- Allocation of unoccupied land to be managed by Districts and local village communities.

Parallel to the improvement of general education, the programme of human resources development will focus on the training of more qualified technicians and engineers needed in the agricultural and rural sector. The strategy is to train and equip District based, genera-listed farming systems, extension workers to go to the "grass roots" to provide adaptive, field research based extension services, and "on the job" training to motivate upland and lowland farmers, in sustainable and adaptive technology, particularly in areas designated for intensive rural development.

1.5 The food Situation

In 1992-93 the National Statistical Centre conducted the first nationally representative households surveys. These were expenditure and consumption surveys a social indicator survey of the same households, and a village survey. The purpose of these surveys was to document social development issues in Lao PDR. In 1994 a nutritional assessment survey was also conducted with the assistance of FAO, anthropometrical data from 2920 households in the 146 villages participating in the previous three surveys was collected. Several small-scale households and nutrition surveys were conducted by international development agencies during the past decade. Differences in objectives, methodology and definition of food security and notations make comparisons of these findings impossible and the necessary information to describe the food security situation in Lao PDR is thus not available. However the findings from the above the surveys give some preliminary insights that are presented below.


Map 1.1
MAP OF LAO PEOPLE'S DEMOCRATIC REPUBLIC
102°
104°
108°
22°
20°
18°
16°
14°
China
Myanmar
Vietnam
Thailand
Cambodia
Gulf of Ton kin
Lao PDR
South China Sea
Pacific Ocean
Indian Ocean
Phongsali
Luang Namtha
Bokeo
Oudomsay
Luang Prabang
Houaphan
Xieng Khouang
Phonsavan
Sayabouri
Vientiane
Saysomboune
Borikhamsay
Vientiane Prefecture
Khammouane
Savannakhet
Saravan
Sekong
Champassak
Attapeu
PROVINCES
1. Phongsaly
2. Luang Namtha
3. Bokeo
4. Oudomsay
5. Sayaboury
6. Luang Prabang
7. Huaphanh
8. Xieng Khouang
9. Vientiane Municipality
10. Vientiane
11. Saysomboune
12. Borikhamsay
13. Khammouane
14. Savannaket
15. Champassack
16. Saravane
17. Sekong
18. Attapeu
0 50 100 150 km
0 50 100 mi

World Bank report revealed that 46.1 percent of the Lao population falls below the poverty line and 21.6 percent has expenditure below the food poverty line. They further found that there are large differences in the incidence of poverty across urban and rural areas and across regions. The incident of poverty is 53 percent in rural areas and 23.9 percent in urban areas. Among the three regions, the south has the highest incidence of poverty (59.8%), and the center has the lowest (40.4%). However, the number of people affected I higher in the center than in the south. The report also presented data on the nutritional status of less than five years old. These results corresponds with the findings on poverty incidence and the results old the 1994 nutritional assessment study and suggest that chronic food insecurity is an important problem in Lao PDR, in particular in rural area.

A survey conducted by the Ministry of Health in nine villages in the Centre and in the south found that insufficient consumption of rice, root crops, legume, vegetables and fruits normally occur in the rainy season and lasts, on average, 3-4 mouths. Insufficient income, insufficient production and natural calamities were identified as the main causes for food insecurity.

Diets in much of Lao PDR are limited. Rice provides most of the energy content. Only a small proportion of daily food intake includes vegetables, fish and meat. The level of micronutrient deficiencies, the most serious of which could be iodine deficiency disorders (IDD), are widespread. The national IDD survey conducted in late 1993 revealed that 95% of the low populations suffer from various degrees of iodine deficiency and 65 percent of the population is severely affected. This disease is caused by low levels of thyroid hormones, which are essential for the normal development of the brain and nervous system. IDD causes focus damage and death and is particularly serious in very young children, where the disease results in irreversible mental retardation. The government responded to these alarming findings and since May 1995, all salt produced or sold in Lao PDR is made iodized by law. A national Vitamin A Deficiency (VAD) survey conducted in April 1995 revealed that VAD is also a serious problem, VAD causes impaired vision, increases the risk of contracting infections and prolongs on exacerbates the course of illness. The problem is seasonal and pregnant women are particularly at risk.

However, no national data exists on Iron Deficiency Anemia (IDA), although a survey of four villages showed that 34.4 percent of women were anemia of these 4.9 percent were severe. Anemia can impede leaving lower labour productivity because of tiredness, and is a cause of maternal mortality, Calcium and Vitamin B deficiencies are also reported by physicians to be an important problem but sufficient data are not available to quantify the problem. **Rice is imported to meet staple needs.**

Nevertheless, the following discussion shows the main constraints to increased food availability.

1.6 Main Constraints

The main constraints to increased food availability in Lao PDR are:

- Low level of education and inefficient agricultural services pose a constraint to the transfer of new and improved technology and information. While the low input, low risk and low output farm technology is appropriate for subsistence production, is places a tight limit on productivity increases. Moreover, labor constraints appeared to substantially limit expansion into new land areas under such production techniques. The scope to increase agricultural productivity and hence returns from farming through improved technology is significant, both for crop and livestock production.
- The limited extent of farmers' market integration and the consequent concern with food self-sufficiency results in very limited crop diversification. Rice is produced in almost 97 percent of all villages. Stronger consideration for comparative advantages in production is conditioned by access to efficient in –and output markets and infrastructure.
- Declining soil fertility in the uplands where slash and burn is practiced population pressure, particularly in the northern region has resulted in a shortage of land in the more accessible areas. This, in turn has led to a reduction in the fallow period with two economic consequences: a decline in soil fertility and an increase in the number of weeding, which again have lead

to the clearance of more forests for crop production, adding to environmental damage.

- Increasing urbanization results in turning high potential agricultural land away from agricultural production, thus decreasing cropland availability. Unexploded ordnance results in denial of expansion of cultivated land area, particularly in certain areas in the north and along the eastern border where large tracts of land can only be farmed at great risk. Each year exploding ordnance causes great human suffering. Well over two million tons of ordnance (primarily antipersonnel cluster bombs) was dropped over Lao PDR and extensive ground battles left an additional staggering amount of unexploded ordnance such as mortar shells, munitions, land mines and other contrition. Twelve out of 18 provinces and more than 50 percent of Lao territory continues to be affected by unexploded ordnance.

In view of the existing condition and farmer's operational efficiency, an attempt was made to analyze and study the farmers' role and Water Users Association.

Siane Saphanthong (1996): Acting, Minister, Ministry of Agriculture and Forestry, Lao PDR observed that in the last decades the Government of the PDR has invested in the construction of different size and kind of irrigation systems. Enormous amount of funds has been provided in the form of grants and loans from the local budget, from international agencies and from friendly countries to create irrigation systems. However, those support are still not enough if the water supply demand I considered for development of irrigated agriculture, and the agriculture production potential of the country. One of the main problems being faced in irrigation is that many irrigation systems have been constructed not according to the required technical norms. They have been left without proper maintenance and proper management, thus leaving the systems in very bad physical condition and in very low economical return. Due to the above situation, the government has elaborated new directives for irrigation development which take in to account the requirements to intensify the partnership of the people and the government in the development of

irrigation systems in order to reach the overall goals set in the Ministry's majors programs. In accordance with the new directives, the conference on irrigation management transfer, which is being organized once again, will discuss about the transfer of operation and maintenance responsibilities to water users organization and to other farmer institutions. The sustainable irrigated agriculture project with the cooperation of the Mekong River Commission has approved the transfer of operation and maintenance responsibility to water user organization within 10 irrigation schemes during the last few years. This has given good practical experience. The transfer process developed by the project has the objective to reach the transfer of 100% of the responsibilities to the farmer's institutions. The intention is to reduce the responsibilities of the government and to increase the participation and sense of ownership to the beneficiaries the farmers, who shall be given the full right to manage and use their own irrigation scheme at the most profitable and sustainable way. It is also observed that the full participation of the farmers will magnify the management indications experience from the implementation of the irrigation management by farmers justify a water fee reduction of 10,000 kip per a from the original water fee collected by the government agencies. This proved that irrigation management transfer is possible.

1.7 Irrigation Project in Lao PDR

In Lao PDR irrigation schemes are classified in 3 Scales as under:

1. Small-scale scheme ranging from 1 to 100 ha;
2. Medium scale scheme from 101 to 500 ha; and
3. Large scale scheme above 500 ha.

- Small-scale weir scheme: there are traditional irrigation systems mainly found in the mountainous areas. They comprise small groups of farmers (usually a single village) and are built by manual labour with local materials at low cost. They are quite suitable to the local, condition but mostly are used for wet season supplementary irrigation in growing rice.

- **Small-scale pump scheme**: in some provinces they are quite numerous. In this type, groups of farmers irrigate, up to 50 ha with shared pump. The investment shows a good rate of return.
- **Medium scale weir scheme**: these are mainly located in the areas in between highlands and plains. They are very often used for wet season rice planting.
- **Medium scale pump scheme**: these types have been installed in Vientiane Province, Champasak and Vientiane municipality about 13,000 ha for both season irrigation. These need a proper management of water distribution because electricity charges have to be paid for.
- **Medium scale reservoir scheme**: they have mainly been developed in Savannakhet province. This type has its advantage in terms of gravity water supply.
- **Large-scale reservoir scheme**: two schemes of this type have been built in Vientiane municipality. Nam Houm reservoir has a command irrigated area of 3,000 ha and Nam Souang reservoir 4,000 ha.
- **Large Pump scheme**: they have been constructed mainly in Vientiane municipality, pumping water from Mekong River and Nam Ngum River.

Despite the huge potential of exploitable surface water resources and urgent need for development, existing irrigation facilities are small relative to the 710,000 ha of demand. Today, supplementary irrigation in the wet season and irrigation in the dry season are available to 150,000 ha and 25,830 ha respectively.

1.8 Objectives of present study

i) *Study problems and practices of country.*

ii) *To study ThaNgon Irrigation project.*

iii) *Study the existing water distribution practices in the study area.*

iv) *Study the management and organization of ThaNgon irrigation project and existing working conditions of Farmers' Association.*

v) *Study management and Farmer Organization in India and other countries.*

vi) *Suggest adaptable improvement in formation of Water Users Association so that equitable distribution of available supplies could be possible.*

1.9 Methodology

Methodology of any research study is the nucleus of scientific investigations, which comprises of the sampling technique, questionnaire/schedules, and data collection, analysis of data and finally presentation and interpretation of data. For achieving the objectives of the study, the questionnaire/schedules were prepared keeping in view the existing conditions of the Farmers Associations In Lao PDR, which is a very important job of the researchers who have to take care of each and every aspects of the research study. I view of these facts, an attempt was made to examine different aspects of the ThaNgon irrigation project: Role of Farmers' Association in Lao PDR, so that the Farmers Associations/group of the farmers behavior could be analyzed with a common objective to improve irrigation facilities in the study area (i.e. ThaNgon Irrigation Project: Role of Farmers' Association). The study area was purposively selected for the study, which has an unique salient features of success story, which could be replicated else where in the country.

Unfortunately, it is not happening to analyze and study the present scenario of the project secondary data were collected from different published studies. Averages and tabular analysis was employed to study the operational efficiency of the Farmers Association. Besides analytical tools i.e. growth rate etc. were also attempted.

In this context the requisite data were collected from the ThaNgon irrigation Project. The data such as detailed command area, financial position, performance of society, profits to the society, area irrigated season wise and crop-wise, cropping pattern (present and designed), irrigation rates etc, were collected from the ThaNgon irrigation Project.

1.10 Analytical Tool

One of the major problems in irrigation management in Lao PDR is lack of adequate communication between farmers and the irrigation authorities. Criticism is often voiced that the existing structure of the irrigation Department dampens the pace of productivity through irrigated farming. It does not encourage functional specialization or motivate Government outlet is generally excluded from the purview of irrigation Department and no other agency is fully in charge of it. Besides, the farmers are not in full control of the reach to enable collective community organization. Therefore, the key to implementing participatory elements of the water policy is through the creation of mutually acceptable roles and regulations of irrigation Department normally do not foster this type of joint responsibility in Lao PDR.

Besides averages, the tabular analysis was adopted, in order to examine the performance of the Water Users Association.

1.11 Food production and Agriculture

The agricultural sector is the foundation of the Lao economy, generating almost 60% of Gross Domestic Product (GDP) and employing nearly 85% of work force. Attention is also being given to rice production in the six large Mekong River flood plain (of which the Vientiane Plain is one) and other fort-two smaller plain. The emphasis is on the mobilizing farm participation and involvement of them for increasing the actual use of paddy field potentially served by irrigation systems from the present 30-40% to 60-70%. Land clearing for the establishment of 40,000 ha of new paddy lands will encourage shifting cultivators to abandon the destructive

cultivation of upland rice on steep forested slopes and to adopt low land rice production technology. This will allow the catchments areas to be redeveloped and managed for sustained yield from forestry.

Also there is a Cash crops and commodity production policy focusing on increasing the production of: cattle, coffee, soybeans, mung bean, tobacco, sesame, processing of fruit and vegetables etc., to supply for domestic and export markets.

The government considers achieving food self-sufficiency to be an important prerequisite for improving the living standards of the people. Food self-sufficiency will improve both the quantity and quality of food consumption and reduce the instability of availability. The target for the year 2000 AD was to produce 2 million tons paddy, 25,000 tons of maize, 175,000 tons of roots and tubers, 24 kilograms of meat per capita per year and 35 kilograms of fish per capita per year.

Self-sufficiency is to be achieved through intensification in the six major plains; expansion of cultivated area for paddy in mountain valleys where adequate water is available as also promoted agricultural intensification depends on the timely supply of inputs such as improved seeds, fertilizers. Insecticides, pesticides, and agricultural tools at price affordable to farmers. Introduction of integrated pest management systems is also encouraged. Efficient input and output markets need be developed, access to credit need be improved, and the establishment of an effective extension service capable of transferring the new technology to the farmers is essential for the successful implementation of this programme. To encourage production of marketable surpluses, the state plans to introduce a guarantied minimum price for paddy. Hence, the estate will buy and sell paddy in the market to regulate the market price and hold a buffer stock for times of emergency. Intensification in the livestock sector will focus on a combination of improved feeding practices and improved veterinary services.

1.12 Irrigation development Scheme

The objectives of this programme are to increase rural incomes and stabilize rice availability by expanding irrigated area in both the wet and the dry season and to improve the operation and maintenance of existing irrigation schemes.

Construction of small-scale community based irrigation schemes and brothels or water wells for households will be emphasized. These will reduce the effect of droughts; will be used for domestic consumption. Efforts are being made to mobilize loans and grants to invest in medium and large-scale irrigation schemes in high potential areas. Reaching the targets is thus a joint effort between the state and the communities.

Irrigation Development started a few hundred years ago in the North part of the country. There were a number of traditional irrigation schemes on which the water level was raised by small dams made of logs, earth and Stones, thus enabling the irrigation of about 30 ha, during the wet season. In 1960, with collaboration of foreign assistance the improvement of irrigation accelerated. Small concrete dams and water distribution systems were built in several provinces. However, these were inadequate to provide both necessary irrigation and water supply for the villagers. But the major irrigation development began in 1987. The department of irrigation now provides central planning and coordination of irrigation development throughout the country.

However, irrigation development policies are:

1. Increase the participation of farmers and communities in irrigation schemes for effective and sustainable use of all resources.
2. Efficiently use water for increased agricultural system performance and prevention of watershed degradation; and
3. Acquire funds to provide timely and adequate government support to the sector at all levels.

1.13 Commodity Production Support Programme

The purpose of this programme is to develop the agro-processing sector in order to provide income opportunities at the local level and increase the value added of export communities. The commercial crops to be included are rice, maize, soybean, mungbean, groundnut, vegetables, sugarcane, Tabasco, cotton, coffee, fruits and meat (livestock and fish).

1.14 Stabilization of slash-and-burn Cultivation (in upland & mountains)

There is a big problem of cutting trees. The people cut (slash) and burn to make land or agriculture. Therefore, one of the main priorities of the government is to stabilize slash and burn cultivation because of serious negative environmental effect of this farming system. The target is to resettle 100,000 slashes and burn families by the year 2000. These farmers will be encouraged to take up alternative economic activities such as planting trees, animal husbandry, food and/or cash crop production in the mountain plains, wage labour in processing factories or trading. To facilitate the resettlement, the government guarantee farmers, access to the necessary financial and technical support in the area such as land clearing and construction of irrigation schemes.

1.15 Agriculture and Forestry Research Programme

The objectives of this programme are to conduct surveys of agriculture and forestland and of water resources in order to prepare master plan use and agricultural development, especially in the northern provinces. To rehabilitate existing research stationed and Centres, and expand research activities to new areas and to cooperate with research institutes abroad especially in the field of improved seed varieties and their multiplication and in meteorology and hydrology.

1.16 Human Resources Development Programme

The objective of this programme is to upgrade the technical and political skills of the staff in the Ministry of Agriculture and Forestry. The development of an effective extension at the district and provincial level is particularly important. Extension staff will be trained in a technical field and be able to transfer information and technology to farmers. Lack of sufficient skilled staff is an important constraint in all sectors of the Lao economy.

CHAPTER II

STUDY AREA

CHARPTER – II

STUDY AREA

(ThaNgon sub project of The Nam Ngum Pump irrigation project)

2.1 Project History of Nam Ngum Project

The Nam Ngum Pump irrigation project (in the figure 2.1) is one of the medium scale pump scheme and has been financed by an initial grant of ECU 5.5 million from the European union (EU) and commitment of ECU 1.0 million from the Government of the Lao PDR (GoL). It originally, aimed at production an additional 8,000 tons of rice (paddy) per year from 1,800 ha of land in the Vientiane plain and, at the same time, ensuring the food security of 25,000 persons and generating additional income for 1,500 farmers. This was to be achieved by implementing four irrigation schemes, which supplied water by pumping from the Nam Ngum River. The project started in December 1990 and was expected to be complete within four years.

There are four schemes originally Planned as under:

(i) **ThaNgon** (a subproject of the Nam Ngum Pump see figure 2.3.)
(ii) Vieng Kham in Vientiane Province not executed.
(iii) Houay Chiam and
(iv) Ban Phao in Vientiane Municipality.

Prior to project inception, preliminary construction work was initiated by GoL. at three sites (ThaNgon, Houay Chiam, Ban Phao) but could not be completed due to lack of funds. With the project funds made available in the 1991-1994 period, the Hoay Chiam (560 ha gross) and Tha Ngon (400 ha gross) schemes have now been fully implemented and Ban Phao scheme partially implemented (140 ha gross). Details of each sub-project are given in table 2.1.

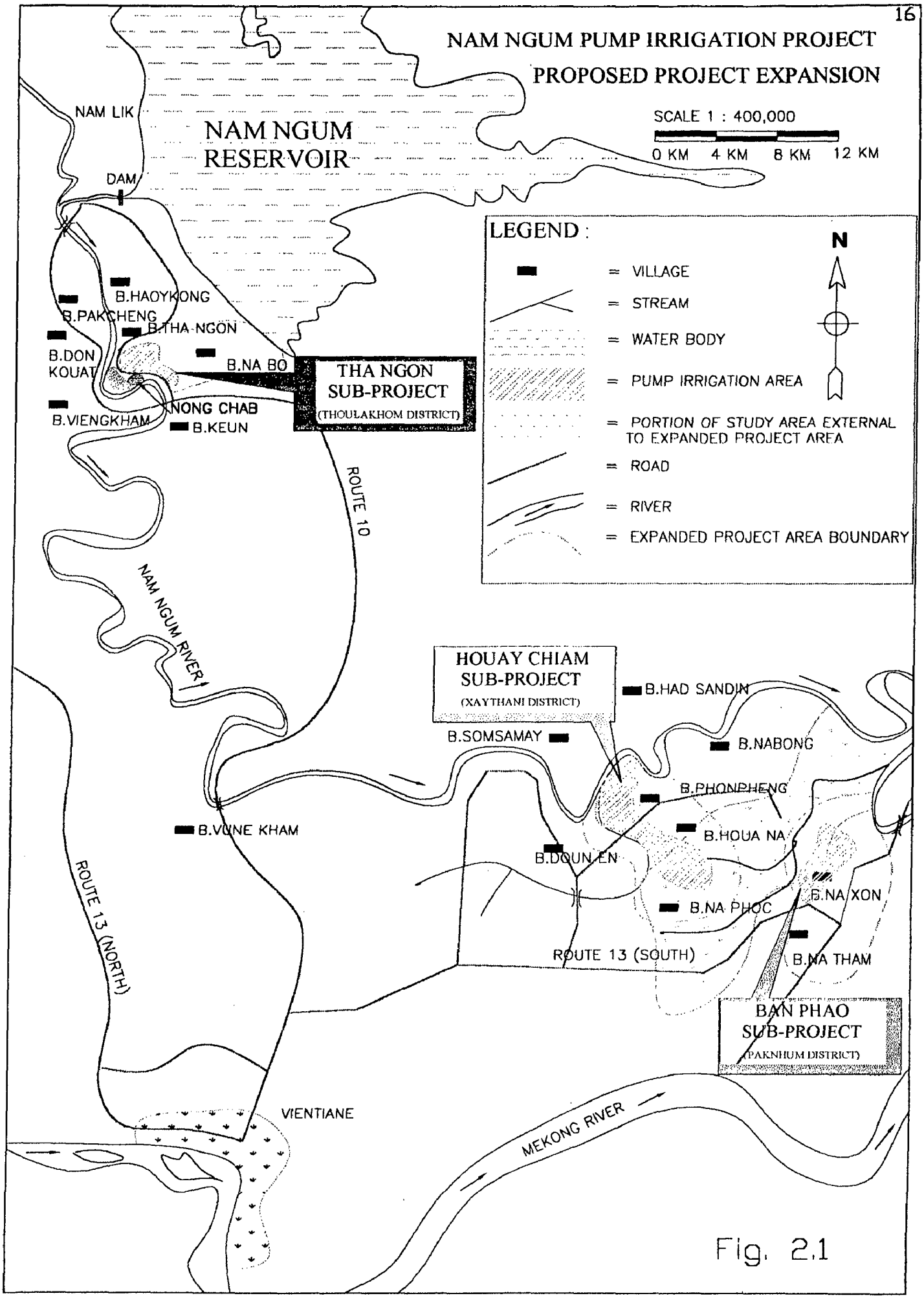

NAM NGUM PUMP IRRIGATION PROJECT
PROPOSED PROJECT EXPANSION
SCALE 1 : 400,000
0 KM 4 KM 8 KM 12 KM
NAM LIK
NAM NGUM RESERVOIR
DAM
LEGEND :
N
= VILLAGE
= STREAM
= WATER BODY
= PUMP IRRIGATION AREA
= PORTION OF STUDY AREA EXTERNAL TO EXPANDED PROJECT AREA
= ROAD
= RIVER
= EXPANDED PROJECT AREA BOUNDARY
B.HAOYKONG
B.PAKCHENG
B.THA-NGON
B.DON KOUAT
B.NA BO
THA NGON SUB-PROJECT
(THOULAKHOM DISTRICT)
B.VIENGKHAM
NONG CHAB
B.KEUN
ROUTE 10
NAM NGUM RIVER
HOUAY CHIAM SUB-PROJECT
(XAYTHANI DISTRICT)
B.HAD SANDIN
B.SOMSAMAY
B.NABONG
B.PHONPHENG
B.VUNE KHAM
B.HOUA NA
B.DOUN EN
B.NA XON
B.NA PHOC
ROUTE 13 (NORTH)
ROUTE 13 (SOUTH)
B.NA THAM
BAN PHAO SUB-PROJECT
(PAKNHUM DISTRICT)
VIENTIANE
MEKONG RIVER

Fig. 2.1

Due to a reduced Lao Government contribution and price escalation since project preparation the specific objective was progressively reduced to 1,100 ha in three sub-projects only. The area in ViengKham was excluded, where no irrigation works wherever implied is the past and where, as an alternative to pumped irrigation industrial tree crop production integrated with livestock husbandry could be envisaged.

Project Management Group:

The project management organization (group) is shown in figure 2.2. The project is under Provincial Agriculture Forest service; each project has a site manager.

Table 2.1 **Nam Ngum Pump Irrigation Project**

Irrigation scheme parameters

No.	Parameter	Sub-project			Scheme Total
		ThaNgon	Houay Chiam	Ban Phao	
1	District	**Thoulakhom**	Xay Thani	Pak Ngum	3
2	Population (Pers)	**4,602**	3,252	1,122	8,976
3	Gross Command Area (ha)	**400**	560	140	1,100
4	Net Command Area (ha)	**360**	504	126	990
5	Pump Rating (kw)	**4x90**	4x110	2x115	1,030
6	Secondary Zones, (No.)	**4**	5	2	11
7	Tertiary Blocks, (No.)	**22**	26	6	54
8	Water User Groups, (No.)	**20**	19	6	45
9	Capacity of canal (m^3/sec)	**0.8**	1.2	0.5	2.5
10	Length of main canal (km)	**6.00**	8.5	5.00	19.50
	- Secondary canal (km)	**11.40**	12.60	10.0	34.00
	- Tertiary canal (km)	**12.50**	15.00	11.00	38.50
11	No. of Farm	**274**	360	250	884
12	Total No. of outlet	**220**	250	100	570
13	Average size of farm	**From 0.2 ha to 1.6 ha.**			

Fig
Nan
ORG

PRO
AGE
FOR
Vien
IST

T.A. CIVIL ENGINEER
(Berardi)

T.A. MACHANICAL ENGINEER
(Parodi)

DIST
AGR
& F

WATER MANAGEMENT CONSULTANT
(Thatsany)

Thot

COMMUNITY ORGANISATION CONSULTANT
(Nithat, Khampha, Sysouphan)

Heac

INTEGRATED CROP MNGMNT. CONSULTANT
(Damrong)

THA
Site

BELINGUAL SECRETARY
(Villy)

Grou
Oran
(Bou

E

DESIGN ENGINEER
(Pasonsay)

--==oo Ad hoc Specialists oo ==--
DESIGN ENGINEER
FIELD ENGINEER
TOPOGRAPHIC SURVEYOR
ECHNICAL SPECIALIST (LIVESTOCK)
TRAINING SPECIALIST (CURRICULUM)
TRAINING SPECIALIST (AUDIO - VISUAL)

Exte
Wor
(Bou

Exte
Wor
Cash
(Kha

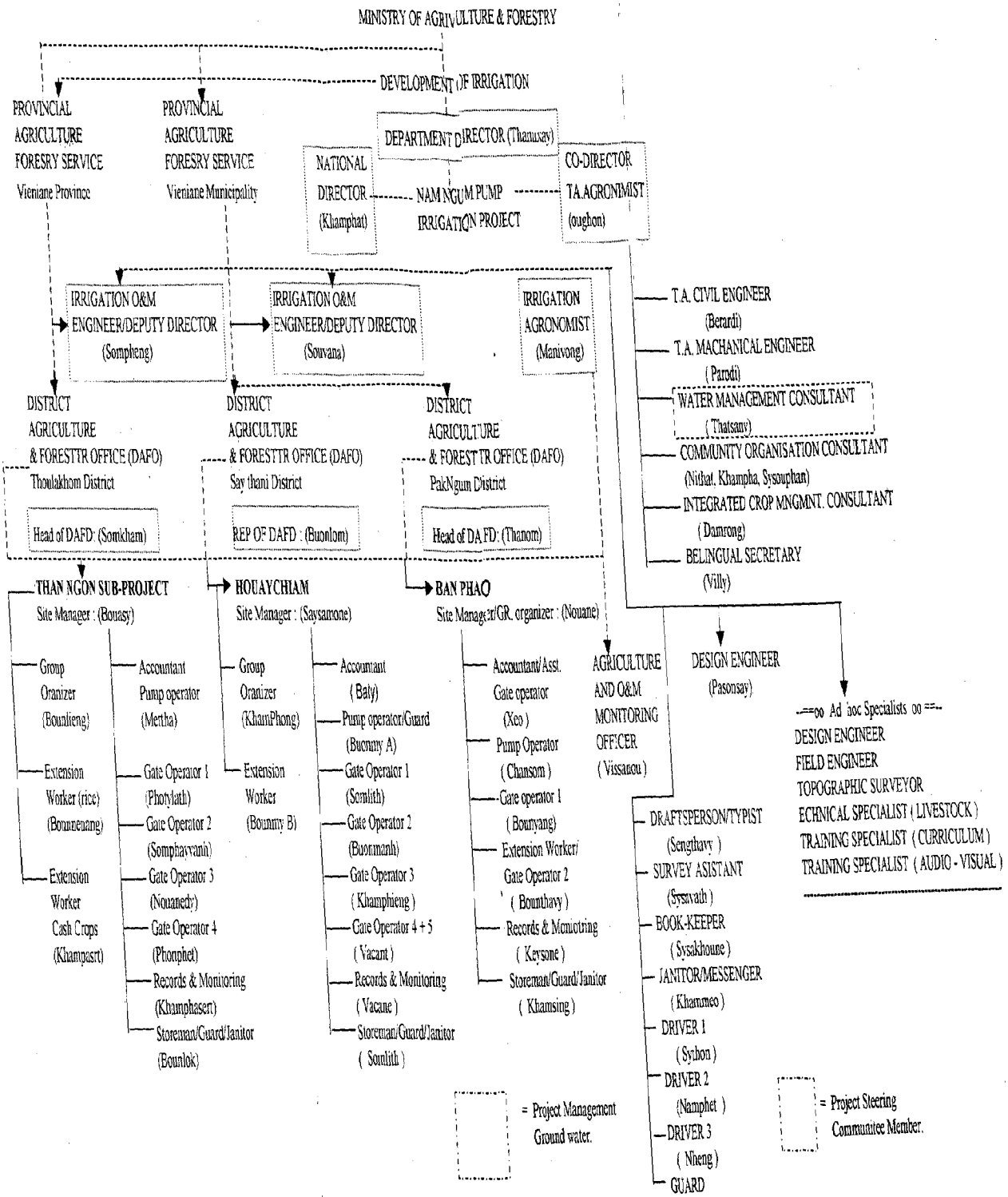
AFTSPERSON/TYPIST
(Sengthavy)
RVEY ASISTANT
(Sysavath)
OK-KEEPER
(Sysakhoune)
NITOR/MESSENGER
(Khammeo)
IVER 1
(Sython)
IVER 2
(Namphet)
IVER 3
Nheng)
ARD

= Project Steering Communitee Member.

