

This water is used for fishing and washing only.

There was a large flood last October. Before the flood plenty of Water grass (Water) covered , the surface of the tank. The plants hindered fishing by net. The flood swept away the plant and brought having flow from upstream. The remaining plants are threatening to overgrow the tank again, so the second most needed help is to get rid of Water grass.

(ix) Community development

The biggest land owner occupies over 30 rai of cultivated land. The smallest land owner occupies less than 6 rai. Since the huai Sup Pradu channel was constructed 17 years ago villager have not gone to the city in the dry season because there is a need for more labour to work on the farms. At the present time about 50 % of the land is used to grow upland crops in the dry season.

There is at present a shortage of labour in the dry season and this is the limiting factor that limits the expansion of the dry season cropping. There are very few tenants in Don Kloei and most of the farmers own the land they farm. There is a nice looking house belonging to a government officer attached to the education department of the provincial office of Kalasin but he is not the richest man in that village.

The Provincial Community Development Office has many projects including:

- 1) public facilities such as building roads, weirs, wells, and bridges;
- 2) public health, such as building toilets, and providing running Water;
- 3) agriculture for children development; 4) ladies' groups; 5) youth groups.

There are 80 persons working for the office.

The office is headed by a provincial community development officer assisted by one assistant and a technician. At the district level, there is a district community development officer, who is assisted by several community development workers, who is responsible at the tambol level.

Community development project under loans from the Japanese Government. This project is situated in the district of Khoawong of Kalasin. This project covers 7 Tambol and 17 villages with a total population of 17,991. The total budget is 12,654,848 ฿ composed of a Thai government budget (counterpart fund) of 6,487,715 ฿ and a Japanese Government Loan of 6,167,130 ฿.

All together there are 3 plans, namely:

- a. Improvement of income and factors of production. This plan consists of 30 projects involving 8,287,440 ฿.
- b. Improvement of basic structure and condition of villages. This plan

consists of 34 projects involving 3,825,510 ฿

c. Development of farmers' groups. There are 20 projects involving 541,895 ฿.

The district of Khoawong is situated to the north-east of Kalasin about 120 Km from the capital city of Kalasin. The responsible officer's name is Khun Somsong Chaisawars who is a technician of the Kalasin Provincial community development office. Tel No.: 811274.

Tapioca is left in the field for 10 to 12 months before harvesting. The main problems in crop production are:

1. water
2. low fertility soil.

There is no hired labour in the village, but villages around Don Kloi hire labour. Usually hired labourers are outsiders who come to look for jobs. They usually stay in the house of the employer and have 3 meals a day with them, and work for the whole season. The wage is ฿ 30/day. The cost of draft animal rental is 50 tang of rice/person.

Unskilled labourers working in cities get ฿ 30/day, and ฿ 40/day in Bangkok. Skilled labourers get ฿ 50/day in the city, and more than ฿ 60 in Bangkok. Each farm h/h has an average of 2 draft animals.

No villagers in Don Kloi borrow money from any source. 60 % of rice products in Don Kloi are used for domestic consumption. The remaining 40 % is for sale. 100 % of rice is sold to the rice mill and all of the tapioca is sold to the tapioca factory. All of the fertilizer used in the village bought from middlemen.

The most needed improvement for the village in the future is to improve agricultural production by intensification and diversification. The former means to apply more input and get better yield from the field. This is a land saving technique.

The latter means to introduce multiple cropping or crop location so that several kinds of crops are grown in the same field in different seasons.

This is to prevent migration, a farmers usually go to a large city or to Bangkok in the dry season to look for jobs.

The effect of irrigation on the village economy has been minor. The economy of the village improved a little after receiving water from Huai Sithon about 20 years ago.

(ix) Brief general information on Ban Don Kloi.

The whole village receives water supply for agriculture from Huai Si Thon Irrigation Project. Another source of water supply is a small pond called Kang Don Klang providing water for growing vegetables and for domestic

use. Therefore, a water supply is available all year round.

(i) Households and population

Table 43

2	Ban Don Kloi	Mr. Prawade Karakul	124 registered households	876	80 %
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(ii)

Table 44

2	Don Kloi	<ol style="list-style-type: none">1. The main crop is glutinous rice for domestic consumption.2. The surplus of glutinous rice is sold for cash income.3. Other crops comprise sweet corn, water melon, musk melon, string beans, and vegetables. These crops are sold for cash income.4. This area is fully irrigated. It is, therefore, apparent that there is some surplus of rice.
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(iii)

Table 45

2	Don Kloi	<ol style="list-style-type: none">1. Very few households are classified as non-agricultural households.2. 8 people from this village work as tricycle drivers in Karasin.3. In the dry season about 30 % of the population of this village works as wage labourers in construction, manufacturing industries, etc., in Karasin.
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(iv)