Fig. 2.4

Nam Ngum Pump Irrigation Project

ORGANIZATION CHART - AS FROM JANUARY, 1996



2.2 Irrigation Scheme Layout

As per Table 2.1 the 1,100 ha gross irrigable command of the project area is sub-divided into three discrete sub-projects each at a separate site on the bank of the Nam Ngum River, and each play constructed before project inception. Pre-existing pontoon mounted pumps at the ThaNgon and Houay Chiam site were replaced by river bank-mounted inclined axial flow pumps. The pre-existing pontoon-mounted pump-set at Ban Phao sub-projects were retained but upgraded. It was proposed to replace them with new EC funded unit during 1996.

The various pump-sets discharge into main canal viz stilling basing on the riverbank. From the main canals the water flow is sub-divided into secondary canals viz Constant Head Orifice (CHO) turnout hence to tertiary canals viz a CHO turnout at the head of each. The service area of each secondary canal is termed on "Irrigation Zone" while the service area of each Tertiary Canal is termed a "Tertiary Block". Most tertiary Blocks are 20-30 ha in extent and serve 15-35 farm plots. Flow in Tertiary canals is released to farmer-built Quaternary Canals through pre-fabricated Farm inlets fitted with drop gates. Each Farm inlet serves several Quaternaries canals, which deliver the metered flow to each farm plot. Each farm plot is connected by a farmer-built Quaternary Drain to the project constructed main drain viz-natural waterways.

2.3 Land System in the Project Area

For agricultural planning purposes, the land systems of the project area are categorized as follows:

(a) Permanent wetlands – not useful for irrigation.

(b) High flood-risk lowlands – less useful to irrigation.

Water measurement by Constant Hand Orifice and distribution the various pump sets discharge into Main canal via stilling basins on the riverbank. From the Main canal the water flow is sub-divided into secondary canals turnouts thence to Tertiary canals via a CHO turnout at the head of each.

(b) Low flood-risk lowlands with free-draining soils – most suitable for irrigation.

(c) Rolling uplands – suitable for irrigation.

(d) Steep uplands preferred for orchards.

(e) Villages and construction areas – for urban population.

Categories b, c, d and e may be irrigated and non-irrigated lands and further discussed in Para 2.5.

Each farm comprises several types of land, the irrigated land in the project area cannot, consequently, be sustainable and successfully developed to optimal productivity without a "whole-farm" approach. Therefore, the farmer must balance his time inputs between his various agricultural activities, both irrigated a non-irrigated, subsistence-oriented and export-oriented. Neither a farmer can act independently of his neighbors as he must share with them such common property resource as irrigation and drainage systems, access roads, fence lines, fishing grounds, grazing lands and forest lands. Therefore. For effective achievement of sustainable agricultural development, a participatory, community-wide approach to the planning and implementation of future intensified land use is inescapable, which has been planned as participatory approach for farmers.

2.4 Sustainable Future Land Use Scenario

The sustainable future likely to be optimal for each the above listed land categories is as follows:

Type	Irrigated Lands	Non-Irrigated Lands
(a). Permanent Wetlands		To be protected from pollution by agricultural chemicals and managed for wild capture fishery.
(b). High Flood-Risk Lowlands	To be fenced and sown to inundation-tolerant pasture species, such as Para grass, for wet-season grazing and dry-season irrigation for "cut-and	To be bounded for wet season fast maturing rained rice productions followed by an over sown leguminous forage crop for stubble grazing by cattle and buffalo the dry

	carry" forages for cattle and buffalo.	season.
(c). Low Flood-Risk Lowlands with Slow-Draining Soils	To be ditched and pounded for paddy field agriculture plus irrigated rice crop in both wet and dry seasons.	To be planted with fruit orchards under-sown with shade-tolerant species such as pineapple, medicinal herds or leguminous forage cover crops.
(d). Low Flood-Risk Lowlands with Free-Draining Soil	To be prioritized for irrigated cash crops in both wet and dry season under Contract Farming arrangements with processors and traders. Irrigated crop with economic, cabbage, tomatoes and supplementary forage for livestock. Private sector processors are negotiating Contract Farming arrangements with project beneficiaries for the irrigated production of some of these crops is utilized wet season rice and dry season irrigated green or grain forage for livestock.	Where required for arable cultivation, to be contour-bounded and planted with alley crops of leguminous shrubs for browse and mulch. Grassed areas to be fenced and managed for pasturing cattle and buffalo. The remainder to be planted with browses shrubs or commercial trees for timber, pulp, wood chips or fuel. Firebreaks to be installed and "social fire protection' measures invoked.
(e). Rolling upland		Where required for arable cultivation, to be contour-bonded and planted with alley crops of leguminous shrubs for browse and mulch. Grassed areas to be fenced & managed for pasturing cattle & buffalo. The remainder to be planted with browses shrubs or commercial trees for timber, pulp, wood chips or fuel. Firebreaks to be installed and "social fire protection" measures invoked.
(f). Steep Uplands		For orchard and forest: to be managed for sustained yield through the protection, weeding, pruning and thinning.

The land use classification detailed above is to a certain extent, "top-down" in nature, but it is based on considerable data-gathering concerning soil, drainage, topography, livestock and socio-economic aspects.

It supplies a useful, broad foundation for the envisaged maps based participatory ("bottom-up") detailed land-allocation planning to follow village by village.

2.5 ThaNgon Subproject

A map of this subject is shown in figure 2.3 general details of this subproject are also included in table 2.1. There are 20 subgroups in the system. In the present study only subgroup No. 3 is studied. The details of farmers are shown in figure 2.5 and list of farmers is given in table 3.1.

The various menology of canal system adopted in Lao PDR explained below:

2.6 Distribution Network

For water transport and its equitable distribution, a water conveyance network from the water control structure and up to the field is needed. It consists of the following component (Fig.2.4).

Main canal: it is the principal channel of a distribution system off-taking from primary source of water i.e. a river or a reservoir or tail reach of a feeder and pumping.

Secondary canal: It is a canal receiving its supply from the main canal and acting as a feeder for tertiary. Direct outlets are also provided for areas along canal.

Tertiary canal: It is a channel receiving its supply from the secondary canal. It supplies water to watercourses.

Outlet: Point of final distribution of water to an area called command area of the outlet. Water course takes-off-from this point.

Watercourse: It is a channel taking-off from a secondary canal, tertiary canal from which field is directly irrigated.

Tail Escape: It is an escape at the end of distribution system intended to convey the surplus or unused water to a natural drain, depression or other suitable place.

Fig. 2.3

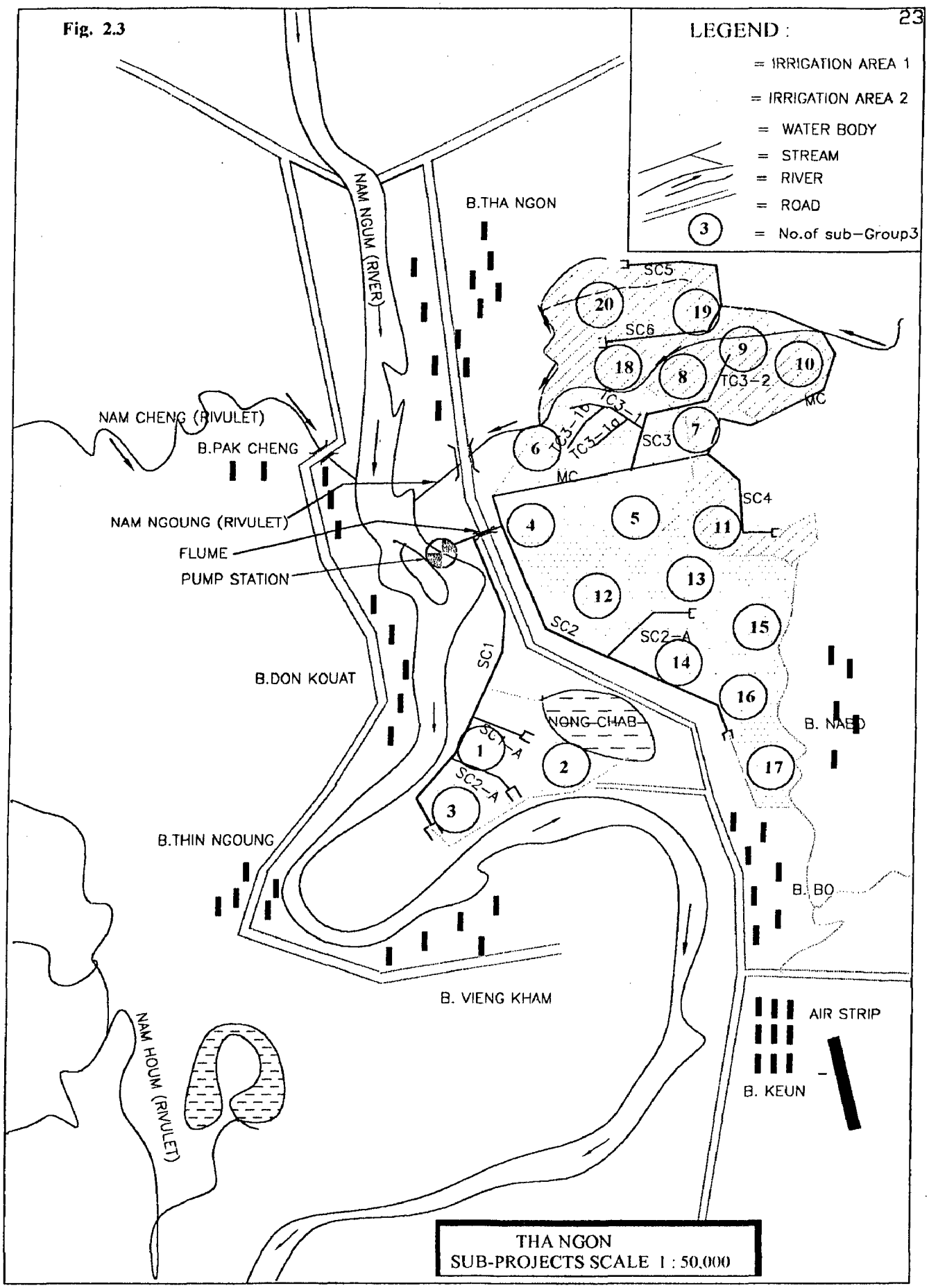
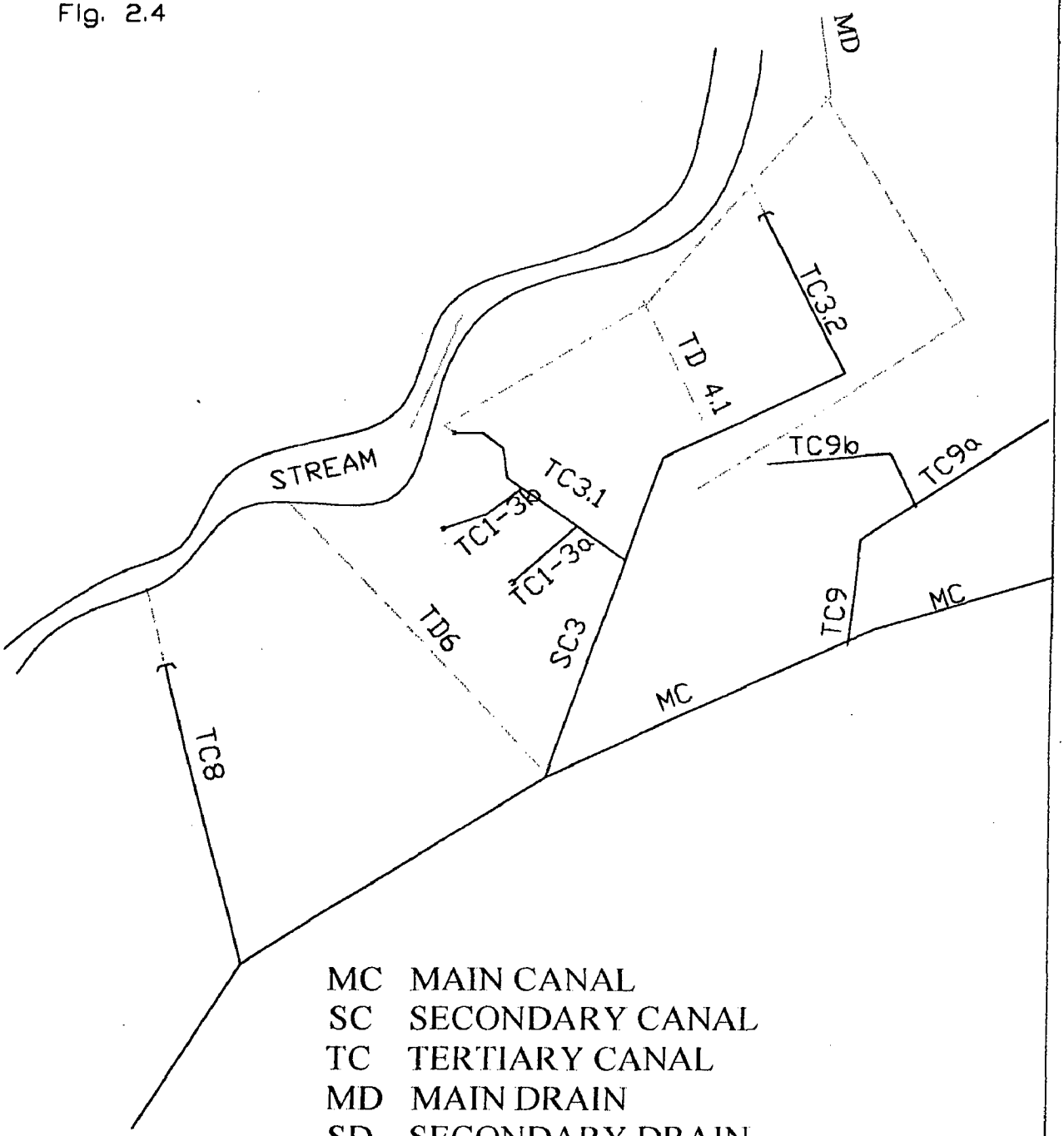

LEGEND :
= IRRIGATION AREA 1
= IRRIGATION AREA 2
= WATER BODY
= STREAM
= RIVER
= ROAD
3 = No.of sub-Group3
NAM NGUM (RIVER)
B.THA NGON
SC5
SC6
SC3
SC4
SC2
SC2-A
SC1
SC1-A
TC3-2
TC3-1
MC
NAM CHENG (RIVULET)
B.PAK CHENG
NAM NGOUNG (RIVULET)
FLUME
PUMP STATION
B.DON KOUAT
NONG CHAB
B. NABO
B. BO
B.THIN NGOUNG
B. VIENG KHAM
NAM HOUM (RIVULET)
AIR STRIP
B. KEUN
THA NGON
SUB-PROJECTS SCALE 1 : 50,000

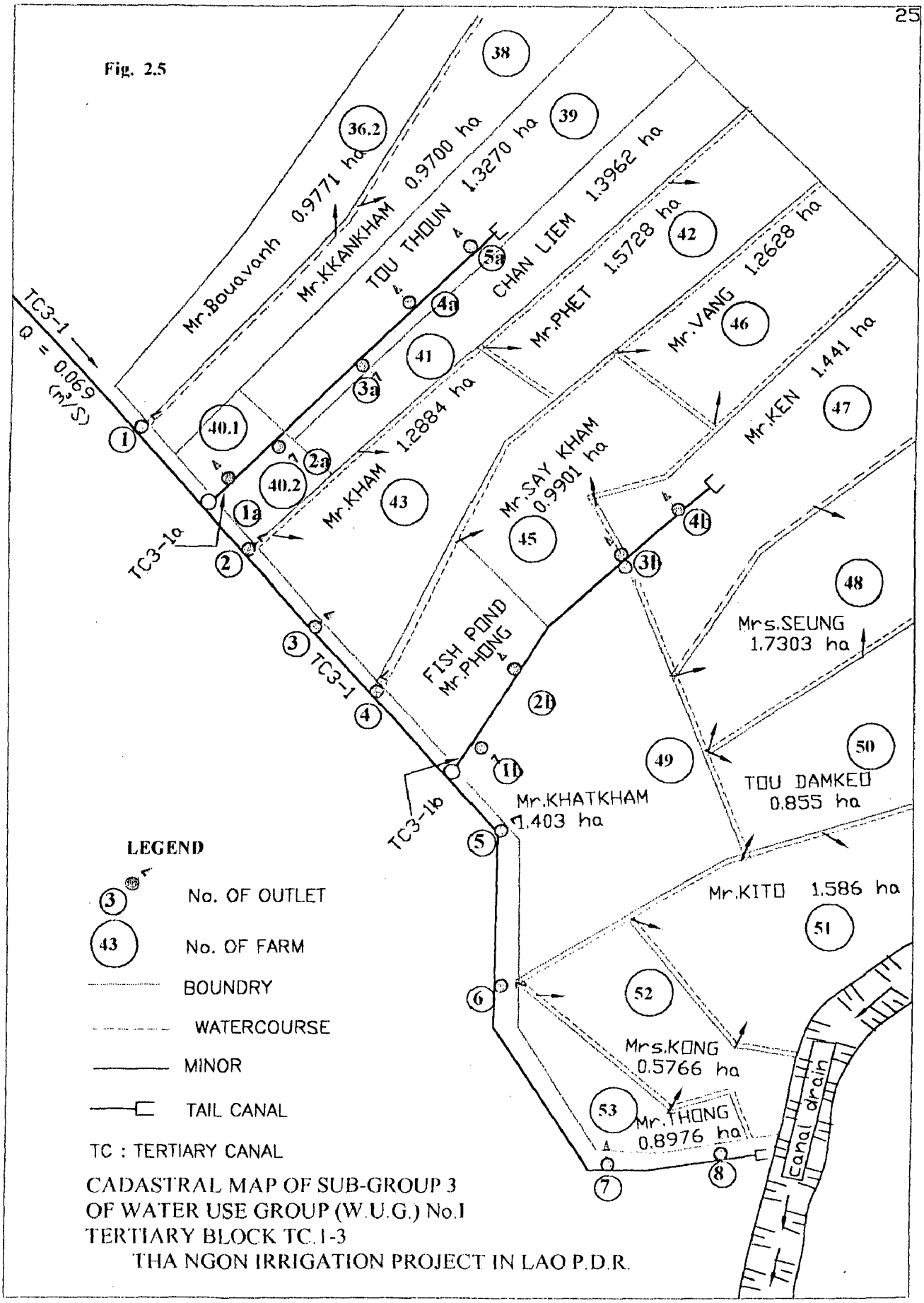
Fig. 2.4



MC MAIN CANAL
SC SECONDARY CANAL
TC TERTIARY CANAL
MD MAIN DRAIN
SD SECONDARY DRAIN
TD TERTIARY DRAIN

MAP 5.1 CANAL DESIGNATION SYSTEM

Fig. 2.5



LEGEND

- 3 — No. OF OUTLET
- 43 — No. OF FARM
- BOUNDRY
- WATERCOURSE
- MINOR
- TAIL CANAL

TC : TERTIARY CANAL

CADASTRAL MAP OF SUB-GROUP 3
OF WATER USE GROUP (W.U.G.) No.1
TERTIARY BLOCK TC.1-3
THA NGON IRRIGATION PROJECT IN LAO P.D.R.

2.7 Farmers Participation policy In ThaNgon Irrigation Project

Since its inception the project has adopted the participatory approach in building up new irrigation scheme with the farmers in the project. The participatory approach involves the farmers' participation from the initiation of the irrigation project. After the construction the scheme is then handed over to the water users organization.

The handed over irrigation system to the farmer's association is implemented in the ThaNgon irrigation project, which includes the following components.

2.6.1 Before Construction

Before ThaNgon irrigation project construction, the staff of the project discusses with the farmers' beneficiaries for their firm deep understanding and to acknowledge their active role into the project or activity. The farmers actively participate in the project viz.

i) Participation by contributing their land area for head work construction various channels, canals and on-farm rural access roads.

ii) Participation from the capacity and the construction materials, which can be found in their locality.

iii) Participation of the water users must occur in key decisions and in up-front planning and development of the physical systems. Such as the draft engineering design plan for construction of the irrigation system is discussed with water users group in a stakeholder workshop, followed by a walk through in which modifications and feedback are sought from the community.

2.6.2 During Construction Period

Before construction work is completed, training is organized and interested farmers associated with the system, to organize the Farmer's Association (Table 6.1). They are responsible for the water operation and maintenance of the project in accordance with the category and the project characteristic regarding the decisions and agreement. The farmers conduct a mutual democratic election with an exemption for ordered expressions of any obligation. They adhere to the implementing of the rules and the statute and decide

the names of the office and institution, besides they explain the objectives of the on-going plan, limitations of duration, broader area of maintenance, name of the member, right and relations of the members as well as the members participation. The water use requires active participation of the members for the maintenance and repair of the irrigation schemes and other general works activities. However, various rules and status are officially adopted which is registered which are informed and considered legal from the point of law.

2.6.3 **After Construction** (i.e. Before Handing Over The Management And Use Of Irrigation water)

After completed construction works, for every category of construction activity and size, format, which have already been controlled and verified. The administrative committee authority in addition to the provincial Agriculture-Forestry service or with other interested institutions should hand over that completed construction to the Farmer's Association property and into their full right and interest on their operation and maintenance.

2.8 Construction works of ThaNgon Project

The status of the construction contract is given in table 2-2, which is discussed follow:

Irrigation canals were completed in February 1993 under contract NNP-ID01

Construction of the pump station, carried out under contract NNP-ID02, was initially scheduled for completion by mid-August 1994, but was delayed as the contractor could not complete the river side works prior to the rising of the Nam Ngum water levels in the wet season.

Drainage works, incorporated in contract NNP-ID03, were completed in December 1994.

Table 2.2

Nam Ngum Pump Irrigation Project

SUMMARY OF MAIN CONSTRUCTION CONTRACTS (As at 31/12/1995)

Contract	Descrition	Value (Mkip)	Dta of Contract Signature	Present Status	Guarantee Funds Retained into 1996 (*)		
					Kip	USD	Kip Equivalent (**)
NNP-06	Construction of Rural Office and Seed Drying Platform at Ban Somsamay, Saythany District	21	11/11/91	Final Acceotance Certificate issued on 15 / 10 / 1993			
NNP-07	Construction of Rural Office and Seed Drying Platform at Ban ThaNgon, ThoulaKhom District	21	11/11/91	Final Acceotance Certificate issued on 15 / 10 / 1993			
NNP-ID01	Irrigation Canals and structures at Tha Ngon sub-Project	606	1/4/92	Final Acceotance Certificate issued on 30 / 3 / 1995			
NNP-ID02	Pump Stations, Irrigation Canals and Structures at ThaNgon and Houay Chiam Sub-Project Cicil works	1,993	8/4/93	Provisional Acceptance Certificate Issued on 31 / 01 / 1995.	39,156,847	43,119,14	97,042,052
	- Electro-Mechanical Equipment			Provisional Acceptance Certificate Issued on 20/04/1995 (retroactive to 13 /03 / 1995)		103,873,073	96,083,200
NNP-ID03	Irrigation Canals and structures at Ban Phao sub-project, Drainage Canals and structures at ThaNgon sub-project	193	10/1/94	Provisional Acceptance Certificate Issued on 02 / 12 / 1994.	8,395,031	1,744,87	10,009,036
NNP-11	Construction of Three Office/Store Buildings	44	27/6/94	Final Acceotance Certificate issued on 04 / 11 / 1995.			
				TOTAL:	47,551,878	148,737,74	185,134,288

(*) To be released at issuing of final Acceptance Certificate

(**) Exchange Rate : 8000 Kip/USD; 1/July through December, 1995.

CHAPTER III

WATER MEASUREMENT AND DISTRIBUTION IN THANGON IRRIGATION PROJECT

CHARPTER – III

WATER MEASUREMENT AND DISTRIBUTION IN THANGON IRRIGATION PROJECT

3.1 Water Measurement And Distribution Practices

As discussed in the previous chapter that the various pump sets discharge into Main canal via stilling basins on the riverbank. From the Main canal the water flow is sub-divided into secondary canals via Constant Head Orifice (CHO) turnouts thence to Tertiary canals via a CHO turnout at the head of each. The service area of each Secondary canal is termed an "Irrigation Zone" while the service area of each Tertiary canal is termed a "Tertiary Block". Most Tertiary Blocks are from 20-30 ha in extent and serve 15-35 farm pots (Map 2.5).

Flow from Tertiary canals is released to farmers built Quaternary canals through pre-fabricated Farm inlets fitted with drop gates. However, each Farm inlet serves several Quaternary canals, which delivers the metered flow to each farm plot. A farmer-built Quaternary Drain to project-constructed Main Drains via natural waterways connects each plot. (Map. 2.4)

ThaNgon Irrigation Project took appropriate and justified action concerning the operation of the scheme and the water distribution system and organization. The tentative water regulation charts were negotiated with the farmers and are being adjusted. The water distribution calculation principles introduced take into account not only the area, the soil texture and the crop requirement but also propose improved cultivation techniques and crop/water management.

Water measurement by Constant Hand Orifice and distribution the various pump sets discharge into Main canal via stilling basins on the riverbank. From the Main canal the water flow is sub-divided into secondary canals turnouts thence to Tertiary canals via a CHO turnout at the head of each.

The fee calculation is based on cubic meter, which can be checked to the double vane check system (Graph 3.2 and Fig 3.1) at the entrance of each tertiary canal.

The ThaNgon irrigation project is a pioneering system in respect of charges for water use by volume in advance through the purchase of coupon booklets. This is enabled by the fact that the irrigation networks have been designed and constructed to deliver water in metered quantities to each farm.

Various computer based and manual calculation system for irrigation water scheduling is under review for adaptation to long-term project management requirement.

A coupon system, new in Lao PDR was introduced in 1994 in ThaNgon. Although this was difficult to organize at the beginning, the farmers contacted do not intend to return to the old system now.

Compared to the pump projects in Lao PDR, ThaNgon has one of the most effective and efficient water distribution systems, and has much to teach other schemes because farmers are the users of water. Unless the farmers are satisfied and involved in the distribution and management of water, the desired boost in production and productivity cannot be achieved.

Irrigation water project for delivery beyond outlets the solution by way of interaction and cooperation provided the formation of the same is not imposed upon them forcibly but it comes through their necessity.

Co-operative in any walk of life helps in promoting over helps of society at large. In this context the formation of irrigation water project within the command area of irrigation projects could bring about social reforms and therefore, such co-operative merit encouragement from all concerned. Government of India document on National Water Policy specially endorsed the "Participation of farmers and voluntary agencies in water management". The involvement of farmer in water management has been recognized in September 1987.

3.2 Estimation Of Water Supplied At ThaNgon Irrigation Project.

As attempt has been made herein to estimate the supplies of water:

Ex.: sub-group III of WUG No.1 (Block Tertiary TC 1-3) which is presented in Map 2.5 volume of water required: V = 19,100 m^3/week (Table 3.2).

V_{day} = (Volume of water required/week)/(6 days per week)

Hence, water to be supplied per day:

$\frac{19,100}{6}$ = 3,183 m^3 /day or say 3,200 m^3/day

1. 100 mm of pounding of water to be used for the rice per week.
2. Production area in the command area of sub-group No. 3.
3. Supply of volume of water of each sub-group (tertiary block) with rotational distribution, which is 6 days per week.
4. **Discharge of water supplied:**

Ex.: TC1-3 – required water supplied in one day = 3,200 m^3.

However, total water volume supplied was 31,700 m^3 (Table 3.2)

- Hydraulic calculations of discharge through a CHO structure have been calculated by using the following formula:

$$Q = W \times Go \times 2.79 \times \Delta H^{0.5}$$

Where

Q : is the discharge in m^3/sec.

W : is the orifice width in m; W = 0.8 m

Go : is the orifice opening in m ; Go = 0.12 m.

ΔH : is the head differential in m (see Fig 3.1).

ΔH = 0.06 m.

$Q = 0.8 \times 0.12 \times 2.97 \times 0.06^{0.5} = 0.0698$ m^3/sec.

However, in practice, it is being used (Fig. 3.1).

CHO structure: Head Regulators

Orifice Gate: 0.80 x 0.60 rating curve.

$$T = \frac{V}{Qx3600}$$

5. Time of water supplied TC1-3

T : Time of water supplied (hour)

V : volume of water to be supplied (m^3)

$$T = \frac{3,200}{0.0698x3600} = 12h44\min.$$

Q : Discharge (m^3/s)

6. Discharge of water of each sub-group (Tertiary block) to be supplied:

$$Q = \frac{Vx1000}{Tx3600}(l/s)$$

7. The relevant data are given in Table 3.2

Q : Discharge (l/s)

V : Volume of water to be supplied per day.

$$*Q = \frac{3,200x1000}{12^{o}44'x3600} = 69.8(l/s)$$

Ex.: Discharge of water for TC1-3:

Total discharge of water in the canals for command area per day

$$*Q_T = \frac{31,700x1000}{12^{o}44'x3600} = 691.45(l/s)$$

8. Time of running pump for command area per day

T : Time of running pump (hour)

$$T = \frac{V_T}{Q_P x 3600}$$

V_T : Total volume of water to be supplied per day (m^3)

$V_T = V_a + L$

V_a : Actual volume of water needed (m^3)

L : Water loss estimation from Main, Secondary and Tertiary canal (m^3)

$V_T = 29,700 + 2000 = 31,700\ m^3$

$Q_P = 1.86 \cdot x\ b\ x\ H^{3/2}$

Where,

Q_P : Discharge of pump (m^3/s)

b : Width of weir of stilling basin (m); b = 2.55 m.

H : Water height above weir of stilling basin (m)

$Q_P = 1.86\ x\ 2.55\ x\ 0.2893^{3/2} = 0.738\ m^3/s.$

Or say 738 l/s.

- In practice, it is used (Fig. 3.2)
- Stilling Basins: CIPOLETTI weir rating curve

Hence,

$$T = \frac{31,700}{0.691x3600} = 12h44\min.$$

- Comparison between
  - + Total discharge of water in the canal: 691.45 l/s.
  - + Discharge of pump : 692 l/s.

It is time used of pump running : 12 h 44 mn.

- In practice, time of pump running:

T_c = 5 h 00 + 2 h 00 + 12 h 44 = 19 h 44 min.

Where:

T_c : Time of pump closing (hour)

5 h 00 : Time of pump stating.

2 h 00 ; Extra for releasing water in the canal system.

Using water in the field.

9. **Cost Estimates**

(a) The charges levied for the year 2000 wet season were:

10 kip/cu.m comprising;

*5.0 kip for electricity.

*3.0 kip for working personnel.

*0.5 kip for lubricants and routine maintenance of electro-mechanical equipment.

*1.5 kip for compensate the water master.

(b) Revenue of water charged on 01.01.2000 was:

29,700 m^3 x 10 kip/m^3 = 297,000 kip.

(c) Abstract of Cost:

i. Electricity charges :(297,000 x 5.0)/2 = 742,500 kip.

ii. Operating personnel :(297,000 x 3.0)/2 = 445,500 kip.

iii. Lubricant :(297,000 x 0.5)/2 = 74,250 kip.

iv. Recompense the water master :(297,000 x 1.5)/2 = 222,750 kip.

Total = 1485,000 kip.

Remarks: In fact, electricity charges on 01.01 .2000 were:

35 kip /kw x 80 kw/h x 2 pump x 13 h 56 = 78,026.66 kip.

(1 US Dollar = 8000 kip).

(1 Rs = 20 kip)

Table 3.1: Water Requirement per week of Sub-Group No.3 of WUG-I

No.	Farmer name	Tertiary canal	Location of farm inlet (No.)	No. of farm	Area (ha)	Volume of water (m^3)
1	Mr. Bouavanh	TC1-3	IL (1)	36.2	0.9771	1,000
2	Mr. Khabkham	TC1-3	IL (1)	38.0	0.9700	1,000
3	Mrs. Boua	TC1-3a	IL (1_a) IR (2_a)	40.2	0.2544	300
4	Mr. Tou Thoun	TC1-3a	IL (4_a) IL (5_a)	39.0	1.3270	1,400
5	Mr. Chan Liem	TC1-3a	IR (3_a)	41.0	1.3962	1,400
6	Mr. Kam	TC1-3	IL (3)	43.0	1.2884	1,300
7	Mr. Pheth	TC1-3a	IL (2)	42.0	1.5728	1,600
8	Mr. Saykham	TC1-3b	IL (4)	45.0	0.9901	1,000
9	Mr. Vang	TC1-3b	IL (4) IL (3_b)	46.0	1.2628	1,300
10	Mr. Ken	TC1-3b	IL (4_b)	47.0	1.4441	1,500
11	Mrs. Seun	TC1-3b	IR (3_b)	48.0	1.7305	1,800
12	Mr. Khatkham	TC1-3b	IR (1_b), IL (5)	49.0	1.403	1,500
13	Mr. Tou Damkeo	TC1-3b	IL (6)	50.0	0.855	900
14	Mr. Kito	TC1-3	IL (6)	51.0	1.586	1,600
15	Mrs.Kong	TC1-3	IL (6)	52.0	0.5766	600
16	Mr. Thong	TC1-3	IL (7) IL (8)	53.0	0.8576	900
				Total	18.496	19,100

TC: Tertiary Canal; IL: Inlet left of canal; IR: Inlet Right of canal.

For raw No. 1 Volume of water per week = (Area x D)

Where D : Depth of water in the field = 100 mm.

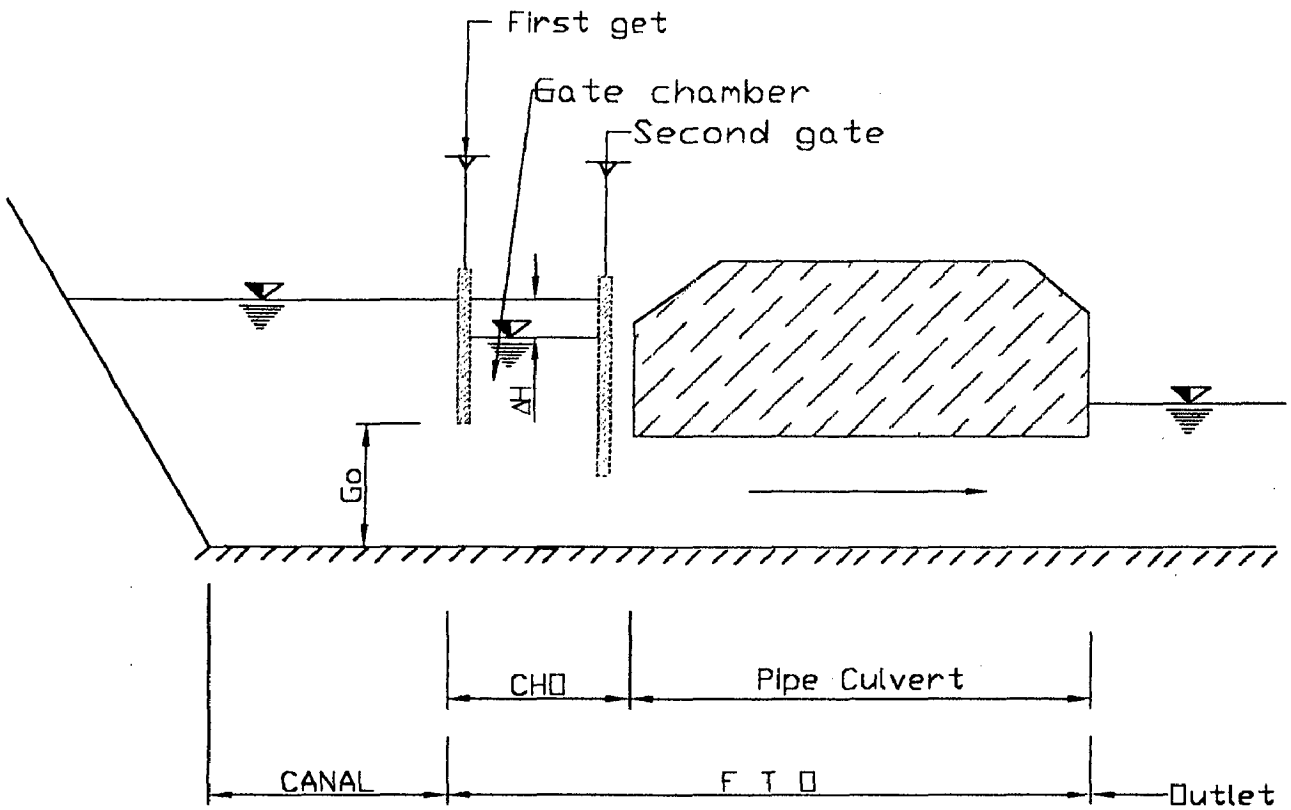
Hence V = 0.9771 x 10,000 x 100/1000 = 977.1 m^3.

Say 1,000 m^3.

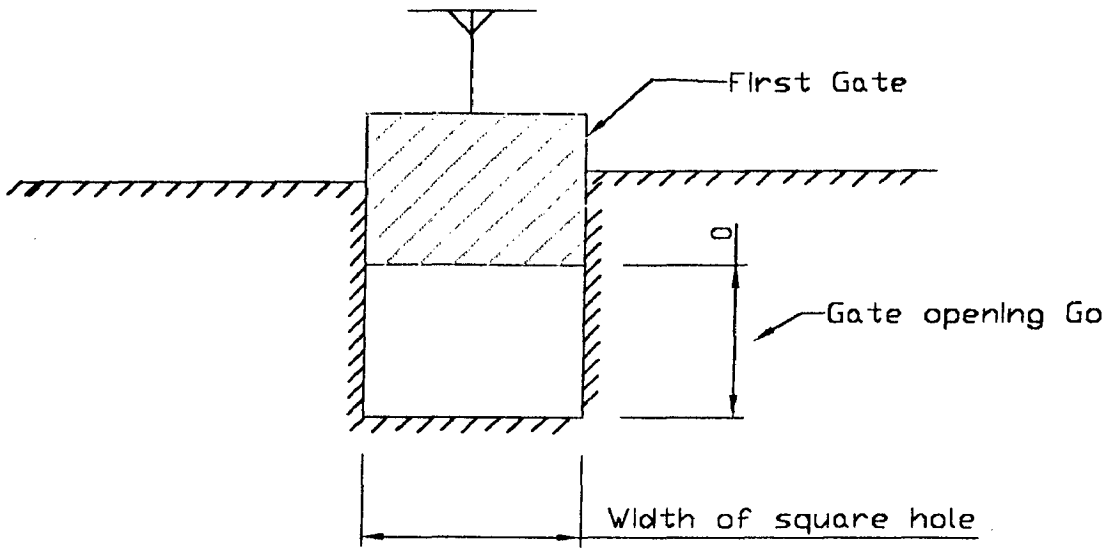
Table 3.2: Water Supplied in the Command Area in one day.

Canal	Actual volume (m^3)			Water	Volume	Discharge (l/s)	
	Main canal	Secondary canal	Tertiary canal	Loss (m^3)	Supplied (m^3)	Main canal	Secondary canal
TC1-1a		2,100			2,100		48.8
TC1-1b					0		0
TC1-4		1,900			1,900		44.2
TC1-4b		0			0		0
TC1-4a		0			0		0
TC1-5		3,300			3,300		76.8
TC1-2a			1,200		1,200		27.9
TC1-2b			1,100		1,100		25.6
TC1-2c			1,200		1,200		27.9
TC1-3			3,200		3,200		69.8
SC1-A		6,500		300	6,800		158.3
SC1	13,800			800*	14,600*	339.27	
TC2-1			1000		1,000		23.3
TC2-2			1000		1,000		23.2
TC2-3Ca					0		0
SC2-A	2,000			200	2,200		51.2
TC2-3					0		0
TC2-3b			900		900		20.9
TC2-4a					0		0
TC2-4b			900		900		20.9
TC2-4c					0		0
TC2-5					0		0
SC2	3,800			508*	4,308*	100.1	
TCM1-a			1,500		1,500		34.9
TCM1-b			0		0		0
TCM2			0		0		0
TCM3			1,400		1,400		32.6
TCM4			0		0		0
TCM5			9,00		900		20.9
TCM6			1,200		1,200		27.9
TCM7-a			2,000		2,000		4
TCM7-b			0		0		0
TCM7-c			0		0		0
TCM8			1,800		1,800		41.9
TCM9-a			2,200		2,200		51.2
TC3-1			1,100		1,100		2.6
TC3-2			0		0		0
TC3-3-3			0		0		0
SC-3		1,100		200	1,300		30.2
MC	12,100			700*	12,800*	297.44	
Total	29,700			2,000*	31,700*	737.82	l/ s

Fig. 3.1



LONGITUDINAL SECTION OF F. T .O. WITH C .H. O.



FRONT VIEW OF A C.H.O.

FIG . 3.2

NAM NGUM PUMP IRRIGATION PROJECT
CHO STRUCTURE : HEAD REGULATORS
ORIFICE GATE 0.80 x 0.60 RATING CURVES

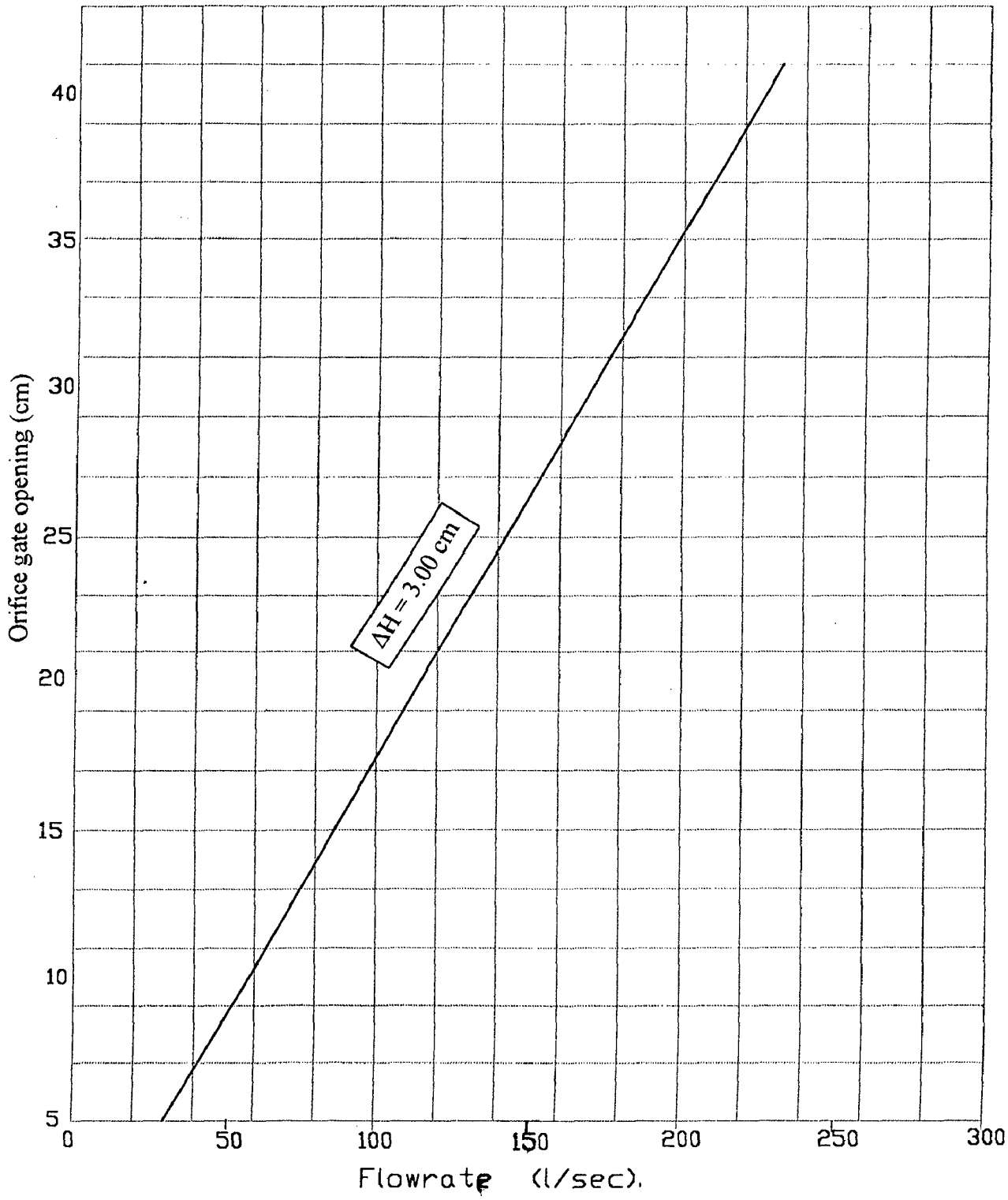
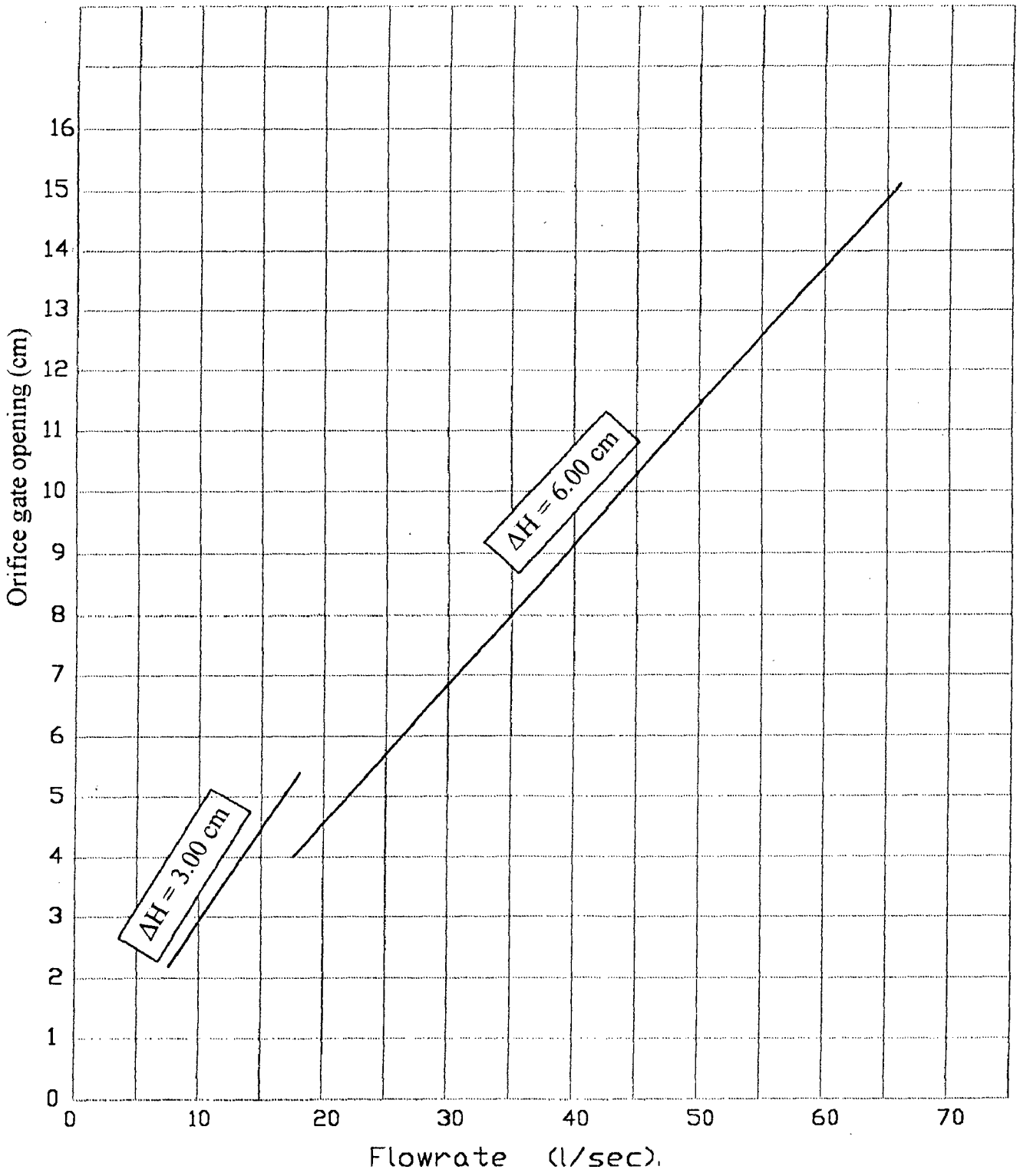


FIG. 3.3

NAM NGUM PUMP IRRIGATION PROJECT
CHO STRUCTURE : FARM TURNOUTS
ORIFICE GATE 0.60 x 0.45 RATE CURVES



3.3 Policy Context Of Pump Irrigation

Irrigation policy throughout 1980's (the during which the project was conceived) is characterized as follows:

- Strong emphasis on the objective of national self-sufficiency in rice.
- Assumption of electric power supply at low (even negligible) cost.
- Assumption of feasibility of government management, operation and (if necessary) subsidy of irrigation schemes.
- Very strong prioritization of irrigation in relation to other alternative investment opportunities in the agricultural section (this applied to the use of external resources, and especially to the allocation of Government (funds).

  From the early 1990's the policy began to change, as a result of adopting the "New Economic Mechanism", political and economic change in the external relation of Lao PDR, change in the nature and orientation of major donors, experience with early irrigation schemes and, in particular, with accumulating, maintenance problems and deficits. Present policy is moving towards.
- Emphasis on agricultural development as a means to reach a number of social and economic goals, including economic growth through sustainable land use.
- A valuation of electricity at its production cost, or even at its opportunity cost in terms of potential exports sales.
- An emphasis towards farmers management and even ownership, of irrigation schemes, while government involvement reduced to a minimum, and moved to reduce and ultimately remove operating subsidies.
- A reassessment of the priority to be given to irrigation investment and development among a number of other agricultural priorities.

The government, following the directives of the fifth party Congress and based on the party politburo Decree No. 21/PPB, is promoting the integrated vertical line organization and management at all levels, the development of effective rules and regulation, the upgrading of national staff capacity, and operation and maintenance training and extension.

3.4 Operation and Maintenance of the pump and channels

In the third Rabbi season, a new innovation was tried with the active participation of the WUA. Every family in the village, no matter what their land holding, including landless families, was issued a coupon entailing them to an equal quantity of water. This coupon could be sold, traded in exchange for land to farm, or otherwise exchanged through the WUA. The coupon must be purchased, at a price of about 25 percent of its estimated market system all the villages benefit from the water and water can find its highest valued uses among the villagers.

The Chairman/President along with the Managing committee Members shall organize a participatory walk through within the area of operation of the farmers organization and identify all the critical reaches which need immediate repair as listed out in above. The competent authority shall assist the farmers' organization Water User Association in preparation of detailed list of works to be undertaken.

The distributory committee shall perform the following functions; namely:

a) To prepare an operational plan based on its entitlement, area, soil, cropping pattern at the beginning of each irrigation season, assistant with the operational plan prepared by the project committee.

b) To prepare a plan for the maintenance of both distributaries and medium drains within its area of operation at the end of each crop seasons and execute the maintenance works with the funds of the committee from time to time.

c) To regulate the use of water among the various water users' associations under its area of operation.

d) To resolve disputes, if any, between the water users' associations in its area of operation;

e) To maintain a register of water users' associations in its area of operation

f) Maintain an inventory of the irrigation system in the area of its operation, including drains;

g) To promote economy on the use of water allocated.

h) To maintain accounts.

i) To cause annual audit;

j) To maintain other records as may be prescribed;

k) To monitor the flow of water for irrigation;

l) To conduct general body meetings as may be prescribed;

m) To abide by the decisions of the project committee;

n) To cause regular water budgeting and also the periodical social audit as may be prescribed.

o) To assist in the conduct of elections to the managing committee; and

To encourage avenue plantations on its area of operation.

3.5 Irrigation System Operation Support

Starting with the 1995 wet season the permanent pump has been used to irrigate that portion of the available service area wherein the farmers have completed land leveling and on-farm works.

A contract for wet season irrigation was signed between the Project Directors and the Chairman of the ThaNgon Project Farmer's Association Under the contract the association agreed to assign Farmer Water Masters to manage irrigation scheduling and recovery of the water charges within each tertiary block.

The charges levied for the years 2000 wet season were 10 kip/cu.m comprising 5.0 kip for electricity, 3.0 kip for operating personnel, 0.5 kip for lubricants and routine maintenance of Electro-mechanical equipment and 1.5 kip as compensate the water Master. Due to the Electro-mechanical equipment being new and still under warranty, no charges were made so far for depreciation or maintenance and repairs.

Unfortunately, due to heavy flooding about 96% of the wet season crop were heavily damaged or destroyed.

Payments by farmers for irrigation water have been accumulated in the ThaNgon Farmer's Association savings account with the Thoulakom District Branch of the Agricultural Promotion Bank. It is proposed that the project shall refund the electricity fee component of these charges as a contribution to the Revolving Fund.

A local Water Management Consultant is assigned first to coordinate the activities of completion of the irrigation network considered necessary as a basis for cropping pattern and water allocation planning by individual water users group. Further, the consultant is required to finalize calibration of the irrigation systems and establish pump and gate operating regimes for the various cropping scenarios encountered.

The remainder of the consultant's assignment is devoted to assisting community organizers and gate operations to train the individual water users group officers in irrigation techniques aimed at maximizing group yields per unit volume of irrigation water applied.

Because the irrigation systems have not yet been fully calibrated or "fine turned" and water users groups not yet fully trained to economical water management the irrigation cost for most of the farmers is still higher than it should have been.

Further, water charges collected from the farmers will be allowed to be accumulated in the Revolving fund saving counts as a reserve against farmer financed operation and maintenance in the poor land over period.

- **Upgrading/Rehabilitating Secondary Canal**

Almost 2 km of SC-1 secondary canal was severely damaged, by both branching and sedimentation, when the Nam Ngum River over-topped its banks during August to September 1995, which required urgent rehabilitation before the 1995-96 dry season irrigation campaigns.

Therefore repairs of flood damages were taken up and infiltration losses were reduced (approx. 80 l/sec) in the first two canal reaches up to km 1.800. Repair sections branched by floods and install some extra drainage ways and flood banks.

- **Design was carried out by project staff**

Construction details: Excavation of sediment and unsuitable soils to 0.50 m below the design guidelines and recompactions with clay-gravel laterite from borrow pit. No.1 canal sides are required to raise at low point to prevent further ingress by floodwaters.

3.6 Other important works

The works discussed as under did not require complex site organization and equipment but in order to save time and avoid lengthy tender procedures, it was envisaged to execute them with hired equipment and personnel under the direction of Project Engineers.

a). Clearing and Training of Nam Ngoung Stream

Its objective was to improve drainage condition and prevent flooding in Tertiary Blocks 3.1 and 3.2 during the rainy season, by clearing the stream bank and cutting meanders. However, project staff under the suppression of the Design Engineer carried out the survey and design.

Construction details: A meander-free route for the obstructed section of the Nam Ngum stream were surveyed and constructed by excavator. In reaches where the new route coincides with the present streambed, excavator cleared bank vegetation intruding into the stream course.

Estimated costs: 5 m kip for approx. excavations volume of 10,000 m^3.

b) Additional Drains

The objective of this activity was to improve drainage conditions of the command areas in plans where canals were constructed across natural flood ways.

Survey and design: to be carried out by project.

Estimated quantities: 850 m of drains.

Estimated unit cost: 2000 kip/m.

c) **Additional Farm Inlets**

However, the objective of this activity was: the provision of additional Farm Inlets was foreseen to increase the efficiency of irrigation water distribution to farmers' field and reduce the area of paddy fields to be sacrificed to quaternary canal construction.

Design: the design of Farm Inlets already installed under contracts NNP-ID01 and NNP-ID02 could be utilized, for which the construction details were that Metal form, were assembled by a local workshop. The forms and materials were supplied to those Water Users Groups, which required additional Farm Inlets. But the groups provided the labor for construction and installation of the priciest inlets.

Estimated quantities: 12 Farm Inlets.

Estimated unit cost: 80,000 kip/unit

d) **Augmentations of canal Free board**

The objective of the augmentation was to enable the farmers in order to restore the canal free board promptly after damage by heavy rains or floods.

Construction details: Laterite clay material was from borrow pits and stock piled at strategic along the secondary canal alignments in order to enable farmers to conveniently repair any flood or rains damage to canal banks.

Estimate quantities: 2700 cu.m.

Estimate costs: 1500 kip/cu.m.

e) **Electro-mechanical installation**

The pump installation commenced in October 1994 but, due to problems with the lubrication system and electric controls, it could not receive Provisional Acceptance unit March 1995.

Meanwhile, the pontoon-mounted pumps were temporarily installed for 1994 wet season, which were used for dry-season irrigation activities in part of the service area. They were on loan from the Vientiane province irrigation service which required refurbishing before return.

3.7 Agricultural Development Support

3.7.1 Review of Project Objectives.

The primary objective of the project is the sustainable production of an incremental of 5,000 tons per annum of subsistence rice or cash-earning equivalent. Irrigation facilities have been created under the project as the means of guaranteeing adequate water for crop and forage production during the periods of inadequate rainfall. Conversely, drainage facilities have also been constructed to drain off excess waters from high rainfall in order to minimize disturbance to crop growth.

The advent of irrigation capability into a previously traditional subsistence agricultural area causes, however, considerable disruption to transitional practices. Considerable readjustment is required on the part of the impacted farmers before full advantage can be taken of the irrigation facilities and the overall sustainable increased productivity objective is realized.

In the following, formulation of an agricultural development strategy aimed at achieving the project's objectives, historical land use and land capability are first described as a basis for planning the pattern of sustainable future land use in the project area.

3.7.2 Historical/Traditional Land uses the Project Area

The project is set on the flood plains and levees of the Nam Ngum River in the Vientaine plain. The project area comprises four main landforms: levees, back swamps, plain lands and uplands. All except the swampland were originally thickly forested.

The first agriculturists to exploit the area subsisted by fishing in the rivers and swamps, hunting and gathering in the forests, and slashing and burning the plains, and uplands for the production of rained "Swidden" rice. Cattle and buffalo were grazed on the riverbanks and swamp verges.

As population pressure increased, Swidden fallow cycles shortened to the extent that Swidden rice yields started to decline. The response to this was to level and bound the plain lands to capture and pond rainfall thus equipping them to be utilized for producing an annual wet-season rice crop.

3.7.3 Definition of Project Area Boundaries for Agricultural Development Support

As discussed above, the impact of the irrigation facilities constructed by the project extends well beyond the boundaries of the commendable area. Those with irrigated paddy field also have other parcels of arable land or grazing land in the vicinity. Many of those without irrigated land previously communally grazed their cattle and buffalo on the paddy field stubble during the dry season. The advents of dry season irrigation have forced them to find other alternatives. Those without sufficient paddy field depend on fishing in the wetlands and are impacted by the waters. Others without wet-season paddy irrigation or releasing toxic chemicals into for producing their subsistence rice in the dry-season.

For such reasons, the project area for agricultural development support purposes is defined as: "that area utilized by farm families (and their animals) resident in those villages of which any of dwellers have paddy field irrigated by the scheme".

3.7.4 Agricultural Development Support Activities

3.7.4.1 Irrigated crop Promotion

The initial agricultural development thrust of the project has been to closely monitor and ascertain crop budgets and to provide on-site demonstrations of irrigation techniques to the beneficiaries, not all of whom have had previous experience with bounded paddy production and virtually none of whom had experience with irrigated crops other than rice.

These demonstration activities have initially been concentrated on ThaNgon sub-project, where permanent irrigation supply first became available ThaNgon has been utilized as the venue for training and demonstration for staff and farmer's representatives of the Houay Chiam and Ban Phao sub-projects as these came on-stream.

Table 3.3 **Nam Ngum Pump Irrigation Project**

AGRICULTURAL INPUT THROUGH REVOLVING FUND

No.	Details	1996 PROJECTIONS					
		Are a(ha)	Rate (kg/ha)	Q'ty (kg)	Jnit C (kip)	Budget (kip)	Expenditure (kip)
A	Rice seed for newly Irrigated land				250	6,236,700	3,448,300
	ThaNgon					1,246,073	1,253,927
	Houay Chiam					3,929502	1,755,498
	Ban Phao					1,061,125	438,875
B	Organic manure for newly Irrigated land				200	88,762,00	838,000
	ThaNgon	322	400	128,800		31,925,74	274,255
	Houay Chiam	528	400	211,200		52,373,38	426,618,
	Ban Phao	46	400	18,400		4,462,87	137,127
	Total revolving fund inputs					94998,700	4,286,300

3.7.4.2 Rice

The project encourages irrigation for dry-season rice production only on those soils having low percolation rates. Seeds of the selected high-yielding rice varieties are obtained from the Na Phok Agricultural Research Station; each Water User Group is being encouraged to select its own seed-growers for ensuring local supplies in future years.

For wet season rice, farmers are encouraged to plant early, quick-maturing varieties to clear the way for planting of dry-season cash crops no later than November each year. This ensures best result from said cash crops by allowing them to establish firmly before the onset of cold weather.

3.7.4.3 Non-Rice Dry-Season Crops

On the free draining soils some experimental/demonstrational plots of cotton, tomato, sunflower, and irrigated maize (for both livestock forage and grain for sale) have been supported. Cottonseeds were obtained from the Lao-French Cotton Research and Development project at NaPhok; that project's cultural recommendations were also adopted. Forage maize seed and fruit-tree seeding have been obtained from the Ministry of Agriculture's Had Dok Keo seed station at Vientiane. Small demonstration plots of tomato have been planted.

A pilot nursery has been established for forage grasses and legumes to be planted later along canals and roadsides throughout the service area.

3.7.4.4 Integrated Crop and Pest Management

In support of the environmental impact considerations discussed in section 3.8 below, the project has been cooperating with the Agricultural Extension Service's Integrated crop Management Programme incorporating the establishment of comparative demonstrations on farmers' field, comprising:

- Integrated fields, comprising.
- Integrated Pest Management (IPM)
- Integrated Crop Management (CM)
- 100% Biological pesticide application.
- "Green Revolution" crop management.
- Botanical weed control using permanent cover-crop techniques.
- Traditional practices crop management.

Detailed records of inputs, costs, yields and benefits were kept and field days held to proclaim and demonstrate the results to the wider farming public.

3.7.4.5 Organic Fertilizers and Biopesticides

For environmental and sustainability reasons, the project now encourages use of locally-produced organic compost fertilizer with added biological pesticides in favour of imported chemical fertilizers and pesticides this serves to minimize negative effect on water quality and aquatic life-forms.

In previous years, chemical fertilizers and pesticides were distributed beneficiaries under Revolving Fund credit. Numerous problems have arisen, however including toxicity to men and animals, mortality to fish and frogs in paddy field and water bodies, blocking of waterways by enhanced weed growth, and crop damage due to incorrect application does of chemicals.

In line with the environmental impact recommendations of the Final Evaluation Mission, and in line with emerging policy of the Ministry of Agriculture and Forestry, the Project now distributes the organic manure product compounded by the Lao Fertilizer Factory located between the Hoay Chiam and Ban Phao sub-project sites. This product is a complex blend of poultry, cattle and pig manure as and guano, with added Biopesticides. It has proven effective in field trials during 1995 and is non-toxic to aquatic fauna.

3.8 Environmental Impact Considerations

In line with the recommendations of the final Evaluation Mission, environmental impact of Project activities has been taken into account when planning agricultural is done for development support. According to the precautionary planning" principle of ecological economics, environmental impact in the project area will be minimized when the following strategies are espoused.

- Burn rice husks, fuel wood or charcoal rather than fossil fuels.
- Use organic manure rather than chemical fertilizers.
- Use integrated pest management and biological pesticides rather than synthetic chemical pesticides.

- Plant tree crops rather than arable crops.
- Minimize the area and time devoted methane-producing sanding water in paddy fields.

It is noteworthy that adherence to ecologically and environmentally sound "organic" farming practices is tending more and more to turn to the Lao farmer's potential economic advantage, also farmlands in neighboring Thailand and Vietnam are fast losing soil structure and fertility due to over-use on mechanization and chemical fertilizers without the balancing contribution of animal manure and composts.

Agricultural processors from those countries are expressing interest in the market potential for Lao-produced "chemical free" raw products for food processing.

3.8.1 Pilot Demonstration Activities Envisaged

For 1996, the approach envisaged for stimulating agricultural intensification combines community development and training measures whose technical content will be based on demonstration plots established on farmer's land, one in each of the eleven Secondary Zones throughout the three component sub-Project areas.

These pilot farms would be fenced at Project cost and supplies which agricultural inputs as an incentive to the provision by the landholders of their labour and cooperation.

The aspects to be demonstrated on the pilot Farms comprise:

a. Integrated pest management.

b. Integrated crop management.

c. Crop water management.

d. "Cut-and-carry" livestock husbandry.

e. Composting of crop and animal wastes.

f. Paddy field agriculture.

Other activities envisaged for adoption in hose gardens, particularly by the women, comprise mushroom cultivation and commercial timber trees, fruit tree and herbal medicines and biocides.

Livestock vaccination is being promoted at village-wide scale while selected individuals will be encouraged in the local multiplication for sale to their fellows of high quality seeds of rice and cash crops.

Table 3.1 summaries the project's expenditure envisaged for establishing the pilot demonstration farms and seed producers. Personal and training costs are covered in the following chapter.

Table 3.2 summary budget projections for mushroom culture and nursery activities expected to involve mainly the women.

Table 3.4 Nam Ngum Pump Irrigation Project

Inputs For Seed Production and Demonstration Farms, ETC.

No	Details	1996 PROJECTIONS				
		Area (ha)	Rate Kg/ha	Q'ty (kg)	Unit cost (kip)	Budget (kip)
A	Foundation Seed for Seed Growers					774,200
	1. ThaNgon	10.5	804	350		281,400
	2. Houay Chiam	14.6	1126	350		394,100
	3. Ban Phao	3.7	282	350		98,700
B	Integrated Crop & Pest Management Demonstration Supplies					2,272,75
	1. Organic Fertilizer	2	400	800	200	160,000
	2. NPL 16:20:00 Fertilizer	2	200	400	170	68,000
	3. UREA 46:0:0 Fertilizer	2	100	200	150	30,000
	4. Seeds: rice	1.5	50	75	310	23,250
	5. Seeds: Other crops	0.5	50	25	500	12,500
	6. Biopesticide	2	50	100	1,000	100,0
	7. Notice Boards	2	505	11	25,000	275,000
	8. Fencing wire	2	3520	7,040	100	704,000
	9. Rice Bank Roofing Etc.			3	300,000	900,000
	Total Agricultural inputs:					3,046,950

Note: 1/ July through December, 1995

3.8.2 Livestock Husbandry Support

3.8.2.1 Livestock Health Care

Livestock are a very significant component of the farm economy in the project area but production suffers greatly from disease incidence and dry-season weight loss. High returns to investment can be derived from the establishment of village operated livestock vaccination services and dry-season nutrition enhancement.

It is proposed to select one "Village Vaccinator" from the project beneficiaries in each secondary Zone (11 in all), and to issue him/her with an initial stock of vaccines and a kit of vaccinating equipment (Table 3.5).

Training in their use will be provided with follow up by Veterinary officers from the DAFO.

By charging for vaccination services the village Vaccinators will amass the own revolving funds for the purchase of further supplies of vaccines through the Department of Livestock.

District veterinary Officers will be funded to reproduce Lao-language instruction handbooks for vaccinators and farmers.

3.8.2.2 Livestock Nutrition Enhancement

Traditionally, bovine livestock in the Project area are husbanded on a free-range basis in the daytime, being herded back to the village for shelter overnight. In the wet season they graze forests, roadsides and wastelands while in the dry season they graze the stumbles in the paddy fields.

The advents dry-season irrigation brings about considerable disruption of the traditional livestock husbandry system and a tendency to reduce livestock number. This tendency is regrettable due to the extremely important role that livestock will continue to play in the farm economy. Cattle and buffalo are one of the few products from Lao farms,

which are in great demand from neighboring livestock health, the long-term market prospects remain bright. Apart from upgrading livestock health, the project is therefore also sponsoring the intensification of livestock production through the planting of "cut-and-carry" forages to be Fed to cattle and buffalo penned overnight in roofed shelters where in their manure can be composted underfoot for later application to the irrigated crops.

A forage nursery will be established on the land of one farmer Chosen from each of the 11 Secondary Zones. Forage promoted will include both grass and leguminous species, the seeds of which will be obtained through the "forage for Small holders" (AusAid) Project with the Department of Livestock.

Table 3.5 Nam Ngum Pump Irrigation Project
Livestock husbandry Support.

No	Details	1996 PROJECTIONS			
		Unit	Q'ty (kg)	Unit cost (kip)	Budget (kip)
A	Livestock Vaccination Service Establishment				3,900,000
I	Vaccination Equipment	Kit	11	200,000	
II	Initial Vaccine Supplies				1,400,000
	1. Cattle	Dose	2,000	100	200,000
	2. Buffalo	Dose	1,000	100	100,000
	3. Swine	Dose	1,000	100	500,000
	4. Poultry	Dose	5,000	100	500,000
	5. Canine	Dose	5,000	100	
III	Documentation				300,000
	1. hand Book Production & Distribution	Book	100	3,000	300,000
B	Livestock Nutrition Upgrading				1,914,000
	1. Forage Nursery Planting Materials	Pkt	11	100,000	1,100,000
	2. Fencing Wire for Nurseries	M	3520	100	352,000
	3. Roofing Iron for Cattle Shedds	Ea	132	3,500	642,000
C	Paddy field Agriculture Support				2,940,000
	1. Fish Fingerlings	Ha	2	1,200,000	2,400,000
	2. Initial Fish-food Supply	Ha	2	120,000	240,000
	3. Pod Manure	Ha	2	150,000	300,000
	Total :				10,454,000

Note: 1/ July through December 1995

3.8.2.3 Paddy field Aquaculture

Fish aquaculture is done simultaneously with rice crop in the same field. Fish grow within 3 months. Before cutting rice all water and fish are taken out.

Crop budget analysis for the Project has shown that net annual benefit from rice + fish in both wet and dry season (necessarily grown with low non-toxic levels of agricultural chemicals application) is greater than the "green revolution" alternative of heavily fertilized rice without fish even though the rice is higher yielding. Environmental impact is also considerably low. The fish harvest compensates more for the lower rice yields.

The Project is therefore encouraging this rotation for parts of the Project area suitable for permanent rice-fish farms i.e., above normal flood levels but with soils of low percolation rate.

One volunteer paddy field aquaculture farmer is selected from each Secondary Zone and will be motivated to dig the necessary ditches and ponds through the provision of Project-funded fingerlings to stock his farm (Table 3.5). the Project will pay per diem for a technical Specialist to make initial and follow-up visits.

3.8.2.4 Agro-Forestry Support (Table 3.6)

For Several reasons, the Project finds it advisable to initiate support practices necessitated by the dry-season irrigation of previously uncropped fields. Dry-season forage supplies alternatives to rice stubble are required.

In addition to grasses and creeping legumes, tropical tree legumes (gliricida, tamarind, leucaena, etc..,) provide a bulky and nutritious supply of "cut-and-carry" forage and can be grown on areas such as canal alignments, fencelessness, uplands etc., where they do not restrict the cropped area.

3.8.2.5 Living Fences (Thorny bushes, bamboos)

Secondly, if he livestock population is to be maintained along with the irrigation system, a much higher intensity of fencing required. Ideally, canals should be fenced on each side to prevent the risk of damage by livestock treading.

Livestock need also to be fenced out of permanent paddy, and on village gardens and orchards. The productivity of pasturelands cannot be sustained unless they are fenced to control grazing pressure. Living fences, comprising thorny leguminous browse species (for living posts) interspersed with fast-growing bamboo's (for rails) present an affordable and durable means of providing adequate fencing at low cost. The rapid establishment of living fences can be enhanced if they are planted in the alignments of temporary barbed wire fences, which are later dismantled and moved to other locations.

Table 3.6 Nam Ngum Pump Irrigation Project

Agro-Forestry Support.

No	Details	1996 PROJECTIONS				1995 Expenditure
		Area (ha)	Q'ty (kg)	Unit cost (kip)	Budget (kip)	(kip)
A	Tree Nurseries Establishment Packages					
	Package Composition				1,920,000	916,000
	1. Living fence Seeding	no.	1,000	250	250,000	
	2. Fruit-tree Seeding	no.	100	250	25,000	
	3. Browse-Shrub Seeding	no.	1,000	100	100,000	
	4. Investment Forest Materials	no.	15,000	100	1,50,000	916,000
	5. Bio-Pesticide Cuttings	kg.	50	100	5,000	
	6. Polybags, Plastic Sheet, Net	Kg	25	1,600	40,000	
B	**Package Allocation**					
	1. ThaNgon Sub-Project	Pkt.	4	1,920,000	7,374,667	305,333
	2. Houay Chiam sub-project	Pkt.	5	1,920,000	9,294,667	305,333
	3. Ban Phao sub-project	Pkt.	2	1,920,000	3,534,667	305,333
	Total :		11		20,204,000	916,000

Note: 1/ July through December 1995

3.8.2.6 'Investment Forest"

While pump irrigation can provide valuable food security for both man and beast, economic projections high light the un-likelihood of being able to fund pump set replacement, after their 15-yesrs projected life, from the proceeds of irrigated arable cropping alone.

Apart from pump replacement, there is the ever-present risk of electric motor burnout (at 1.5 M.kip per unit for rewiring) and the necessary to overhaul the pump at least twice during their life time (at a cost of 10 M.kip per pump set, in addition to spaceports, if performed by contractors).

Given current government policy to hand over the irrigation systems to Water User Group ownership, it is necessary to encourage the farmers to find supplementary sources of funds for heavy repairs and replacements.

"Investment Forest" Plantation is the recommended course where by high-value fat-growing fuelwood and timber tree will be established on community lands and managed by the Farmer's Associations. Irrigation beneficiaries will contribute their labour as part of their obligations in return for the privilege of receiving irrigation water.

The tree plantations would be "living-fenced" and fire-protected by the water user community and reserved for felling only when needed to finance heavy pump set repairs or replacements. Table 3.7 presents the area of investment forest requires as 155 ha per pump station.

3.8.2.7 Fruit Orchards

Lao PDR steadily extends and upgrades road communications with neighboring highly populated countries. Tropical fruits present an increasingly attractive income opportunity. The proximity of irrigation water considerably enhances the possibility of establishing productive fruit plantations, particularly in those higher parts of the command area, which have not yet been bounded and leveled for paddy rice cultivation. Sericulture is a skill already possessed by many of the women in the beneficiary communities.

3.8.2.8 Tree Nurseries

To motivate the initiation of browse shrub, living fence, investment forest and fruit tree plantations, one farm family will be supported in each of the II Secondary Zones to establish a commercial nursery raising tree seeding for sale to the farming community. Temporary barbwire fencing for the nursery blokes will be provided at project cost, together with an initial supply of polybags and tree seeds (Table 3.6)

3.9 Diversified Income Promotion for women

3.9.1 Mushroom Culture

The increased availability of rice straw as a result of dry-season irrigation leads to the possibility of producing straw mushrooms in beneath the elevated houses and rice barns. This provides women with young children the opportunity to diversify family income while still remaining at home.

Even less labour demanding is the production of button mushrooms in sterile plastic bags on a sawdust substrate. The project plans to introduce this mushroom cultivation technology to II selected housewives, one in each secondary zone.

Equipment and an initial supply of inoculated substrate will be provided, together with technical training (Table 3.4).

3.9.2 Homeless Nurseries (Table 3.4)

Many Lao housewives grow small plots of herbs and vegetables on elevated bamboo platforms away from chickens and other livestock. The project will provide fencing and plating materials to eleven selected housewives, one in each secondary zone, to improve on this technique and produce herbal medicine and biopesticide planting materials for family use and for dissemination throughout the project area.

Table 3.7 **Nam Ngum Pump Irrigation Project**

Diversified Income Promotion for Women

No	Details	1996 PROJECTIONS			
		Unit	Q'ty (kg)	Unit cost (kip)	Budget (kip)
A	Mushroom Culture Package				250,00
I	**Package Composition**				
	1. Pre-packed Polybags-2/	No.	1000	150	150,000
	2. Hand books	Ea.	500	200	100,000
B	Herbal Gardens				117,000
I	**Package Composition**				
	1. Biopesticial herb Seeds	Pkt.	1	3,000	3,000
	2. Herbal Medicine Seeds	Pkt.	1	5,000	5,000
	3. Polybags	No.	200	45	9,000
	4. Hand Books	Ea.	500	200	100,000
II	**Package Allocation**				
	1. ThaNgon sub-project	Pkg.	4	367,000	1,468,000
	2. Houay Chiam sub-project	Pkg.	5	367,000	1,835,000
	3. Ban Phao sub-project	Pkg.	2	367,000	734,000
	Total :				4,037,000

Note: 1/ July through December 1995

2/ Bags for mushroom production include substrate, in column, plastic ring, Cotton wool plug.

CHAPTER IV

EXISTING FARMERS ROLE AND WATER USERS ASSOCIATION

CHARPTER – IV

EXISTING FARMERS ROLE AND WATER USERS ASSOCIATION

The terms of the project Financing Agreement (E C 1990-01) required the GoL. and European Commission (EC) to carry out a Joint mid-term progress evaluation of the project plus and evaluation at the end of the project period. The mid term Evaluation took place from 19th October to 2nd November 1993, which has been updated by the evaluation Mission during March - 13th April 1995.

The mid-term review Mission recommended to concentrate all technical and financial efforts on ensuring the sustainability of the 1,100 ha already committed for construction, rather than to immediately increase the irrigated areas. In view of disappointing economic returns expected from rice irrigation, emphasis was also given to diversifying out of rice monoculture and to incorporate livestock promotion and aquaculture into the project activities. To achieve this, the Mission recommended to extend the project until year-end 1996 and to allocate additional funds for Technical Assistance and project operation and maintenance (O & M).

The joint Final Evaluation Mission supported the funding of mid-term Review Mission and emphasized the need for project extension in order to consolidate the farmers' capacity to make optimal use of the irrigation facilities installed, and strengthen governmental capacity to provide viable operation and maintenance (O & M) services for the installed facilities.

The Evaluation Mission also concluded that (by concentrating on agriculture development, O & M support) by mid 1996 the project will come close reaching revised objectives of an increased (or paddy equivalent) production paddy of 5,000 tons, food security for 15.000 people, and additional income for more than 900 families. For achieving this, the project will have to concentrate and efforts in the coming years on bringing the whole scheme area under well organization-irrigated agriculture.

Both Mission confirmed the importance of incorporating water measure structure in scheme design, for payment of water charges by volume of intensive agricultural extension, and of effective mechanisms for water users group organization (all of which activities have been introduced in each sub-project since an early stage). In March, 1995 the Lao PDR Government and the European Commission agreed in principle to extend the project phase 1 unit end 1996, and the technical Assistance inputs up to end-June 1996. The Draft extension of the financing Agreement was forwarded from EU Bruxelles to GoL. for countersigning in July 1995. An additional EU contribution of 521,00 ECU was involved.

4.1 Water Users' Association In Lao P.D.R.

Unfortunately in our country, more attention has been paid for the development of irrigation resources but the problem of optimum use of water and its scientific management on the farmers field has not received due attention. Much too often the social and economic aspects of water use have been overlooked. Mere creation of the utilizable potential and infrastructure facilities is not enough. In this objective, the farmers must be educated about the repair and maintenance of the watercourses and make their full use for increasing production. But the non-involvement of the farmers, in design and operation of the system causes conflicts and problems. Since the farmers are the actual beneficiaries, their participation is essential. Unless they are involved, irrigation malpractice and offenses cannot be checked even with the force of law. However, the farmers' active involvement in irrigation development programmes can be ensured by a participatory and community based approach for which an appropriate organization can be of three-tier system of an elected "Water Users' Association". This Pyramid can serve the farmers'

community with (I) at the lowest level a 'Chak-Samiti' which can be constructed from the farmers within the Chak or the outlet command, and. (ii) Secondary level can constitute a sub-project committee farmed of the representatives of the outlet committees in a distribution system and an Apex body at the state level. In this three-tier system, on the tertiary level, the farmers' association can represent the farmers' at the highest position in the project development. This could be named as 'Project Policy Decision Committee'.

The physical boundaries of the Association could be along with the hydrologic unit. The forming of Water Users' Association can more appropriately consist of a bottom up approach i.e. to organize the farmers along with the cultural, physical and social dimensions, which may enable them to participate in irrigation management. It is necessary to provide the water use mechanism by which they can adopt new technologies and programmes. Material support such as equipment, loans, construction materials etc. obviously would benefit to provide incentives. The role of the association could be as follows:

(i) To give legal advice for the water users contracting with the government on order to undertake watercourse and land leveling improvement.

(ii) To provide an assurance that the watercourse would be properly operated maintained and improved after construction of the physical component.

(iii) To provide a vehicle for the farmers to attain an important identity in the country and give an opportunity for them to develop and assume individual as well as collective responsibilities in the use of scarce natural resource i.e. water. The Association would also provide the water uses an opportunity to develop a social consciousness for the use of the resources.

(iv) Water Users' Association would reduce the risk of all users simultaneously sharing the responsibility in a more equitable manner.

Water users Association are extremely popular ideas in the literature, serving both the interest of those who promote people's participation more or less as an end in itself, and those on the other side who do not want to worry about the problems below the outlet.

(v) To give the water users an opportunity to have an important feedback to the purveyor of water and inform the purveyor of constraints and limitations to which the ultimate user is subjected.

(vi) Associations would provide water users a right of resource directly to the courts where otherwise a conflict of interest of interest may exist.

(vii) As a legal entity representing collective goals and duties of farmers within a watercourse.

(viii) Water Users' Association at the Chak level (TC) in the villages will serve as the first link in the channel of communication between the water users and the governmental agencies with this role.

Irrigation water project for delivery beyond outlets the solution by way of interaction and cooperation provided the formation of the same is not imposed upon them forcibly but it comes through their necessity.

Co-operative in any walk of life helps in promoting over helps of society at large. In this context the formation of irrigation water project within the command area of irrigation projects could bring about social reforms and therefore, such co-operative merit encouragement from all concerned. National Water Policy specially endorsed the "Participation of farmers and voluntary agencies in water management". The involvement of farmer in water management has been recognized in September 1987.

4.2 Managements/Organization system

Management Group is a transitional institution where in the key personnel being seconded from the Department of Irrigation, the Provincial and District Irrigation service and the private (consultant) sector. After project termination it is intended that the National Project Director would transfer to the Irrigation Department, the two Deputy Directors would return to their respective provision as Irrigation services while the site Managers and Gate Operation would hopefully, remain in sits but under the auspices of the respective District Agricultural and Forestry Offices.

The objects of the farmers' organization shall be to promote and secure distribution of water among its users, adequate maintenance of the irrigation system, efficient and economical utilization of water to optimize agricultural production, to project the environment, and to ensure ecological balance by involving the farmers, inculcating a sense of ownership of the irrigation system in accordance with the water budget and the operational plan.

- Managing the water and irrigation network within a tertiary unit or village irrigation area, so that the water can be used effectively by the members to meet crop water requirements and be distributed equally between farmers.
- Maintaining the tertiary network or village system on good working order.
- Managing the payment of member contributions, in the form of money, crop harvest or labour, to pay for operation and maintenance of the system and other activities to development of the group. The presidential Instruction sets down the organizational structure of water Users Association, is illustrated.
- Board members of water User Association are:

  a) Chairman.

  b) Vice Chairman

  c) Secretary

  d) Treasurer

  e) Water Master.

- The member of Water User Association is the whole farmer whose getting the advantage directly from tertiary irrigation water services which covering:

  a) Land owner

  b) Land owner cultivator

  c) Cultivator

  d) Owner of fish pond which use irrigation water

e) Agency who cultivate paddy or pond

f) Other irrigation water users.

Guidance:

a) The governor, head of Province, giving the guidance in the frame of establishment of Water User Associations.

b) Head of Regency (district), has the responsibility in conducting the establishment and development of Water User Associations.

c) Head of Sub-District has the responsibility to coordinate and take care of Water User Association.

d) Head of village conducts the establishment and development of Water User Association in according to his responsibility and authority.

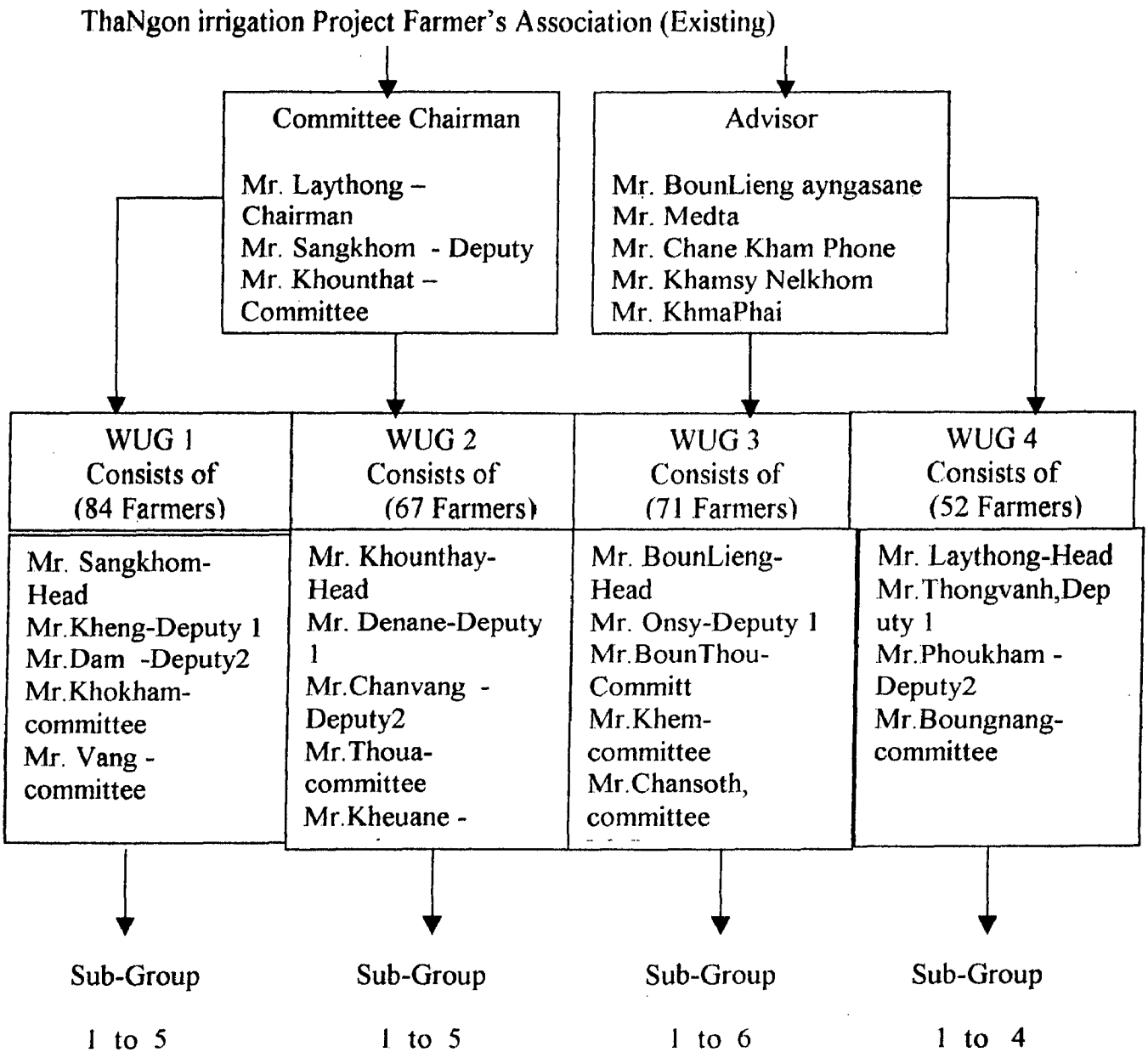
4.3 Human Resources Development

a) Project Management Group

With reference to the project organization Diagram (Table 4.1) the Project Management Group is a transitional institution where in the key personnel being seconded from the Department of Irrigation, the Provincial and District Irrigation service and the private (consultant) sector. After project termination it is intended that the

National Project Director would transfer to the Irrigation Department, the two Deputy Directors would return to their respective provinces as Irrigation services while the site Managers and Gate Operation would hopefully, remain in site but under the auspices of the respective District Agricultural and Forestry Offices.

Table 4.1 **Organizations Of The ThaNgon Irrigation Farmer's Associations** (Existing).



b) District Agricultural and Forestry Offices (DAFOs)

Several of the Field staff is Seconded from the relevant DAFO's. They are gaining "on-the-job" experience in irrigation scheme operation and management at local level.

c) Support to Farmers' Associations (FAs)

At the project termination, it is intended that the site office, storerooms and associated facilities will be handed over to continued operation by respective Farmers Associations Through the Project's Local Technical Assistance Consultants, a major thrust of the project's institutional development activities during early 1996 was aimed at motivating and training Farmers Association members to take over the water management role presently filled by project appointees. As regards the scheme operation and management the Farmers Association are required to take the responsibility for collection of water fees from farmers and payment of electricity costs, also negotiating with the Irrigation Department pertaining to repair and maintenance of civil works beyond the capacity of beneficiaries' manual labor. Coordination of the Water Users Groups for land use planning and irrigation scheduling is another crucial function, as per the negotiation of contract Farming agreements with private sector processors and traders.

d) Water Users Groups (WUGs)

One Water Users Groups comprises 20 – 30 farmers, which coincides with one normal or two small Tertiary Canal Blocks. All Water Users Groups have now been established and office bearers- a water Master and Book-Keeper-have been appointed. One of these also functions as chairman. Several of the WUGs, however, still exist only on paper rather than in function and a major task of community organizers is to familiarize the office bearers, and all members, with their duties and responsibilities.

e) Farmers' Interest Groups

Different farmers groups have different interests for attaining greater efficiency and to encourage group solidarity, effective dispersion of technical knowledge and mutual self-help, the agricultural development assistance professed by the project, will be channeled through interest Groups elaborated as under:

- **"Rice Bank" Group:**

Following the extensive flood damage experiences in August 1995, funds from the European Union, channeled through the NGO " Agency International Centers la Farm (AICEF)" is being utilized to purchase and distribute subsistence rice. For those requiring assistance but having irrigated paddy fields (and thus a change to grow and repay the rice received) rice Bank Groups have been established, to use the donated rice as the basis for local food security and disaster relief insurance for the future. Farmers are encouraged to donate timber and labor for erection of the live Bank buildings while the Project supports the purchase of roof iron and metal fixings.

- **"Food for work" Groups:**

Those who lost due to floods, but no irrigated paddy fields, are encouraged to organize into "Food-for-work" group to engage in local labor intensive infrastructure development activities for which payment is made in rice rations.

- **Other Interest Group**

Other interest Groups envisaged include large livestock Groups, Nurserymen's' Groups, Mushroom grower Groups and Paddy field Agriculture Groups. Each Group participates in pilot demonstration activities and the preparation and distribution of the relevant handbooks for disseminating technical knowledge to the wider community.

f) Institutionalization of Rural Finance and Credit

Long term project financial sustainability is founded on the premise that farmers should share the loss with government for the proper and effective operation and maintenance of the whole irrigation in to crops that are more remunerative than rice is only just beginning.

- **Payment of water and O&M charges**

From the very outset, the project has adopted the principle that irrigation should pay for their water, preferably in cash and such a system has been developed at scheme level because the Agricultural Promotion Bank have only very recently established at District level and does not yet have effective procedures for directly providing credit facilities for the water dues.

- **Revolving Fund**

The financial system adopted by the project Centres on a Revolving Fund which was established from the proceeds of grants of agricultural inputs funded by EC-As each farm comes under irrigation for the first time and a grant with the aim of maximizing benefits in terms of crop yield from the water applied. The "Revolving Funds" are managed by the respective Farmer Associations.

The farmer association on lands the inputs to the project beneficiaries and accumulates repayments and interest into a serving Account with the local branch of the Agricultural Promotion Bank. These funds then remain available locally for purchases or inputs in future.

Revolving Fund surpluses are kept in an interest bearing Bank deposit in the name of each Farmer Association, whose functionaries are trained during the project period in the management and administration of the Fund. The proceeds are handed over to the full ownership of the farmers Association upon project completion during the Project, period with drawls from the fund are only authorized upon the decision of a General Meeting of Farmers Association under the signatures of two senior functionaries of the Association and one Project Team member.

Proposed expenditure on agricultural inputs through the Revolving Funds is budgeted in table 2.2.(Chapter II).

4.4 Training Programs

a) Training for Project and Government staff

During the high pressure of construction activity of the past years there was considerable transfer of detailed technical skills but little opportunity to impart basic management skills to the counterparts of the Technical Assistance Consultants. Further more, the management of survey team and contractor (who are already generally well experienced and organized) is a very different matter to managing the agricultural sector, which is more diffused in structure and whose proponents are less disciplined and more loosely organized.

b) Trainings for Agronomist and Agriculture extension workers

1. Integrated crop and Pest Management

It is proposed to sponsor the Irrigation Agronomist and Extension Worker from each District Agriculture-Forestry office and those of the project's Gate Operators with agricultural Extension experience to attend such course.

Disillusionment with the ecological, environmental and social impact of the "Green Revolution" has led to a resurgence of interest in traditional integrated agricultural techniques and scientific approach to productive agriculture with a reduced recourse to application of toxic chemicals. This of much significance to Lao agricultural in a world market where premium prices are commendable for "Chemical free" agriculture produce. It is also very important that no pollutants washed from agricultural land to the wetlands of the Mekong River system, upon whose fisheries hundreds of Agriculture at Konkaen University in Thailand provided short courses in integrated crop and Pest Management.

The course is conducted in the Northern dialect of Thai, which is easily understood Lao personnel, at the facilities of the EC- funded Northeast water management and Irrigation Strengthening project (NEWMASIP).

2. Training to the Pump operators

+ Pump operation and maintenance course

After final Acceptance of the inclined pump refresher the Technical Assistance Mechanical Engineer provides trainings to pump operators. Site Management and Stand by pump operator also participates.

i) Out of country study Tours:

- To Vietnam

A study tour to Vietnam for management-level project Team and District Agricultural and Forestry office staff was arranged.

Several large parasitical pumped irrigation and drainage schemes were visited with particular emphasis on operation and maintenance, organization, farmers' grouping, seasonal credit, cost recovery and accounting systems. Irrigation systems in the foothills studied regarding aspects of watershed conservation and equitable development for farmers without irritable land.

- To Thailand

It is also proposed that visits will be made to two venues in Northern Thailand by Field staff and District Agriculture – Forestry office Personnel.

The first is farmer-owned and operated pump irrigation cooperative in Uttaradit Province with a very active well-run Farmer Association and water management system.

The second venue is the grower's area of the Lampang Food cannery co., which has also commenced pilot contract Farming activities in the service area of the ThaNgon Project.

ii) **In country study tour**

A tour by Project Field staff and District Agriculture Forestry office personnel is proposed to acquaint them with the production of irrigated diversified dry-season crops by farmers in Kasy, Vangvieng and Feuany District of Vientiane Province, under the sponsorship of the world Bank funded Upland Agricultural Development Project.

c) Training for Farmers' Leaders

- **Training Sessions**

The local consultant community Organizers is required to provide theoretical training for Water Users Group Functionary's area, 40 per time, in regular fortnightly sessions at the three-project site office, which will focus on.

- Crop water Management
- Integrated crop and pest Management
- Accounts Bookkeeping.
- Organization and conducting of group Meetings
- Conflict Resolution
- Livestock Health Care and Nutrition
- Paddy field Aquaculture
- Mushroom culture
- Herbal Medicaments, Biopesticides and their Cultivation.

- **Field Visits**

These will take the form of inter-project visits where by farmer leaders from one project will be transported to, and accommodated at, WUG's in other project area, which have accomplished some demonstrable technique. The relevant village women's Group will be financed to arrange the catering for the Overnight stay, which is valuable in Giving ample opportunity for discussion of pros and cons with those who have perfected the techniques under demonstration.

Topics to be highlighted will include.

- Crop water requirement
- System operation and maintenance
- Paddy field Agriculture
- Cut-and-carry livestock feeding
- Compost production
- Living fence establishment
- Seed multiplication
- Tree and forage nursery techniques.

Selected farmer leaders are taking on a tour of the Vang Vieng with project field staff and District Agriculture Forestry Office Personnel.

4.5 After Handing-Over

Positive results were observed as given under:

- Water user's groups have been formed and improved step by step.
- Farmers became aware of the importance of irrigation activities and consider themselves owners of the project and became active participants in projects.
- The functions, right obligations of the groups improved gradually.
- The protection, and repair irrigation schemes by becoming more effective.
- The distribution of water to members became more systematic tan before. The use of water became more efficient and economic. Farmers do make sure the irrigation equipment and assistance protected.
- Coordination between the Farmers' Association and government officials are getting closer and quicker.
- The ThaNgon Project has fully constructed technical irrigation structures down to

farm level, with the capacity to accurately meter water distributed to each field. It is one of the few irrigation projects in the region where water is paid for by volume, in advance. This ensures that farmers become quickly oriented against waste and conscious of efficiency after use with consequently saving in power consumption and the reduction of evaporative wastage.

CHAPTER V

REVIEW OF LITERATURE

CHAPTER V

REVIEW OF LITERATURE

An attempt has been made in this chapter to review the available literature pertaining to the farmers' role in participation in irrigation system.

5.1 WATER USSERS ASSOCIATION IN INDIA

In India, Irrigation project are classified on under:

1) Major project – Irrigating more than 10,000 ha.
2) Medium project – Irrigating between 2,000 to 10,000 ha.
3) Minor Irrigation Project – Irrigating less tan 2, 000 ha.

In minor Irrigation project, there can be surface/gravity Irrigation system and Tube well Irrigation system. Also there are tube wells in all the above project.

5.1.1 Typical Distribution Network

On a major project water transport and its distribution i.e., a water conveyance network from the water control structure and up to the field consists of the following component (Fig.5.1).

Main canal: It is the principal channel of a distribution system off-taking from primary source of water i.e. a river or a reservoir or tail reach of a feeder.

Branch Canal: It is a canal receiving its supply from the main canal and acting as a feeder for distributory. Direct outlets are also provided for areas along canal.

Distributory: It is a channel receiving its supply from the branch canal. It supplies water to minors and watercourses.

Minor: It is the smallest channel in the system receiving its supply from distributary canal, and providing direct irrigation through outlets.

Outlet: Point of final distribution of water to an area called command area of the outlet. Water course takes-off-from this point.

Watercourse: It is a channel taking-off from a branch canal or distributory or a minor from which field is directly irrigated.

Tail Escape: It is an escape at the end of distribution intended to convey the surplus or unused water to a natural drain, depression or other suitable place.

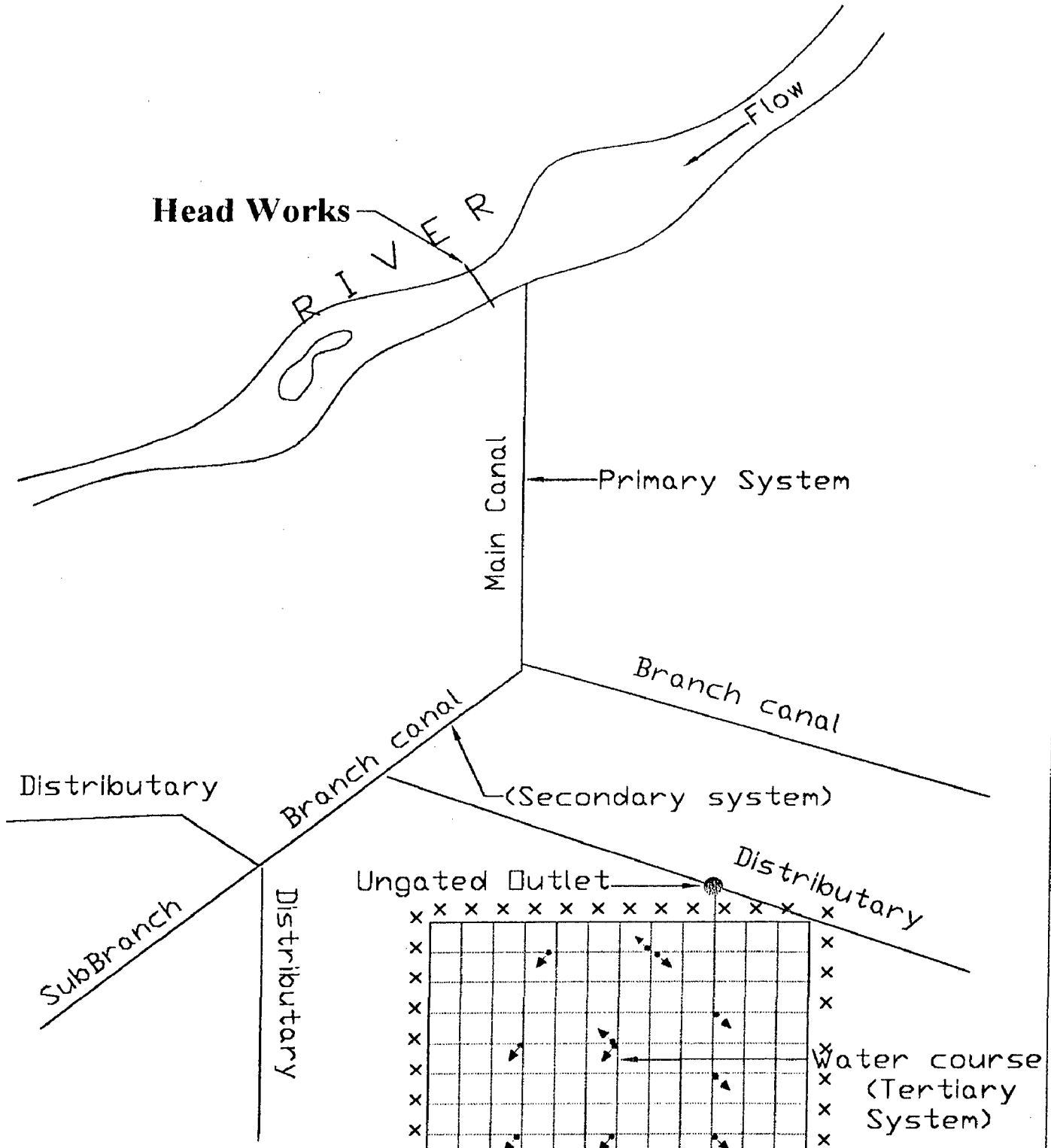
Above the outlet, maintenance of the canal system along with efficient operation has to be ensured to adequate, assured and timely supply of water to the outlet. Below the outlet, a complete and functional network of field channels (watercourses) in the outlet command area with suitable number of conveyance control, distribution controls and application control structures are necessary.

Generally, the main-canal may run continuously subject to availability of water except for a closure of 2 to 3 weeks a year required for repair and maintenance and depends upon the cropping pattern prevalent. Branch, distributary and minor canals may or may not run continuously throughout a crop season depending upon the necessity to strike a balance between water supply and demand.

5.1.2 Rotational Distribution

The Irrigation systems in North India plain were projected on the principle to extend irrigation to much larger area than could be fully supported by the largest available supplies and thus have perpetual scarcity condition, the resultant agricultural production and insurance against famines would have been at their optimum levels and the production would have been maximum per unit of water then per unit of land covered. It is a greater social appeal. Because of scarcity conditions the distribution method under the option was to very precise and effective one with its main focus on equity of distribution and management.

In view of the above principle of distribution of water the rotational practice of running of distribution channels have been followed. The distribution channels run in rotation with gap in their running but normally runs at full capacity.



REFERENCES

1. Managed by state
2. Managed by farmers
3. Outlet
4. Nakka
5. Water course
6. Chak Boundary
7. Holding Boundary

Fig. 5.1 Typical Distribution System

5.1.3 Management Of Supplies Among Farmers:

The established practice of distribution among farmers is by 'WARBANDI' or 'OSRABANDI' where in 'WAR' means turn and 'BANDI' means fixation. Thus 'warbandi' means fixation of turn for irrigating the crop/field.

The 'warbandi' is a system of water distribution and management much popular in Northern India. It is designed such that every farmer is entitled to receive a predetermined amount of water in proportion to his holding. He tailors his cropping pattern according to this water allocation. But free to adopt the area of his crops.

This practice is well established in U.P. Haryana and Punjab States in Northern India.

Osrabandi has become very popular in North India canals due to the following benefits:

1. Water supply is properly distributed and economically used.
2. Canal are also cleared and well maintained.
3. It has lessened conflicts between farmers.
4. Normally greater coverage of irrigated area has been observed after Osrabandi.
5. Offence of ignoring clans individual farmers in Osrabandi are cognizable and a case could be instituted under Northern India canal and drainage Act VII of 1873 section 70, in the court of judicial Special Magistrate Canals.

5.1.4 Water Users Association In India

There has been serious thinking by Government of India on recommendation of 2nd Irrigation Commission Government of India (1972) to abridge the gap between Irrigation potential created and utilized Command Area Development Authorities (CADAs) were created in various State on different project commands, duty sponsored by Government of India an also supported by States. These command area Development Programme have an

important element to involve farmers in management of water such as establishing Osrabandi and encouraging farmers participation.

National policy Statement of government of India (1987) also declared that "Efforts should be made to involve farmers progressively in various aspects of management of Irrigation systems particularly in water distribution and collection of water rates" However, the achievements were not very encouraging on the part of States.

The following are the main reason for efficient water management, which need participation of farmers.

1) With creasing population need for food grain going to increase.
2) Area under irrigation and cultivation not going to increase.
3) There will be increasing pressure on water use in other sector other then irrigation.

In recent years Andhra Pradesh (AP) has taken substantial initiative under Dynamic leadership of chief Minister. The Andhra Pradesh Farmers Management of Irrigation Act (Act 11 of 1997) was enacted in India to promote farmer's participation in the management of Irrigation through Water Users Association.

In this Act the following function have been entrusted to WUAs.

1) To prepare and implement a Warbandi schedule for each irrigation season.
2) To prepare a plan of action for maintenance of the system and to carry out maintenance.
3) To regulate the use of water according to the Warbandi schedule.
4) To promote economy or the use of water allocated to the Association.
5) To assist Revenue Department in preparing demand of water rate and is collection.
6) To maintain a Register of landholder.
7) To maintain an inventory of irrigation system in its area of operation.
8) To monitor flow of water for irrigation.

9) To resolve the disputes between member.

10) To raise resources.

11) To maintain annual accounts and arrange annual audit.

12) To encourage plantation on bunds & available land.

13) To conduct regular water budgeting and periodical social audit.

Beside State of Andhra Pradesh (A.P.) the state of Goa, Madhya Pradesh (M.P.) and Tamil Nadu have made specific provisions for WUAs under the irrigation sector and legal backup has been provided through enactment/amendments to their irrigation Acts.

In some other state like Gujarat, Maharashtra, Karnataka Kerala, Orissa and Haryana it has been decided to switch on to participatory Irrigation Management through WUA at different level adopting appropriate modules.

Activities in this direction are also catching upon other States in varying degree and level.

The States of A. P. and M.P. together account for 81% of the country's WUAs, which cover 28% of CCA, basically as a result of the recently enacted laws.

The prominent provisions of Adhra Pradesh (India) Farmers management of Irrigation Act. (Act 11 of 1997) are approached.

5.1.5 Turnover of public Tube wells in Uttar Pradesh: (Case study of a successful cooperative society)

Uttar Pradesh (UP) is the largest State (province) of India in terms of population and ultimate irrigation potential and fourth largest in terms of geographical area.

A. GOVERNMENT POLICY

In February 1992, the Government of UP after due consideration decided to start a pilot project under which initially 100 State tube wells of the Irrigation Department (ID) were to be handed over to the command farmers after they had constituted a Nalkoop Panchayat Samiti (Tube well Cooperative Society) for operation and maintenance on lease for five years. The conditions laid down by the State Government for the turnover of the tube wells are as follows:

- The water distribution system of the tube well is fully constructed.
- The discharge of the tube well is not less than 25 000 gallons per hour.
- The tube well operator will be appointed and paid by the society and he will be accountable to the society for his work. In case the operator appointed by the ID is already working in the tube well turned over to the society, his continuance in that job will be at the discretion of the society.
- The society will bear the cost of electrical charges at the rate applicable to private farmers and the balance due to the Electricity Board will be borne by the ID as a subsidy to the society.
- The government will pay to the society at the of US$76 per tube well in the beginning as its contribution so that the society may not face any difficulty in carrying out minor repairs.
- The turnover scheme will be executed by the ID but the early proceedings of the lawful constitution of the society and other lawful responsibilities will be borne by the officers of the Cooperative Department at the district and block levels.

- The society of tube wells in UP a lease rent of US$1.5 per year during the lease period.

The turnover of tube wells in UP started from Kharif, 1992 and till May 1994, 45 State tube wells had been over to the farmers.

a) Mampur tube well cooperative society (MTCS)

The paper describes the establishment and the working of MTCS. In particular the paper examines the changes associated with irrigation management transfer (IMT) such as water use efficiency cropping intensity and productivity cost of water to the beneficiaries, control of the water to users I IMT and the gains or losses to the government.

b) The Mampur Tube well

The 33 KG tube well in sultanpur District is located in Mampur Village, which is about 28 km from Sultanpur towards Jaunpur. It was constructed in 1974-75 as a state tubewell and during 1989 when the Lambhua cluster was being formed under the Indo Dutch Tube well Project (IDTP). This tube well was also included in the cluster and it was decided that this tube well be treated as a "dedicated tube well". This meant that the tube well would be provided with a power supply on a dedicated feeder line and minor repairs would be made in the existing system of the tube well.

According to the official records, the tube well has the following features:

- The Gross Command Area (GCA) is 96 ha and the Cultural Command Area (CCA) 84 ha,
- The power of pump installed is 20 horse power.
- The discharge of the tube well is 41,000 gallons per hour.
- The number of farmers in the command is 150. Of these 108 have less than

0.5 ha of land, 35 have 0.5-1 ha of land only 7 farmers have above 1 ha of land. This means that this is preponderance of marginal and near landless farmers in the command.

c) The polities of turnover and confrontation

The main reason behind the turnover of the tube well to MTC was the farmers' extreme dissatisfaction with the arbitrary ways the tube well operator distributed water and levied water charges. The Socio-economist with the Monitoring and Appraisal Cell (MAC) of the IDTWP played the role of a catalyst by accident. The crucial assurance and the accident. The crucial assurance and the encouragement for the formation of MTCS came from the Executive Engineer (EE) at Sultanpur. He told the farmers that if they could muster the support of more than 50% of the tube well command farmers he would help them in the takeover of the tube well. However, the most important factor was the interest and the stakes of pro-takeover village leaders, particularly that of Tewari (present Secretary of the society). Tewari's younger brother was a strong contender for the post the tube well operator in 1989 but Singh ultimately got selected for the post. According to Singh, Tewari could never forgive him for this and, therefore, did not leave any stone unturned in letting the tube well turned over to a society whose backbone was Tewari.

Until the turnover of the Mampur tube well, relation between the coordinator Farmer Participation Unit (FPU) and the EE was satisfactory. However, a big confrontation between the two started soon after the turnover of the Mampur tube well and this has created lots of problems for other tube wells in the district. This has been discussed at length in a report by the author.

d) Socio-economic bases of power

The bases of power on India in general and India in particular consist of religious groupings, social rankings, numerical strength and economic means. Social rankings are largely determined by the caste compositions. The essence of case is the arrangement of hereditary groups in a hierarchy. The popular

impression of the hierarchy is a clear-cut one, derived from the idea of Varna, with Brahmins (priests) at the top and Harrijans (scheduled castes) at the bottom. But as a matter of fact, only the two opposite ends of hierarchy are relatively fixed, in between and specially in the middle regions, there is considerable room for debate regarding mutual position (Srinivas 1969). Numerical strength has acquired a very important role after independence in 1947 and more particularly with the advent of the democratic process.

B. WORKING OF MTCS

The working of the tube well society is examined in two parts. Part one examines the working of MTCS in terms of its legitimacy and institution building. This includes observance of rules and regulation and maintenance and distribution of water. Part two examines the impact of IMT in terms of various gains or losses emanating as a consequence of transfer of the tube well from the government agency to a farmers' cooperative society.

a) Fulfillment of legal requirement

As regard the question of fulfillment of legal requirements, it is found that the society has observed most such requirements. Its general body and the Board of Directors/Management Committee have been meeting regularly as required by the bylaws. The general body consists of 150 farmers having land in the tube well command, although voting rights have been conferred to only 58 share-holding farmers. During 1992-93 the general body met thrice with an average attendance of 41. During 1993-94 also, the general body met thrice with an average attendance of 55. As per the bylaws, the general body must meet at least twice in a year, one after each of the two cropping seasons, kharif and rabi. In the case of Management Committee/Board of Directors, although bylaws do not specify any number, it is envisaged that it should meet as often as required. In 1992-93, there were 4 meetings with as average attendance of 10 members out of the total 15. in 1993-94, there were 13 meeting with an average attendance of 8.

5.2 WATER USSERS ASSOCIATION IN NEPAL

5.2.1 Water User Association (WUA) formation

In Nepal, Irrigation project are classified on under:

	Terai (Plain Area)	Hill Area
1.	Major project – Irrigation more than 2000 ha	more than 500 ha.
2.	Minor project – Irrigation between 501 to 2000 ha	101 to 500 ha
3.	Small project – Irrigation less than 500 ha	Up to 100 ha.

To assist with the organizing process, a sociologist from the Department of Irrigation, selected Farmer Organizers (FOs) from the farming community, the main duties of FOs were:

1) To collect information and data about water users, and
2) To explain clearly to farmers in the system how the joint-management program works. Basic qualifications of an FO were the ability to read and write, being an active farmer from the area where he or she was to work, and the ability to ride a bicycle. Using FOs from the farming community proved extremely useful as they had excellent local knowledge, and generally trusted by farmers, and who could communicate effectively with system management staff and bring up issues with them.

5.2.2 Organizational set - up of WUA.

The apex level organization, the main committee was formed from canal organizations for canals, which have outlets from the main canal. Branch canal organizations for branch canals serving large areas, with outlets serving smaller areas are equally represented on the main committee, each branch canal organization sending one representative to be a main committee member. This person cannot hold office in the lower-tiered organization.

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Table 5.1

Performance of the tube well before and after IMT (area in ha currency in US$)

Item	Before IMT			After IMT	
	1990-91	1991-92	1992-93	1992-93	1993-94
A net irrigated area					
Kharif		31	43	14	54
Rabi	32	51	-	56	63
B Gross irrigated area(watering Area)					
Kharif	-	72	99	14	162
Rabi	63	144	-	159	176
B Average no. of watering					
Kharif		2.3	2.3	1.0	3.0
Rabi	2.0	2.8	-	2.8	2.8
D .Running hours					
Kharif	-	1315	1691	188	1232
Rabi	656	2040	-	1344	1515
E. Average time per net ha irrigated					
Kharif	-	42.4	39.3	13.4	22.8
Rabi	20.5	40.1	-	24.0	24.0
F. Average time per watering					
Kharif	-	18.3	17.0	13.4	7.6
Rabi	10.4	14.2	-	8.5	8.6
Water charges ($)					
Kharif	-	210	240	28	187
Rabi	182	581	-	407	459
Average water charges/watering ($)					
Kharif	-	2.9	2.5	2.0	1.2
Rabi	2.9	2.8	-	2.6	2.6
Average water charges per net irrigated ha($)					
Kharif	-	6.8	5.9	3.0	3.4
Rabi	5.7	11.4	-	7.3	7.4

Table 5.2

Cropping pattern and productivity before and after IMT

Crop season/crop	Before IMT		After IMT	
	% area	Productivity (Qtl/ha)	% area	Productivity (Qtl/ha)
Kharif				
Paddy	24	35	37.4	38
Millets	16	NA	13.1	NA
Pigeon pea	11	NA	8.3	NA
Sugar cane	5	195	8.2	200
Other crops	2	NA	0.2	NA
Fallow	42		32.8	
Total	100		100	
N+	84 ha		84 ha	
Rabi				
Wheat	50	21	54	
Pigeon pea	15	NA	10.3	
Other pulses	10	NA	19.8	
Sugarcane	2	195	4	
Other crops	8	NA	6.1	
Fallow	15		4.9	
Total	100		100	
N=	84		84	

Table 5.3

Income and expenditure of MTCS (20September 1992 to 20 September 1993)

Income (in $)		Expenditure (in $)	
Share capital @ $0.6/percent for 57 Member and $1.5 for one member	36.06	Electricity charges	186.36
Membership fee @ 15 cents/person	8.79	Tube well and fish pond repairs	133.33
Nucleus fund given by ID	75.76	Lease rent payment to ID	3.03
Collection from irrigation charges		Stationary, etc.	16.59
		Deposits in the bank	177.87
		Cash in hand	18.25
Total	35.43		535.43

Note: Rupee conversion rate: Rs 33.00 = US$ 1.006

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A meeting of the general assembly was called to elect the main committee officers. Nominees for the posts were allowed to speak, then the general assembly voted for officeholders. At West Gandak, as per the wish of farmers, the chairperson came from the tail of the canal, the vice-chairman from the head, the treasurer from tail, the secretary from the middle section.

5.2.3 The first challenge

The system manager used government funds as a leverage to obtain more involvement of farmers and enhance institutional development. He used the limited available budget more in the branches where there was more participation by farmers. The system managers gave attention first to the organizations that were readily willing to mobilize their own resources. This move encouraged the emerging organizations.

The WUA is being trained by the agency staff and consultants working in the system for more scientific water distribution procedures with the help of inventory map showing details of the area and the discharge required to irrigate these areas.

5.2.4 Financial Record

It means a detailed record of financial transactions and related matters. The main characteristics of this type of record is the maintenance of WUA's details of incomes and expenditures. The financial detail is audited once in a year with registered auditor and is to be produced in the general assembly for approval. The financial records needs the following details.

Although users' associations are designed to function as efficient organization in the management, conservation and distribution of water, they would have to account for the administration of a public asset as provided under the Nepal Constitution.

- Expenditure by WUA in operation and maintenance of the canal, management expenditure of office and salaries of the hired personnel.
- Labor mobilization by the WUA
- Membership of the WUA
- Number of shareholders in the system
- Number and position of the hired personnel in the office and in the field.
- Decision of GA and executive committee (minute book).
- Operation, maintenance, and management.
- Users in the command area and their land holding.
- Crop pattern and area.

a) Irrigation Service Fee

1) The concerned Irrigation Office shall collect the irrigation service fee in the project/system operated by His Majesty's Government itself or any Development Board constituted under Development Board Act, 2013 until the joint management system is introduced.

2) The irrigation service fee shall be collected on the basis of irrigated area for each crop.

3) The responsibility to collect the irrigation service fee from the water users for irrigation service rendered by the irrigation project operated under the joint management shall be vested in Water Users' Association registered with His Majesty's Government.

4) In case the irrigation service fee realized by the Water Users' Association is 80 percent or less than that of the fee to be collected such Water Users' Association shall be entitled to keep only 50 percent of the amount of the share to be received by the Water Users' Association.

5) There may separate (rate of) irrigation service fee I the different irrigation projects/systems operated or to be operated under joint management. While fixing irrigation service fee the concerned irrigation office and Water Users'

Association jointly on the basins of land shape, type of water resources and irrigation, expenditure to be incurred in repair and maintenance and intensity of crops also shall fix it.

6) In case the amount of share is not sufficient for the maintenance and operation of the canal, the Water Users' Association may collect necessary additional service fee from water users as decided by it subject to the provisions of its Constitution.

b) Water Tax:

The collection of water tax is done in the system on the share basis of land holding. The present rate of water tax is 60 / hectare per crop in the main system. However, in the Piparpati-Parsauni, the present rate Rs 150 / ha /crop which is more than double of the main systems rate. They had also the initial rate of Rs 60/ha/crop in 1993 but after the transfer of canal to users, they felt that it was insufficient to run the system. After actually finding out the cost of OMM in this heavy situation canal, they fixed this rate of water tax. During informal discussions with farmers and in the meeting of WUA (main committee), it was one of the main issues of discussion.

In WGIS, the water tax is generally collected at upatoli level and the lower level for operation and administration of cash is either upatoli or toil level depending on the tier of organization existing in the particular canal system. The total collection is distributed in the ratio of 20%, 30%and 50%, i.e., 20% of the water tax is retained at the toil level (or upatoli level), 30% is to be given to the next higher organization (branch and main) and the rest 50% goes for the OMM of the main canal

c) **Water Distribution Records**

It is the record of the water delivered from the head regulator in the main canal that is to be distributed and actually delivered in each branch/minor as per

the area in the canal system. This type of well organized water distribution and allocation record system helps in resolutions of water disputes to a great extent. The following information is needed for this.

- Daily, weekly, monthly and yearly water distribution records.
- Record of area irrigated by each canal system.
- Record of crops and area covered by it.
- Water discharge measurement records at different location in the canal system.
- Water demand records of each canal system.

5.2.5 Water conflict and its resolution

Water conflicts within a system can be broadly grouped into two categories conflict Among Water Users. This is a major source of contribution by the users in OMM and very successful in many farmers managed irrigation systems (FMIS) in Nepal. The experience of FMIS is tried to capitalize here in this system also where farmers have contributed in desisting and minor maintenance activities like reshaping the canal (earth work) and grass and bush cutting operations, The heavy silting nature of the canal has made the labor contribution more significant where in WGIS canal system (except main and branch canals), most of the desisting and cleaning operations require manual work.

Water availability is not the only factor for better-irrigated agriculture performance. It should be followed by agricultural extension services, provision of inputs, fertilizers and pesticides including market facilities, which are not facilitated properly in the system. So, an integrated IMT program with the inclusion of such activities should be made and implemented with the working together of various related governmental and non-governmental organizations.

5.2.6 Government Policy

"Water User's Association" means an autonomous body having perpetual succession established and duly recognized under Water Resources Act, 2049(1992) and managed by the farmers who use water for irrigation and includes the general body of the water users, committees of different levels and coordinating agencies within the organizational structure of the Association formed in accordance with the nature and extent of the irrigation system/project.

1) To develop fast, manageable and reliable as well as environment friendly irrigation system.
2) To carry out programs for additional new constructions and renovation by mobilizing people's participation in the irrigation system and projects constructed and operated in traditional manner by the farmers as autonomous body in private sector and to mobilize financial resources to cause to carry out repair and maintenance of such irrigation systems and projects by the farmer; to make the users group efficient and strong in connection with the use and distribution of water.
3) To establish reliability of irrigation services with an objective to increase agricultural production by making cost effective investment in irrigation development and extension programs which are sustainable in view of technical, financial, institutional and environmental perspective and realize more return in short period and by making required quantity of water available to farmer's field at appropriate time.
4) To adopt a system of preparing up to date list of feasible irrigation systems in various basin and sub-basin in addition to adopting the policy to consider irrigation as the main part of multipurpose water resources projects.
5) To establish the principle of regional balance for development of irrigation in line with feasibility of water resources.
6) To bring uniformity in the implementation process of government institutions and donor agencies involved in the development and extension of irrigation.

7) To gradually decrease government's responsibility in construction, repair and maintenance and operation (of irrigation systems/projects) by gradually increasing participation of organized users without causing adverse affect to the effectiveness in the implementation of irrigation development project at different stages and to increase the role and responsibility of the organized users in different stages of program implementation.

8) To increase the research and training capability in irrigation technology and management system of departmental units.

9) To make legal provision to empower the Users' Association to impose and collect irrigation service Fee and to establish a system of spending the collected amount in the development and management of agriculture system in irrigated area as to avoid the tradition of involvement of government in renovation of irrigation projects repeatedly.

5.3 WATER USSERS ASSOCIATION IN PHILIPPINE

5.3.1 Project Goals And Objectives

The original objective of the project in regard to farmer's group was only to organize and develop FIG's. That would manage the equitable distribution of water on the farm level and maintain the farmer level irrigation facilities. To use the FIG's channels for production loans without collateral, technical assistance and marketing assistance was not considered because there were other farmer's organizations designed for this purpose. However, this limited objective was revised when the members of the Agricultural Coordinating Council (ACC) discussed that other farmers' associations were not functioning well, principally due to lack of cooperation or group discipline. The revised objective called for the organization of a larger type of multipurpose irrigation-based farmers' association.

5.3.2 Organization Of Farmers Irrigations Groups (FIGs)

Within the MRMP management structure, one of the support divisions is called the Agricultural Development Division ADD. This is the only staff division having direct implementation responsibilities. Under 1 is three schemes namely:

1) The Land Use and Water Management Section (LUWMS).

2) The Evaluation and Statistics Section (EESS).

3) The Farmers Assistance and Training Section (FATS).

5.3.3 FUNCTIONS

1. The Land Use and Water Management Section

   a. Conduct water management studies to establish the water management parameters of the service area.

   b. Conduct fertilizer trail in cooperation with selected FIGs.

c. Provided resources speakers for training sessions of water management technicians and FIG officers.

2. The Evaluation and Statistics Section

a. Collect agricultural development information periodically through farmer and institutional survey.

b. Compile, analyze and interpret the collected data.

c. Distribute the result of analysis to the members of the Agricultural Development Coordinating Council (ADCC) to the discuss during monthly meeting.

3. The Farmer's Assistance and Training Section.

a. Responsible for organizing Rotational Unit Group (RUGs), FIGs and training of the officers & members.

b. Responsible for the preparation and implementation of the training programs for water management technician in order to develop their capabilities in allocating and delivering water to the FIGs.

c. Responsible and attending meeting and answer technical question in rice production when ask by farmer cooperation whenever representatives of the concerned agencies are not available.

5.3.4 Organizational Development and Maintenance

The farmers of MRMP did not invert a single cent in the construction of the system. They were not even asked to contribute labour in the construction of the farm-level irrigation facilities. The Irrigation Administrations (IAs) was organized after these facilities are constructed and water was flowing to their farmers. Therefore, many members do not have the problem of getting water. The key function that finds profile together in system that were designed and constructed by water users themselves, such as the "Zangjeras" of I locos Notre in the Philippines and the "SOBAK" of the province of Bali in Indonesia.

The performance of the IAs is canal cleaning was compared with the performance of the individual Ditch tenders based on the following criteria:

a. Height of grass on canal embankments.

b. Property maintained canal cross section.

c. Properly maintained gate and checks.

d. The amount of debris floating in the canal

The participation of the IAs in the collection of ISF was also analyzed and the results were compared on the district basis. Overall, the percentage of ISF collected in areas of IAs is considerably higher than where were no IAs. The importance of strong O&M management support is also clear. District I support for IAs has been particularly strong and the areas of district I having IAs, this support have paid off with a high 91%verage collection.

The performance of the IAs in maintenance and payment of ISFs was included in assessing the performance of area Engineers and WMTS. MRMP management recognized that the IAs would require continuing support and educational assistance until the group discipline had been fully developed.

5.3.5 Problems And Solutions

The program implementers faced several problems from both farmers and government agencies during the process of organizing IAs. The problems included inconsistency of administrative and hydrological boundaries, resistance of some farmers to joining the IAs, lack of appropriate government policies to support the program and resistance by some agency representatives to developing strong IAs.

5.3.6 Farmers Insistence on Administrative Boundaries.

Some of the farmers, especially those also holding political positions and those that do not have good relations with the officials of adjacent villages, insisted on subdividing the canals into sections based on administrative boundaries so that each village would have just one IA. One convinced they were invited to speak to

their respective constituents before allowing the farmers to elect the IA officers. The procedure was done in such a way that all villages would be proportionally represented in the IA. IA funds for community improvement projects such a multipurpose concrete pavements, repair of improvement of farm to market roads, etc. were allocated proportionally to the number of farmer members from each village. The canal section was subdivided into subsections and each village assigned on subsection to clean and maintain.

5.3.7 The absence of Appropriate Policies to Support the Program.

As mentioned previously, strong IA participation in the O&M of the system is indispensable. Efficient and effective collection of ISFs can be attained only through active IA participation. The irrigation facilities were nearly finished when the program to organize the IAs was introduced in MRMP. This was because the loan agreement sis not requires the organization of IAs and NIA had not established guidelines for organizing IAs in large system like MRMP, before the start of project construction. Therefore NIA was not able to respond quickly to the request of the IA officers to make membership mandatory to increase IST rates for non-members.

5.3.8 Job Insecurity of IA organizers.

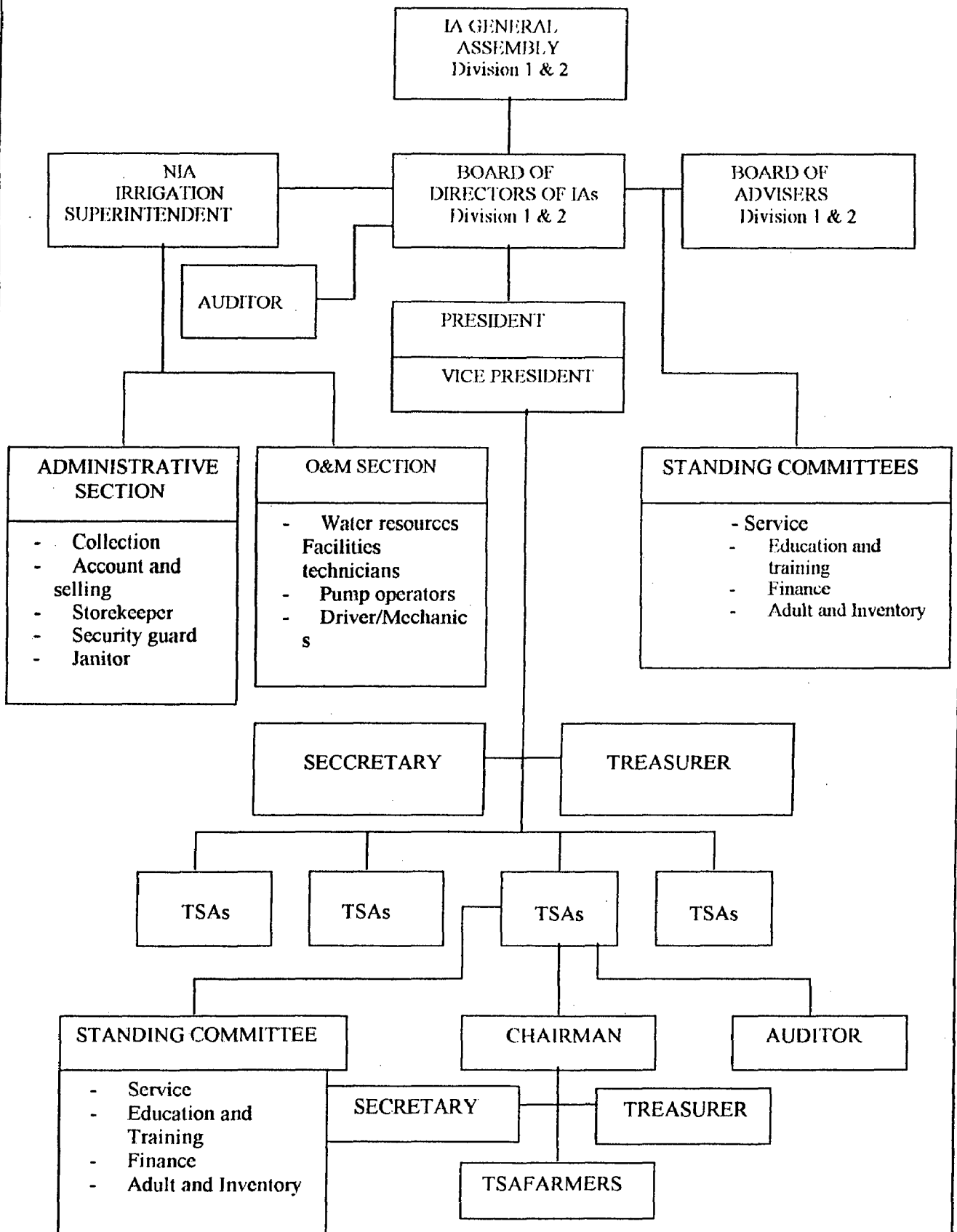
The management had originally employed more people in LUWMS to intensity its activities in promoting recognized the importance of having strong IAs. This starting in 1979, the management started to reinforce the manpower of the FATS, the section that was responsible for organizing FIGs.

Full support and cooperation of the O&M personnel in the development of IAs is indispensable. But most of them were afraid of having strong IAs that would take over their work after the project. Their suspicion because stronger when the management started turning over to the IAs some Ditch tender section for partial O&M. some ditch tenders were transferred to other places while those who retired

were not replaced. Their fear grew stronger when the area covered by water Management Technician was increased from 500 hectares to 1000 hectares due the retrenchment policy of NIA. These charges made the work of the IA organizers more difficult and frustrating. Nevertheless, some O&M district managers continued to be supportive of the IA program.

FIGURE 5.2

Organization chart for joint the Libmanan-Cabusao Pump Irrigation System between NIA and IAs



1. Every Turnout Service Area (TSA) is organized as typically shown in the chart.
2. Each of the two Divisions was one IA organized as shown in the chart.

5.4 WATER USSERS ASSOCIATION IN INDONESIA

5.4.1 Objective of the WUA as:

- Managing the water and irrigation network within a tertiary unit or village irrigation area so that the water can be used effectively by the members to meet crop water requirements, and be distributed equally between farmers.
- Maintaining he tertiary network or village system in good working order.
- Managing the payment of member contributions in the form of money, crop harvest or labour, to pay for operation and maintenance of the system and other activities for development of the group.

Guiding and supervising the members to ensure that all rules related to water use from Central Government, Regional Government or the group itself are adhered to.

Irrigation network of the primary channel and the secondary channel are the responsibility if the Public Work Irrigation Division. Irrigation network of the tertiary channel is the responsibility of the farmers.

Tertiary network is the irrigation network, which has the function as the water supply in the tertiary block, which consists of tertiary channel, quaternary channel and drainage channel including the whole structures and its accessories. We called it the farm level.

In the Presidential Instruction Part IX, Article 12 was said that:

a) The government, Head of the Province, giving the guidance in the frame of establishment of WUA.

b) Head of the regency/municipal has the responsibility in conducting the establishment and development of WUA.

c) Calmat, Head of the district, has the responsibility to coordinate and take care of development of WUA,

d) (Head of village), conducts the establishment and development of WUA in according to his responsibility and authority.

The boundaries of the WUA are defined as one of:

1. Operation and maintenance of the tertiary network.
2. Function and responsibilities of the WUA.
3. Agriculture and water requirements.
4. Tertiary network construction.
5. Preparation of list of WUA members.
6. Preparation of WUA (Basic rules and Internal affair Operation Rules).

Finance and planning

5.4.2 Performance of WUS

There are a number of reasons why the WUA program has not progressed as smoothly as might be wished, amongst others:

a) Small landholdings mean that the WUA has a very large membership, often over 200 farmers, who have only basic education, so organizing an effective association is slow process and cannot be developed by a crash program.

b) The farmer traditional, behavior, education, way of thinking and believe are still strong.

c) Enforcement of WUA rules is a problem since members and the WUA ulu-ulu (water Master) who is usually also a farmer are reluctant to report violators.

d) The traditional village water distribution system managed by the ulu-ulu desa (village) (Water Master) under direction from the head of village often continues to run in parallel with WUA, which can result in conflicting Practices.

e) The errors of the design and construction, which caused water, cannot flow.

f) In some villages, the establishments of the WUA are not based on bottom up system, but top down system.

g) Farmers claim for changing the layout of the tertiary net works after construction while they are already agreed before construction.

h) Farmers expect to receive water supplies without having to pay (construction of 25 kg paddy/ha/season), and tend to wait for Government funds t initiate any maintenance or revalidation of the tertiary.

i) Interagency working relationship between local Government, Agricultural, Extension, Services and Irrigation Services are not so smooth.

Has been set up in West Java Irrigation Service to coordinate the training program members are:

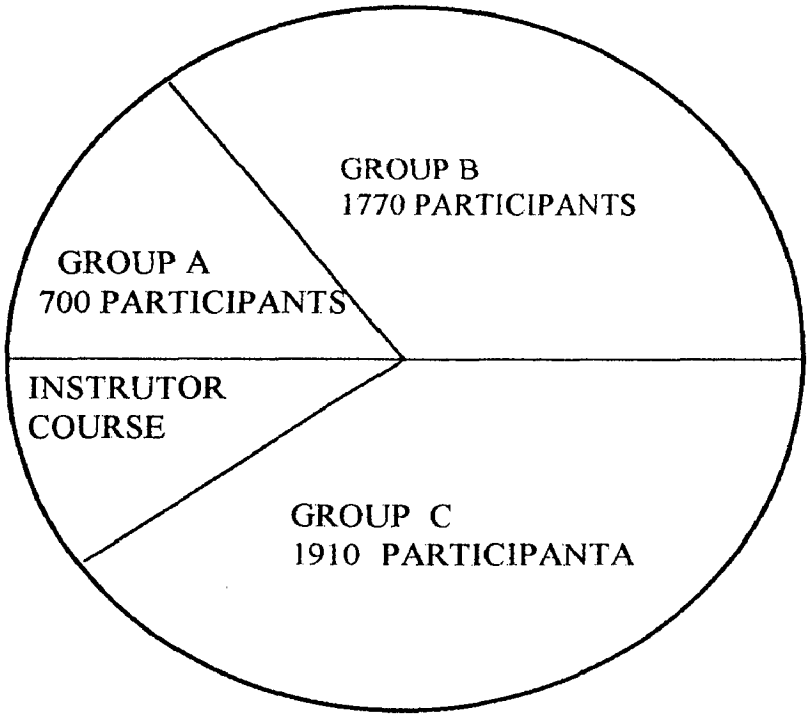
1. Project manager of water Management Training.
2. Head of Carbon regional (Irrigation District Service).
3. Head of Pengairan Indramayu Regional (Irrigation District Service).
4. Head of Operation and Maintenance province.
5. Head of Education and Training Division Jatiluhur.
6. Head of Irrigation Service Section Cirebon.

Farmers role below the outlet

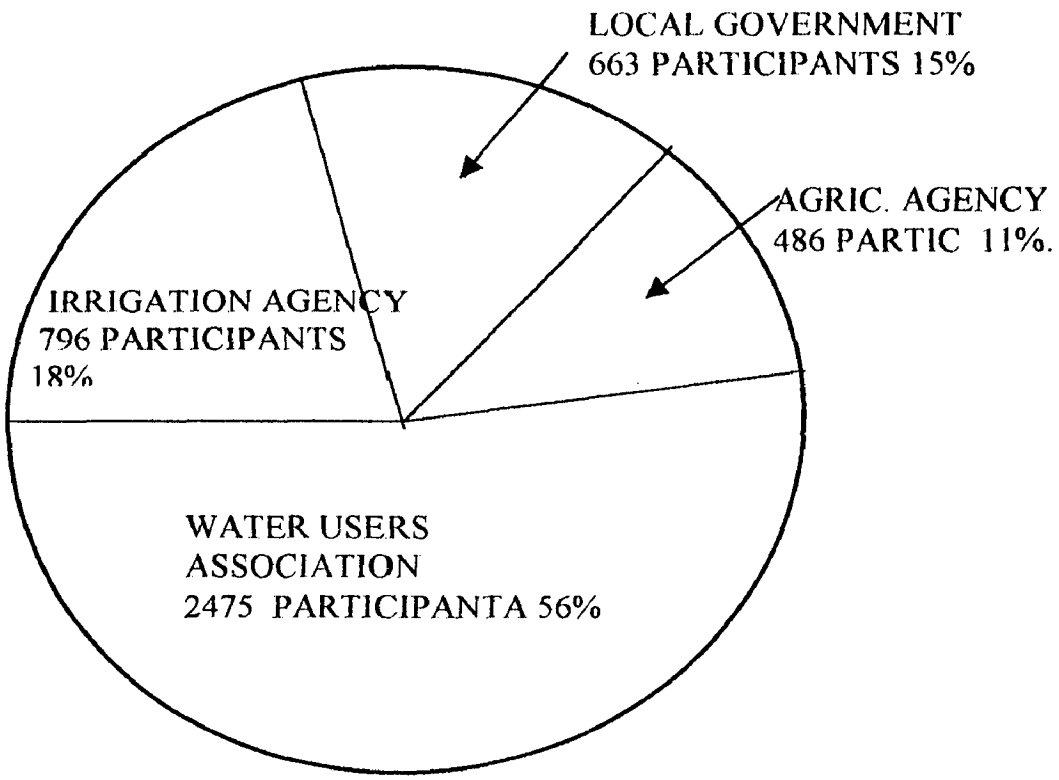
The plan for water user organization or farmers cooperation "below the outlet" is also valid with respect to maintenance. On the one hand collaboration of farmers would facilitate collection of fees for the government, particularly in situations with many small and fragmented holdings. On the other hand maintenance of the field ditches and small structures below the outlet could be entrusted to the farmers, thus reducing the government burden on maintenance cost.

Fig.5.3 Target and total participants of water management training

Project of west Jawa



1. Group A will be given for regency level.
2. Group B will be given for sub districts level and
3. Group C training will be given for village level in the local farmer language, generally local language.



5.4.3 Government Instruction For Guidance Of Establishment Of The Water User Associations

The programme for promoting and strengthening water Users Association commenced in 1969 on the beginning of the first 5-year development plan, with Presidential Instruction No.1, 1969, which followed by a directive from the governor. The situation has been clarified by Presidential Instruction No.2, 1984 which defined the obligations of the Water Users Association as:

1. Managing the water and irrigation network within a tertiary unit or village irrigation area, so that the water can be used effectively by the members to meet crop water requirements and be distributed equally between farmers.
2. Maintaining the tertiary network or village system in good working order.
3. Managing the payment of member contributions, in the form of money, crop harvest or labour, to pay for operation and maintenance of the system and other activities for development of the group.

5.4.3.1 The Board Members

Board members of Water User Association are:

a. Chairman.
b. Vice Chairman.
c. Secretary.
d. Treasurer
e. Water Master.

5.4.3.2 The members of Water User Association

The member of Water User Association is the whole farmer whose getting the advantage directly from tertiary irrigation water services which covering:

a. Land owner
b. Land owner cultivator
c. Cultivator
d. Owner of fish pond which use irrigation water
e. Agency who cultivate paddy or pond
f. Other irrigation water users.

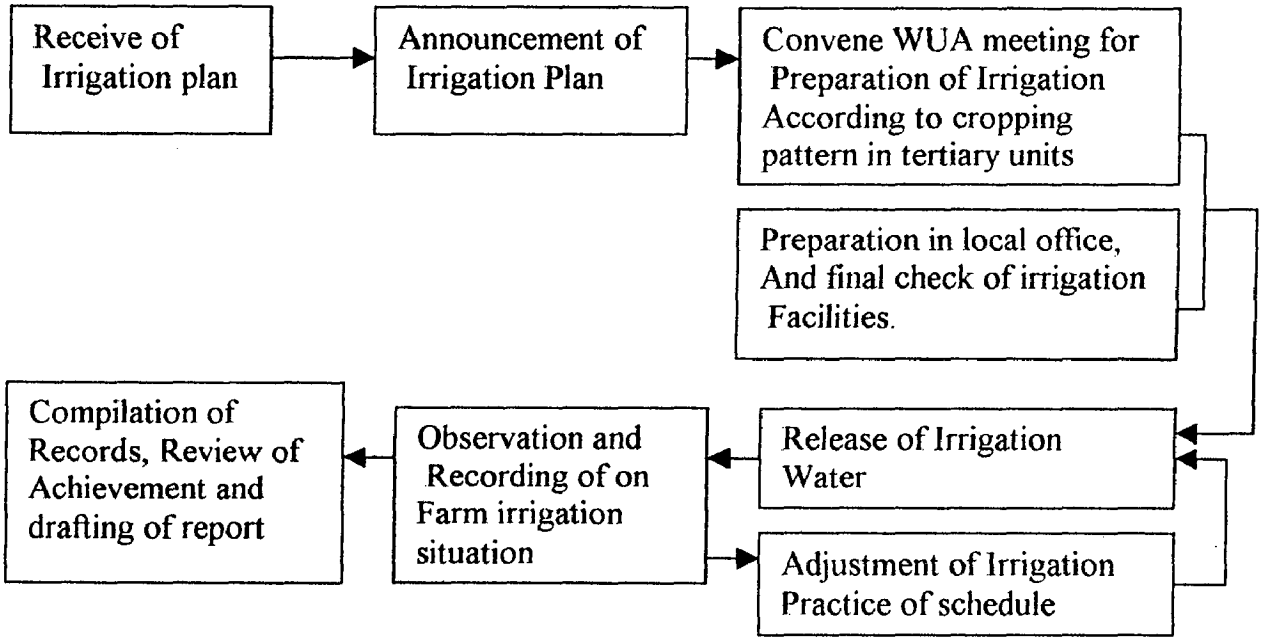
5.4.3.3 Guidance

a. The Governor, Head of Province, giving the guidance in the frame of establishment of Water User Associations.
b. Head of Regency (District), has the responsibility in conducting the establishment and development of Water User Associations.
c. Head of Sub-District, has the responsibility to coordinate and take care of Water User Association.
d. Head of village, conducts the establishment and development of water User Association in according to his responsibility and authority.

5.4.4 Distribution Of Irrigation Water

One the irrigation supervisor has received the irrigation plan from relevant section, then he should have it duly implemented procedures of implementing the irrigation plan are illustrated in the following chart.

Procedures Of Irrigation Implement



5.4.5 Announcement of Irrigation Plan

1) After receiving the approved irrigation plan announcement of the plan should be made by Pengamat office to inform the water user's organization, as well as the relevant agencies of the irrigation plan, and to solicit their coordination, support, and assistance.

2) Meeting with Water User Association.

The main topics to be explained and discussed in the meeting:

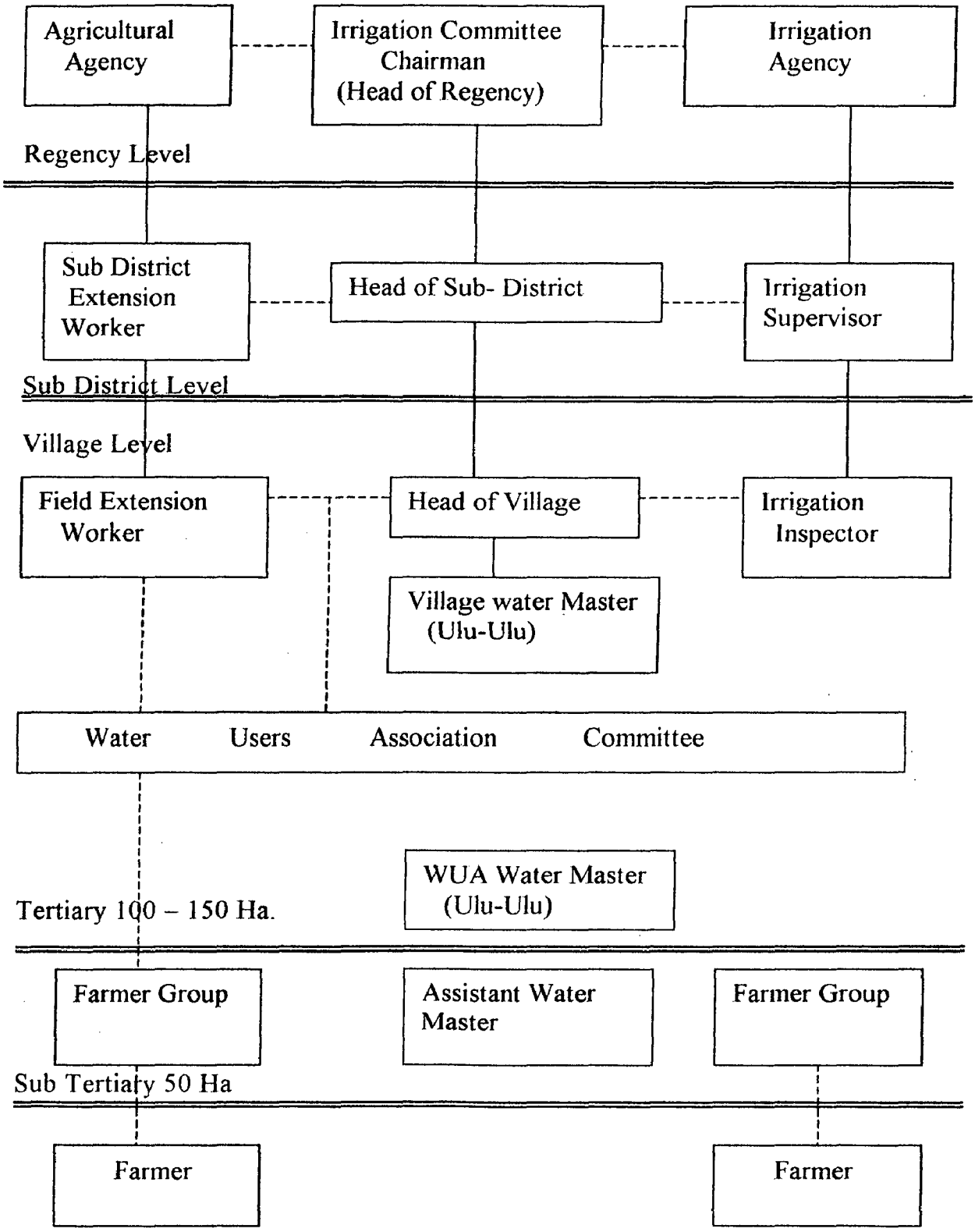
a. Explanation by Irrigation Inspector or Irrigation Supervisor of detailed Irrigation plan as well as the rotational group system.

b. Briefing by the water master of WUA an special points of the irrigation practices prepared to make to the irrigation plan, i.e. conditions of continuous or rotational irrigation method to be implemented, organization of group for rotational irrigation, order of rotation etc.

c. Determination on the ways and means of repairing tertiary and quaternary canals and farm drains before irrigation begins, and also the ways and means of maintaining such ditches during the application of irrigation.

d. Arrangement of the agricultural cooperative groups. The peak demand for manpower and farm implements, during the land preparation, transplanting and harvesting periods.

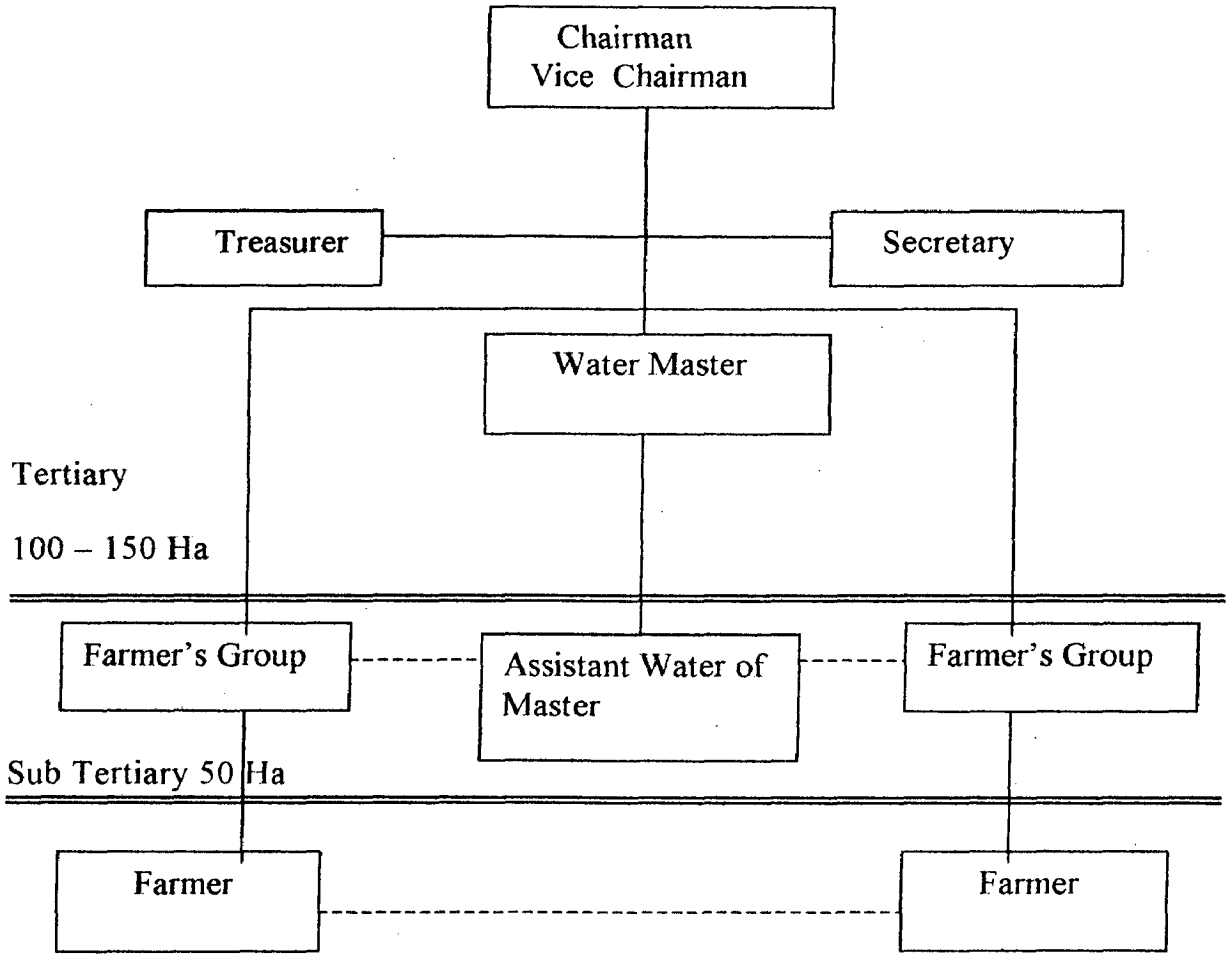
Figure 5.4 GUIDANCE OF ORGANIZATION STRUCTURE FOR WATER USER ASSOCIATION



Legend ——— Line of instruction

--------- Line of Coordination

THE STRUCTURE ORGANIZATION OF WATER USER ASSOCIATION COMMITTEE



Legend ——— Line of instruction

--------- Line of Coordination

5.5 WATER USSERS ASSOCIATION IN SRI LANKA

5.5.1 Objective

The objects of the farmers' organization shall be to promote and secure distribution of water among its users, adequate maintenance of the irrigation system, efficient and economical utilization of water to optimize agricultural production, to project the environment, and to ensure ecological balance by involving the farmers, inculcating a sense of ownership of the irrigation system in accordance with the water budget and the operational plan.

The most important tools to achieve these are the *Distributaries Canal Organization* (DCOs) and the Joint Management Committees through which officials and farmers jointly plan and manage irrigation O&M. INMAS is managed by the *Irrigation Management Division* (IMD).

In this section, the achievement of the participatory management programme in Kaudulla are evaluated according to the two official policy goals, which are:

- Increasing the share of O&M expenditure borne by the farmers by transferring a large portion of the O&M responsibilities to them. This would help relieve pressure on the government budget.
- Improvement of the productivity of the irrigation schemes through improved farmer ability to mange the system to serve crop need.

In Sri Lanka, actual operation and maintenance expenditures are determined and allocated by higher authorities and may not be based on real requirements and the possibility of recovering recurrent costs from the farmers. Operation and maintenance budget requirements are first submitted estimated requirements are then adjusted due to budgetary constraints Consequently, the final allocations by the Treasury are much less than expected.

Some farmers have strategically used establishment of farmer organizations to improve their access to better and cheaper services, especially in terms of water supply at the system level and provision of agricultural inputs. And the help of the

project management and other agencies, farmers have learned to expand these services and build up financially sound farmer organizations. As far as these achievements are concerned, new pillows have eased some of the headaches of a group of farmers that has access to the services of the farmer organization. Without wanting to disregard these achievements, the question still remains what good participatory management has done to the agencies' objectives. The basic conclusion of this paper is that it is not fair to attribute the disappointing results in system management to the fact that some of the management responsibilities have been handed over to farmer organizations. The main reason for this conclusion is that participatory management has only partially been implemented. A mere handing over of responsibilities is not sufficient to make farmer leaders agency staff accountable for their financial share of the responsibilities.

5.5.2 Functions of Water Users Association

The water users association shall perform the following functions namely:

a) To prepare and implement a warbandi schedule for each irrigation season consistent with the operational plan based upon the entitlement, area, soil and cropping pattern as approved by the distributory committee or as the case may be the project committee.

b) To prepare a plan for the maintenance of irrigation system in the area of its operation at the end of each crop season and carry out the maintenance works of both distributory system and minor and field drains in its area of operation with the funds of the association from time to time.

c) To regulate the use of water among the various pipe outlets under its area of operation according to the warbandi schedule of the system.

d) To promote economy in the use of water allocated.

e) To assist the revenue department in the preparation of demand and collection of water rates.

f) To maintain a register of landholders as published by the revenue department.

g) To prepare and maintain a register of co-opted members.

h) To prepare and maintain an inventory of the irrigation system within the area of operation,

i) To monitor flow of water for irrigation.

j) To resolve the disputes, if any, between the members and water users in its area of operation.

k) To raise resources.

l) To maintain accounts.

m) To cause annual audit of its accounts.

n) To assist in the conduct of elections to the managing committee.

o) To maintain other records as may be prescribed.

p) To abide by the decisions of the distributory and project committees.

q) To conduct general body meetings, as may be prescribed.

r) To encourage avenue plantation on canal bunds and tank bunds by leasing such bunds, and

s) To conduct regular water budgeting and also to conduct periodical social audit, as may be prescribed.

5.5.3 Financial responsible

Participatory management programmes focus too much on sharing *activities*, without making clear who is financially responsible for these activities and who can be made financially accountable if these activities do not take place. The key to sharing financial responsibilities is clarity, from the sides of both the agencies and farmer organizations. Both agency staff and farmers do not really know what they are up to in the near future. Project mangers and engineers receive instructions from their headquarters to stop handing over O&M contracts to DCOs, but still the payments continue. Farmers are not interested investing their DCO income in O&M activities because experience has shown them that the agency continues to provide O&M

contracts to DCOs. There is a lot of uncertainty about the continuation of the O&M contracts.

Evaluation of the financial arrangements created at the level of the distributaries by both the irrigation agency and farmer organizations themselves show that these arrangements have failed to become powerful incentives for significantly reducing O&M costs and improving O&M

The Sri Lanka Parliament discussed and passed Amendments to the Irrigation Bill in which farmers' organizations are given the opportunity to operate and maintain irrigation infrastructure below the distributaries-canal level in exchange for exemption from paying water taxes.

5.5.4 Legal foundation for participatory management

One of the major problems' in Sri Lanka participatory management policies is that the concepts of participatory management and the vesting of irrigation management responsibilities are not defined precisely enough. Handing over some management responsibilities does not remove the ultimate control of the government over resources. Both land rights and the ownership of the physical works remain with the government. Farmer organizations as well as farmers' representatives in the project management committees have to take on duties and responsibilities, but there do not get the necessary rights and the authority in return. Under these circumstances farmers might find it difficult to enforce a system in which both farmer leaders and agency staff can be made accountable for the way they mobilize funds and resources for the improvement of system management. Participatory management processes will not create effective property rights to land, water and physical works. Legal provisions to share right and authority should be a precondition for, not the outcome of, participatory management. Unfortunately neither the Act under which farmer organizations are registered, nor the new amendments to the irrigation Ordinance provide these rights.

CHAPTER VI

CONCLUSION AND RECOMMENTDATIONS

CHARPTER – VI

CONCLUSIONS AND RECOMMENDATIONS

Water and land are most essential natural resources for life and are likely to become more scarcely resource in the coming decades due to fast increasing demand for water and land in all sectors of the economy. Optimum use of water and land is an imperative necessity. For better productivity as well as efficient water management, the farmer involvement is the most important because the farmer in farm sector is the actual user of the water.

Farmer's involvement on ThaNgon

In the ThaNgon irrigation project the sage seems set for further economic development. People i.e. farmers are keen to take advantage of new opportunities and to assume new responsibilities.

The ThaNgon irrigation project has improved the irrigation efficiency and thus has a future in the command area of irrigation project. It offers ideal solution of the problem of distribution of irrigation water on the basis of equity it also makes easy introduction of the discipline of "Rotational Water Distribution" and also of irrigation water in bulk on volumetric basic. The success story of organization lies in the leadership provided by the member of the organization. In view of these facts, a strong leadership needs to be developed in the project area.

All the sample farmers were well aware about the existence of WUA and agency in the system. Most of them, about 92% (84 farmers) knew the name of their chairman and majority, about 58% (53 farmers) were keenly interested and had the knowledge of major functions of it.

Performance of Water User's Group in general, farmers from the system expressed higher satisfaction for the WUA and satisfaction for the agency. The reason behind higher level of satisfaction over the effectiveness and performance was known to be the involvement of the farmers and/or their representatives in all the activities and transparency in the functioning of WUA and agency after the initiation of the transfer process.

Due to the hard livelihood of initial days of settlement in the area, the

people of the command area of the ThaNgon irrigation system had shown strong sense of participations in irrigation development activities. Higher level of participation was reported to take place from the older settlers of the area as compared to new settlers.

Regarding water dispute, majority of farmers about 85% (77 farmers) reported that there were disputes but only some in the period of peak water requirement at the time of paddy season, which were resolved amicably with little efforts from the senior people.

Agricultural Performance

From a farmer's perspective, profitability is the ultimate measure of the performance of this operation, but it is a measure obviously influenced by a large number of variables besides quality and cost of irrigation service.

Agricultural Aspects

As a result of comparatively better water utilization, the ThaNgon farmers reported to increase their yield to as much as 50%. The farmers response and the information from the related sectors of agriculture revealed that there was no proper agricultural extension services facilities, improved inputs availability, fertilizers and pesticides and provision of market facilities for the farmers even after the initiation of management transfer process. The net benefit of 9100 kip per hectare of the irrigated agriculture computed from the agricultural benefit of the 1996 and 1998, just before and after the transfer proved to be encouraged despite the poor agricultural extension services and many problems still existing in the production process. So, an intension program of facilitating these activities with the improved water delivery should be envisaged.

Financial Aspects

The system was at least successful at this state in identifying the number of alternative resource sources to fund the system and some of them were already contributing. Irrigation Service Fee(ISF) was the only reliable major source of income for the WUA. The collection of it was less than 25% and it looked impossible to sustain the system requiring about 1 million with only about 15% of the requirement fulfilled from the ISF. If it is assumed to increase the fee collection from this nominal amount of kip 60/ha/crop to kip 150 ha/crop as was

the rate in Performance Participation Management Maintenance Committee (PPMMC, the collection of kip 0.8 million of Irrigation Service Fee for the Operation Maintenance required at least 60% efficiency. This 60% collection might not be sufficient in the long run and needs to be increased for the long-term sustainability of the organization.

Social works

The farmer's involvement in overall planning helps in solving many sociological problems such as construction of farmer roads; pasture lands, schools, temples, hospitals etc. That could be taken up with mutual cooperation. But, it still needs an active participation of farmers at each level and stage of water management.

Water distribution system

The rotational delivery system has following advantages:

- The discipline and economy in use of water
- the reduction in wastage of water and additional coverage under irrigation.
- The farmer's awareness of his legitimate share of water.
- The farmer's keenness to receive it timely and his understanding of the significance of proper land development and water application.
- The pre-planning pf cropping operation and arrangement of inputs.
- Minimizing the water disputes.
- Upward shift in agriculture production.

Rotational delivery system is a system of equitable water distribution by turns according to a pre-determined schedule specifying the day, time and duration of supply to each farmer in proportion to his area in an outlet command.

Policy of Irrigation Management Transfer (IMT)

The irrigation policy of the government was not that consistent for last decade. It was only in 1996, irrigation policy of the government with the transfer. Therefore, to take the IMT in its long path, a new firm policy of the government should be enacted. This will bring confidence not only for the farmers but also for all, including agency personnel to move in certain direction.

Organization

Farmers are the real owners of an irrigation system and are generally low educated, comparatively poor, and non-exposed to outer world. So, the organizations of such community should be simple, guanine and proportionately represented. Therefore, looking at the present organization, it has long hierarchy of organizations i.e. 4 tier and many canal systems. Therefore, it is in the interest of all concerned to make it, if possible, single or two tier at the maximum. Provision can be made to represent directly of the farmers as per the area and the number of household. The weight age for the area and the household for representation from all committee to the main committee could be preferably 50, and similar representation from all committees in the general assembly. The main and branch canals could be managed by main committee and the others by the lower committee with only two tier and the said representation ratio in the main committee and general assembly.

Distribution of Cash Resources

It had been noticed that there were some discontent among the lower farmers about their major share of collection (70%) going to higher organization. This matter needs to be carefully looked into otherwise there could be significant impact on the collection efficiency. Further, the distribution of cash resources depends upon the budgeting the expenditure needs of the different levels. It better to give at least 50% if not much, incentive to collecting level. However this matter this should be discussed between the WUA's at different level and finalized accordingly in the general assembly.

Other Sources of Resource Generation

In our assumption, though we have considered only ISF as reliable source, it needs to be taken care of that there are many source generation sources identified; though most of them look difficult at this stage. Some of them are said to have yielded some cash before. So, efforts should be made to increase the cash from these courses. A campaign to initiate the most feasible new program at this state including dealership of the agricultural inputs in the area should be started. Such activities have already started in similar IMT system in Lao P.D.R. and successfully done in Philippines.

Extension Services

Water availability is not the only factor for better-irrigated agriculture performance. It should be followed by agricultural extension services, provision of inputs, fertilizers and pesticides including market facilities, which are not facilitated properly in the system. So, an integrated IMT program with the inclusion of such activities should be made and implemented with the working together of various related governmental and non-governmental organizations.

A mid – term evaluation in 1993 recommended, in the interest of sustainability that agricultural and rural institutions development support be extended to the farmers, who were earlier unfamiliar with irrigation, for a meaningful period following the commissioning of the irrigation system

Strong Legal Basis for WUA

Registration of WUA in the office of Chef District Officer (CDO) under the Company Registration Act (1975) is one of the factors in ThaNgon that has some how increased the confidence of the farmers. Till now, it seems that nobody has questioned the legal validity of this registration and has been only a working solution for the problem. Actual legal status is not yet realized without the proper act of registration of the farmers' organization and it will be the interest of all working in this field to more towards this direction. Some design principles are given in Annexure I. A memorandum of understanding between Government and WUA is necessary as indicated in Annexure III.

Auditing System

The past experience in most of the system in Lao has made the farmers suspicious of the managing organization about the use for their collected resources. The farmers in the ThaNgon irrigation system have also made provision for auditing the financial account but the record did not show the audited account audited by independent professional auditor as per the provision. Therefore, a transparent, fair and accessible auditing system audited by some professional in the field and the ratification provision by the general assembly should be done to bring back their lost confidence and can be an incentive to contribute their part.

Farmers Capability Development

The efficiency of the system O&M and resource generation largely depends upon the farmer's capacity. The farmers of WGIS and other irrigation system in Lao P.D.R. are illiterate, exposed t outer world and needs lot of training and exposure before they are comparatively capable of handling the system though, some training activities especially to main committee members and other farmers are being carried out, it is far below their requirement of handle such system unilaterally by them. So, training activities including field visit to similar successful system especially for grass root level farmers should be undertaken and continued.

Monitoring and Rectification

The IMT is a new and emerging process and the experiences of it are very limited. So, judging by the type of the system, organization etc., and the process should be started with repeated monitoring and evaluation of the system and early rectification if required. An in WGIS, some probable organizational problems and resource generation weaknesses have been outlined and it will be better to study and watch the effect of such weaknesses.

Expansion of Mandate:

A Phase II project support is undertaken in the project area which aimed to use the project's created irrigation potential and an agricultural extension facilities as a foundation for improving the levels of living of the non-irrigated farmers in the project environs through promotion of animal husbandry and Agro-forestry along with the District Agricultural and Forestry extension services, which should focus on:

- Continue to promote sustainable use irrigation water in the project command areas, in view of the Government Policy to reduce the structural deficit in rice production, to stabilize seasonal rice production and to hand over the operation and management of irrigation schemes to farmer's groups;
- Reduce inequalities in living conditions between those farmers having irrigated land and those who do not (i.e. having unirrigated land) have;
- Reverse the trend towards environmental degradation brought about by slash-and-burn cultivation in non-irrigated areas over-uses of fertilizer and

pesticides, and so on.

- Contribute to the smooth transition to the market economy of the agricultural sector in the Vientiane Plain.

The final evaluation of the project ThaNgon was done in December 1994, which concluded that the engineering design and construction had been of good quality. However, further assistance would be required to make the scheme sustainable, in particular the Water Association which have been established require, further strengthening, so that in future they should be able to take full responsibility for all operation and maintenance of the scheme. Furthermore, concerted efforts are required to be directed at promoting further participatory socio-economic development in and around the scheme areas, so that the farmers should eventually be able to cover the full cost of the O&M, and enjoy a higher standard of living.

In September 1996 a preparatory Mission recommended to expand the project area to the entire lower Num Ngum basin, comprising 104 villages with a population of over 80,000 and a cultivated area of about 37,500 ha. Implementation required to be based on a participatory approach, primarily through, demand responsive village development plans, micro-projects and community-based groups and organizations.

However, the European Commission considered the proposal to be too ambitious and deficient in their economic justification of the viability and sustainability of the proposed interventions. Therefore, it was decided to send another Mission, called the Final Preparatory Mission, to finalize and redraft the proposals. The Mission consisted rural development Specialist/Team leader and Agro Economist, which did their job during May 21, to June 5, 1997. A more detailed itinerary is presented as below. They stated overall objective of the Mission was to:

1. Collect additional economic information needed to justify the viability and sustainability of the whole project.
2. Redraft the project dossier and the proposal for a financing decision (in line with detailed guidelines provided); and
3. Prepare terms of reference for technical assistance for inclusion in the tender dossier.

The effective project starting date is likely to be about September 1998 and the project will have duration of six years. However, for its better performance, farmers'

participation at each stage and level of water use is necessary.

Joint management program is the best-suited platform to enhance the farmer's participation, which allow a good opportunity to both the farmers and officials to learn, to adjust, to develop the initial under standing about the problems of irrigation system with out blaming each other. Therefore to implement the JMP with active farmers involvement is suggested.

To achieve successful and sustainable irrigation in accordance with the project objectives and the present economic and policy context, the following steps are required:

- Design and construction of appropriate infrastructure: essentially be completed.
- Development of effective farmer organization and water management: be completed on limited scale.
- Consolidation and strengthening of farmer organization foe effective maintenance: recommended for project second phase.
- Establishment and/or clarification of clear government institutional structures for scheme technical support, recommended for project second phase.

Agricultural development of scheme areas to achieve significantly higher levels of profitability, and ensure a sound basis for financial sustainability recommended foe irrigation project second phase.

Proposed Design Principles For Local Irrigation Organizations

i.e., "Farmers management irrigation system" (FMIS)

Much of the work on successful FMIS has been aimed at identifying the institutional principles by (Uphoff 1986; freeman 1989; Hunt 1988; 1989; 1990 Ostrom 1990; 1992; and Tang 1992). Here the major principles emerging from that work are summarized:

1. A supportive policy, regulatory and legal environment, preferably recognizing water rights and ownership of infrastructure by the irrigation community;
2. Capacity to mobilize resources adequate to meet the costs of operations and maintenance, including emergency repairs;
3. Benefits exceed costs of participation, with proportional equivalence between benefits and costs; and
4. Effective collective choice arrangements or "organizational control of water" by users (Hunt 1990), which will normally have the following characteristics:
    a. Organizational autonomy, with clearly defined boundaries (area and membership), in which the users control both capture and allocation of water, and officials derive their legitimacy and authority from users and are accountable to users ("internal charter of authority" in Hunt's terms);
    b. Financial autonomy, i.e., an institutional arrangement in which the irrigation management organization relies on direct methods to raise most or all of the resources needed for O&M (Small and Carruthers 1991: 41-49);
    c. Single organizational entity manages single infrastructural system;
    d. Maintenance and conflict resolution are tightly connected to the capture and allocation of water;
    e. Transparent performance monitoring arrangements; and
    f. Nested (or federated) organizational structure.

Other principles are the maintenance of written accounts and records; water sufficient to meet crop water demands; general assembly of members which chooses a committee of officials; use of specialized paid staff for regular maintenance; and local recruitment of staff.

Relationship of managing agency to the government

An irrigation management agency can be either financially *independent*, that is , self-financing; or financially *dependent* on outside sources (generally the treasury) for most or all of its funds; in this case, it is the outside sources – the government – which control and allocates the level of resources available to the managing agency. An irrigation management agency that receives some funding from outside sources (such as capital funds for construction) which are not re-payable, but which is dependent on generating operational funds internally, may be considered partially independent.

The concept of organizational autonomy" is based primarily on work by Hunt (1988; 1989; 1990), Ostrom (1990; 1992), Ostrom et al. (1993) and Freeman (1989). Whether authority over decisions and activities is internal on external depends on the source of the "charter of authority" – the state, or the use-members. Hunt (1990) extends this idea of a charter of authority to the hypothesis that organizational control of water" is the key variable affecting farmers' willingness to participation management tasks.

Therefore, to define the variable clearly, "autonomous" refers to a charter of authority, which is internal, i.e., by the consent and agreement of the members or shareholders; authority the state may define the rules governing such charters. It is thus autonomous from the state. *"Dependent"* refers to a charter of authority, which is based on an external source, usually the state. It is thus closely articulated with the state, and is a mechanism for state control. Government-owned and – managed irrigation systems are by definition dependent in terms of their charter of authority.

Typical irrigation system management are given in table 1, figure 6.1 and 6.2

TABLE 6.1

Matrix of irrigation system governance arrangements

Agency Manages	Relationship of Agency to Government	
	Dependent	Autonomous
Single irrigation system	Egypt Punjab, Haryana, India Sindh-Pakistan ORMVAS, Morocco[a] 1	Mendoza, Argentina Irrigation Districts, USA Taiwan systems *Unidades* in Mexico Communals Philippines FMIS by definition 2
Multiple irrigation system	3 Sri Lanka; Nepal Most states on India NWFP, Baluchistan – Pakistan *Distritos* in Mexico[b]	4 National systems under NIA-Philippines.[c]

a. ORMVAS are a partial case: they are partially autonomous financially, but their charter of authority is derived from government.

b. These are in transition through a turnover programme and are therefore moving into cell 2 (autonomous, single-system).

c. NIA is a partial or mixed case; it is partially, but not fully, autonomous in financial terms, and its charter of authority is based on dependence on the government; therefore, the distinction between the cases in cell 3 and this case in cell 4 is not as great as is often claimed.

1. Fully autonomous organizations managing single irrigation systems (those in cell 2 of Table 1) will exhibit the highest performance, will prove most adaptive to changing conditions, and therefore will prove to be most sustainable.

2. Autonomous agencies managing many systems (cell 3) may be innovative and "customer-oriented" but dispersal of attention among a multiplicity of systems will limit accountability for particular systems, and therefore limit their performance.

3. Agencies which are only partially autonomous (i.e., either organizationally or financially but not both) will have only limited accountability to the users, which will limit their performance.

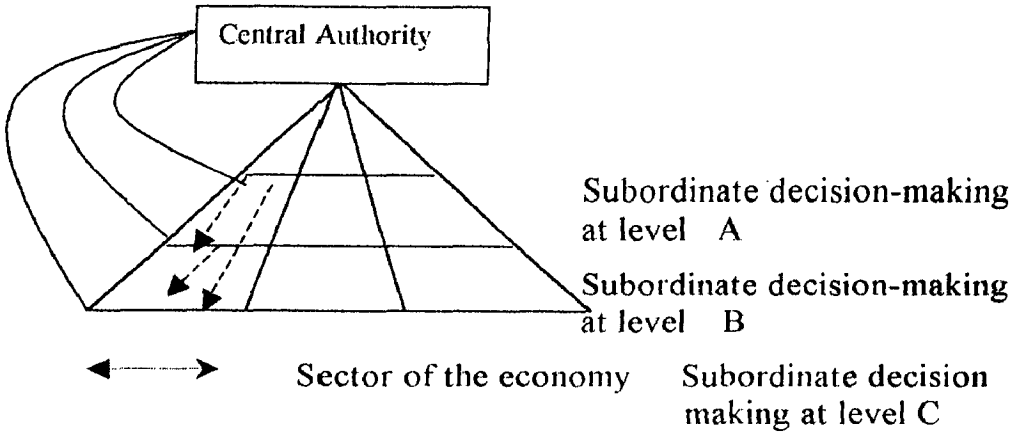
4. (i).Dependent agencies managing single systems (cell 1) may exhibit a mo of accountability because the stakeholders will be limited to those with an interest in that system; increasing accountability by maximizing their autonomy (reducing dependence) may be the most important reform in the long term to improve performance. (On the other hand, such organizations may concentrate those intent on, and in a position to, "capture" rents from such systems, making them vulnerable to rent seeking).

4.(ii). Dependent agencies managing many systems will be least accountable to system users because of the large number of stakeholders. Accountability is dispersed, weakening the hierarchical control mechanisms for promoting higher performance or preventing "capture" of particular systems. These weaknesses in hierarchical control may facilitate interested individuals to innovate on some systems, but institutionalization of such experiments will be difficult. The result will be a wide range of levels of performance, but with a preponderance of low levels.

The term "autonomy" is not to be confused with "private". A strong government role is necessary inmost countries, not only to avoid "capture" by an influential minority, but also because the authority inherent in the government is necessary for enforcing rules to manage and conserve a common resource. Local authorities with specific government mandates for the integrated management of particular irrigation systems, whose charter of authority derives from the users, seem t be an effective arrangement for managing irrigation systems.

Figure 6.2

Society according to early development planning

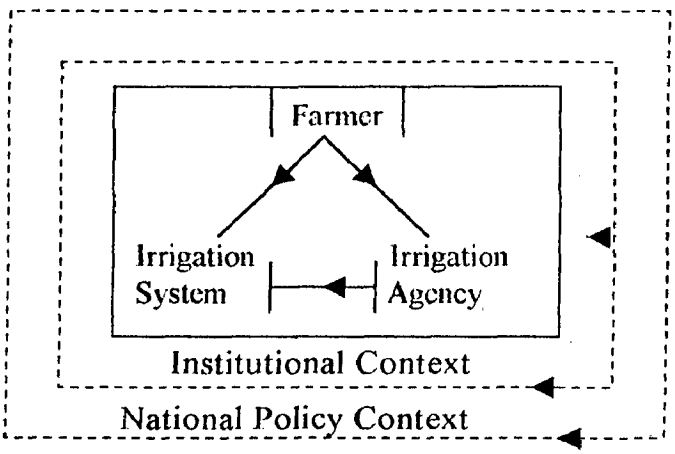


——▶Policy decisions

- - - - - - -▶Operational decisions

FIGURE 6.3

Various approaches and their targets



1. On-Farm Development
2. Promoting Participation
3. Strengthening Agency
4. Irrigation Management Transfer
5. Institutional Reform
6. Policy Reform

ANNEXURE -III

MEMORANDUM OF UNDERSTANDING

Experience suggests that an Agreement/Memorandum of Understanding between the Society and the Agency is a must for successful functioning of WUAs. The officials get transferred; office bearers also change, so it is necessary to have a written document, which can be invoked in case of difference of opinion. They cannot function in an amorphous atmosphere wherein the water is given at the 'pleasure' of the irrigation bureaucracy. The agreement should highlight the duties and responsibilities of both the parties-providers and users of waters. It should specify the quantum of water WUAs are entitled to, season-wise, and the persons designated for operational process, persons to whom the disputes could be referred. It should also state the amount of the water fees and the dates on which they are to be paid. A clear transparent Memorandum of Understanding helps to achieve success in the functioning of the WUAs.

The question is raised as to whether volumetric supplies and pricing are a necessity for the success of societies; Maharashtra experience shows that they are necessary. One can envisage a successful WUA based upon crop-area assessment, provided some other condition are fulfilled. It is the experience that these are not fulfilled. To illustrate: in Maharashtra when an irrigator applies for water, he is charged full irrigation fees for the season, even if he gets one watering or none at all. In such a situation, irrigation/WUAs would certainly prefer to pay for water, which they actually get. Our extensive discussions with the farmers prior to the formation of societies reveal that they are not in favour of the existing system and would prefer to pay for what they get. The lesson is clear: volumetric supplies and pricing will accelerate the WUA formation and in their eventual success. Incidentally, the system is strongly advocated in the National Water Policy.

Annexure performance assessment of WUA should be carried out. A typical annual performance assessment form is given in Annexure IV which can be suitable modified as per the specific requirement.

ANNEXURE - IV

Annual performance assessment

Item	Planned (m^3)	Actual (m^3)	Potential Points	Points Awarded
Water delivery				
Total discharge			4	
Irrigation water			5	
Delivery to Yingang canal			3	
Water delivery days			3	
Total points			15	
Irrigated Area				
Irrigation area			5	
Irrigation Area X times			5	
Total points			10	
Water use Efficiency (WUE)				
WUE of main canals			4	
WUE of branches			4	
WUE of Sub-branches			4	
WUE of whole canals system			4	
Total points			16	
Irrigation Duty and Efficiency				
Irrigation duty at the head of main canal (m^3/ha)			3	
Irrigation duty at the outlet of sub-branches (m^3/ha)			2	
Irrigation duty in field (m^3/ha)			2	
Annual gross irrigation water per ha			3	
Irrigation efficiency at the head of main canal (m^3/ha)			3	
Irrigation efficiency at the outlet of sub-branches (ha/m^3/s)			2	
Total points			15	
Rate of Functional Structures				
Structures			4	
Canals and branches (km/number)			3	
Total points			7	
Maintenance				
Lined canals (km)			6	
Silt clearance (km/number)			4.3	
Structures maintained (number)			4.5	
Total points			15	
Income and Expenditure				
Total income			5	
Total expenditure			5	
Operating and managing cost			3	
Annual maintenance cost			3	
Total points			16	
Crop Yield Assessment				
Grain			2	
Wheat			2.5	
Cotton			1.5	
Total points			6	

Grand total potential points = 100
Grand total of points awarded

WUE: Water Users Efficiency

APPROACHED

Andhra Pradesh Farmers'

management irrigation system act

ACT No. 11 of 1997

Objectives And Function Of The Farmers' Organization

In 1987, the Government of Andra Pradesh, India in acted on Act No. 11 of 1997 titled as above, and passed by assembly.

1. Objectives

The objects of the farmers' organization shall be to promote and secure distribution of water among its users, adequate maintenance of the irrigation system, efficient and economical utilization of water to optimize agricultural production, to project the environment, and to ensure ecological balance by involving the farmers, inculcating a sense of ownership of the irrigation system in accordance with the water budget and the operational plan.

2. Functions of Water Users Association

The water users association shall perform the following functions, namely:

a) To prepare and implement a warabandi schedule for each irrigation season, consistent with the operational plan, based upon the entitlement, area, soil and cropping pattern as approved by the distributory committee, or as the case may be, the project committee.

b) To prepare a plan for the maintenance of irrigation system in the area of its operation at the end of each crop season and carry out the maintenance works of both distributory system and minor and field drains in its area of operation with the funds of the association from time to time.

c) To regulate the use of water among the various pipe outlets under its area of operation according to the Warbandi schedule of the system.

d) To promote economy in the use of water allocated.

e) To assist the revenue department in the preparation of demand and collection of water rates.

f) To maintain a register of landholders as published by the revenue department.

g) To prepare and maintain a register of co-opted members.

h) To prepare and maintain an inventory of the irrigation system within the area of operation,

i) To monitor flow of water for irrigation.

j) To resolve the disputes, if any, between the members and water users in its area of operation.

k) To conduct regular water budgeting and also to conduct periodical social audit, as may be prescribed.

3. Functions of Distributory Committee

The distributory committee shall perform the following functions; namely:

a) To prepare an operational plan based on its entitlement, area, soil, cropping pattern at the beginning of each irrigation season, assistant with the operational plan prepared by the project committee.

b) To prepare a plan for the maintenance of both distributaries and medium drains within its area of operation at the end of each crop seasons and execute the maintenance works with the funds of the committee from time to time.

c) To regulate the use of water among the various water users' associations under its area of operation.

d) To resolve disputes, if any, between the water users' associations in its area of operation;

e) To maintain a register of water users' associations in its area of operation

f) Maintain an inventory of the irrigation system in the area of its operation, including drains;

g) To promote economy on the use of water allocated.

h) To maintain accounts.

i) To cause annual audit;

j) To maintain other records as may be prescribed;

k) To monitor the flow of water for irrigation;

l) To conduct general body meetings as may be prescribed;

m) To abide by the decisions of the project committee;

n) To cause regular water budgeting and also the periodical social audit as may be prescribed.

o) To assist in the conduct of elections to the managing committee; and

p) To encourage avenue plantations on its area of operation.

4. Functions of Project Committee

The project committee shall perform the following functions; namely:

a) To approve an operational plan based on its entitlement, area, soil, cropping pattern as prepared by the competent authority in respect of the entire project area at the beginning of each irrigation season;

b) To approve a plan for the maintenance of irrigations system including the major drains within its area of operation at the end of each crop season and execute the maintenance works with the funds of the committee from time to time;

c) To maintain a list of the distributory committees and water users association on its area of operation;

d) To maintain an inventory of the distributory and drainage systems in its area of operation;

e) To resolve disputes if any, between the distributory committees,

f) To promote economy in the use of water;

g) To maintain accounts;

h) To cause annual audit of its accounts.

i) To maintain other records as may be prescribed;

j) To conduct general body meetings as may be prescribed;

k) To cause regular water budgeting and also the periodical social audit as may be prescribed; and

l) To encourage avenue plantations on its area of operation.

5. Appointment of competent authority and his functions

1) The Government may by notification appoint such officer from the irrigation and command area Development Department, or any other department or corporation including Irrigation Development Corporation, as they consider necessary, to be the competent authority to every farmers' organization for the purpose of this Act.

2) The competent authority appointed user sub-section (1) should be responsible to the respective farmers' organization in the implementation and execution of all decision taken by the farmers' organization.

6. Resources of Farmers' Organization

The funds of the farmers' organization shall comprise of the following namely:

i) Grand received from the Government as a share of the water tax collected in the area of operation of the farmers' organization;

ii) Such other funds as may be granted by the State and Central Government for the development of the area of operation;

iii) Resources raised from any financing agency for undertaking any economic development activities in its area of operation;

iv) Income from the farmers' organization for the irrigation system within its area of operation;

v) Fees collected by the farmers' organization for the services rendered in better management of the irrigation system; and

vi) Amounts received from any other source.

7. Right Of Farmers Organization

The right of farmers Organization shall be as follows:

i) To obtain information in time about water availability, opening/closing of main canal, periods of supply and quantity of supply, closure of canals etc.;

ii) To receive water in bulk from the irrigation department for distribution among the water users on agreed terms of equity and social justice;

iii) To receive water according to an approved time schedule;

iv) To allocate water to non-members;

v) To levy separate fees for maintenance of the system;

vi) To levy any other fee or service charges, to me[illegible]ent costs and any other expenses;

vii) To utilize the canal bunds – as long as such use is not obtrusive, or destructive to hydraulic structures by planting timber, fuel, or fruit trees or grass fro augmenting the income of the farmers organization;

viii) To obtain the latest information about new crop varieties, and their pattern, package of practices, weed control, etc.; for agriculture extension service and purchase inputs such as seeds, fertilizers and pesticides; for use of its members;

ix) To have full freedom to grow any crop other than those expressly prohibited by a law and adjust crop area within the total water allocated without causing injury to neighboring lands;

x) To participate in planning and designing of micro-system;

xi) To suggest improvement/modifications in the layout of Field Channels/Field Drains to supply water to all the members in command;

xii) To portend promote use of the ground water.

8. Responsibility Of The Farmers Organization

The responsibility of Farmers Organization shall be as follows:

i) To prepare the schedules of water deliveries and communicate to the concerned;

ii) To organize preparation of crop plan to match water deliveries with crop requirements;

iii) To supply water to all members in the command area as per the approved terms;

iv) To carry out timely maintenance and repairs to the distributory system including drains and other properties;

v) To organize repairs of the system by the farmers free of cost or on payment;

vi) To avoid and prevent misuse and wastage of water;

vii) To use water economically and judiciously and furnish data, to the Irrigation Department on water use, irrigated area, irrigation efficiency, and crop yields.

viii) To inspect water utilization by the farmers in the command, assess irrigated crop areas and collect data on crop yields;

ix) To impose and recover penalties or fines for misuse and wastage of water and tampering or damaging with the irrigation network controls, sluices, outlets etc., as per the provision of the Act;

x) To educate farmers on preparing fields and adopting modern methods of field irrigation, such as borders, furrow, graded bounding for all round efficiency;

xi) To educate farmers on new crop varieties, packages of practices, pesticides, weedicides, etc.;

xii) To procure and hire implements and gadgets for agricultural operation where feasible and needed;

xiii) To impale the system for efficient and economical use of available allocated water, for efficient production of crops; and

xiv) To minimize conveyance and operational losses.

9. Legal Backup

Farmer groups so formed should have the status of legal [person]. This is necessary as certain agreements on volumes, rates, payments, etc., have to be entered into. Under our existing set-up such agreements cannot be entered into with individuals or informal groups. Of course, in India, quite a large number of informal groups are working successfully. But it may be noted that they work because of the weight of tradition. These associations have been working for the past couple of centuries or even more. The only substitute for the weight of tradition under the given circumstances is the 'force of law'. However, this is an enabling provision and by itself is not a guarantee for sustained and conflict-free working.

The question of what form the legal backup should take, i.e., either cooperative company, trust, or a registered society is a matter of choice. In Maharahtra, the farmers have opted for the cooperative form, as they were familiar with this form in other economic activities.

In the existing irrigation legislation in several States, powers, duties and responsibilities of various officers are defined in respect of management of water distribution. With the introduction of WUAs in between irrigation bureaucracy and

the individual irrigation, it is necessary to delegate some of these powers to the groups, as far as their jurisdiction is concerned. In Maharashtra, a newly formed Society was threatened with a notice for damaging a field due to overflow in the channel. If the incident has happened in earlier days or elsewhere, the Canal Officer had adequate powers to deal with it. The lesson from this incident if that powers under the Irrigation Act have to be delegated if WUAs are to perform efficiently. The State Government is seriously considering the empowerment of the Societies in this respect.

10. Accounts/ Finance

(1) The FO shall open an account in a Nationalized bank or Cooperative bank in its name and shall be operated jointly by the President/chairman and one of the managing committee members as nominated by the Managing Committee. The FO shall maintain the cashbook and accounts of expenditure with appropriate vouchers and receipts.

(2) Every expenditure should be supported by a receipt, or voucher which shall be duly passed for payment by the president or anybody authorized by him.

(3) All expenditure has to be approved by he finance sub-committee, at least once a month.

Account Registers to be Maintained

(4) Every farmers organization shall maintain accounts register. Each of the following record shall bear the name, address and the seal of the farmers organization and shall be machine numbered;

11. Financial Audit

At the end of each financial year and not latter than three months after the commencement of the new financial year, each of the Farmers Organization shall cause its accounts to be audited as follows:

1. The Managing Committee shall, appoint an Auditor who has adequate experience in normal auditing works.
2. The auditor so appointed shall be person of repute in the area of operation of the

farmers organization who has reasonable knowledge account or any recognized auditor.

3. The appointment of the auditor shall be approved by the Managing Committee of the Farmers Organization.
4. The auditor so appointed shall take all steps necessary to scrutinize the accounts of receipts and expenditure, within thirty days of his appointment and furnish the audit report along with the statement of accounts and balance sheet to the President of the concerned Farmers Organization, duly attesting the same.
5. The audit report should be submitted to the general body in its meeting for its approval.
6. The Managing Committee of the farmers Organization shall be furnish the implementation report to the General body of all matters as pointed out in the audit report and the Managing Committee shall implement the decisions of the General Body in this regard; and
7. If the overall transactions exceed Rs. 10.0 lakhs per annum, the farmers organization shall engage the services of a Chartered accountant.

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