Table 46

2	Don Kloi	<ol style="list-style-type: none">1. Because of the improved irrigation system the degree of population movement is smaller in this village.2. Only those who own no land go to work in the city.3. Migration permanently to other cities is nearly zero.
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2	Don Kloï	4. In the dry season only a small number of people, mostly skilled labourers, move to work in the city, but they return in the wet season.
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(v)

Table 47

2	Don Kloï	<ol style="list-style-type: none"> 1. Most houses are traditional two-storey houses. 2. Judging from the conditions of the houses, most of them have been built for quite a long time. 3. There are some new houses being built in the village.
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(vi)

Table 48

2	Don Kloï	<ol style="list-style-type: none"> 1. The people here are quite self-sufficient; therefore, debts are small in this village. 2. There is no farmers' group in this village and no co-operatives.
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(vii)

Table 49

2	Don Kloï	<ol style="list-style-type: none"> 1. There is no public health office in the village. 2. Because of the short distance to the city, most villagers can obtain medical treatment from Karasin Hospital.
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(viii)

Table 50

2	Don Kloï	<ol style="list-style-type: none"> 1. Drinking water comes from piped water provided by the city of Karasin. 2. For those households without piped water, they use rain water kept in containers; if there is not enough they buy drinking water. 3. As for the water for other domestic uses, most people use well water, and every household has a well.
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2	Don Klooi	4. 50 % of the households use modern toilets and 50 % still use old style ground toilets.
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(ix)

Table 51

2	Don Klooi	<ol style="list-style-type: none"> 1. Children in this village must go to primary school at Friendship School 32 outside the village community. 2. This school provide 6 years of primary education. 3. Students who complete the primary level may go to secondary school at Karasin. 4. Only 30 % of the students continue up to secondary education, and less than 10 % continue to higher levels after finishing secondary education.
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6-3 Research project No. 3.

- Project region (Khon Kaen Province).
Laloeng Wai Tank Irrigation project.
- Research village.
Ban Ya Kha

(1) General situation of research site No. 3

(i) Location

Ban Ya Kha is the tenth village in tambol Muang Pol, Amphur Pol, in Khon-Kawn. The area of this village receives water supply for cultivation from La Loeng Wai Reservoir. This village is located about 70 kilometers from the city of Khon-Kaen. Although this area is irrigated, the water quality is not so good because there is a high degree of salinity in the water supply.

This area is saline but irrigated, so it is quite interesting to see the difference in productivity. There are 105 households, 80 % of which are fully engaged in low-land farming. There is one "water users' association" covering 7 villages, including Ban Ya Kha, with membership of 70. These 70 households posses 3,600 rai of irrigated land.

(ii) Level of irrigation

This project was built and completed in 1958. The drainage area above the dam site is square kilometers. The distribution system covers an area of 6,000 rai but the delivery of irrigation water can be achieved effectively over only an area of 5,000 rai. The water in the reservoir contains a larger percentage of soluble salts, and is considered saline water. At the time of the visit to this reservoir the reservoir water was almost at the minimum level and no irrigation delivery was made. The conductivity of the reservoir water was found to be 385 micro-moh/cm. While that of still water in the left main canal at farm turnout No. 2 was 460 micro-moh/cm. and at farm turnout No. 5, 480 micro-moh/cm. The conductivity of water in the rice field nearby was found to be a little less than that in the canal.

It was found that the rice yield of this project was somewhat low compared to other tank irrigation projects. The average yield was found to be 350-400 kg./rai because of effects of the saline water and soil. From the irrigation point of view, the 6.2 km left main canal covers an area of about 3,500 rai and will be used as a study area. This area covers 4 villages i.e. Ban Tha Luang, Ban Ya Kha, Ban Khok Nam Kliang and Ban Han Yai. The Phol District Water Works also uses the water from this project by pumping directly from the reservoir.

The water in the reservoir, which is saline water, has been selected at "Laloeng Wai Tank Irrigation Project" located near Phol District, Khon Kaen Province.

(iii) Water management

To obtain irrigation operation data, the following measuring instruments were installed:

Table 52

1) Non-recording rain gage at Phol District station	1) It is proposed to install one water level recorder in the reservoir (concerned with water spill from the reservoir).
2) Water level staff gage in the "La loeng Wai Tank Irrigation Project" reservoir.	2) It is proposed to install two water level recorders at the head of the left and right main canals. Another one recorder is to be installed at the outlet tail water.

(iv) Saline water agriculture through the reservoir at Laloeng Wai.

Laloeng Wai Reservoir is located near the Korat-Khon Kaen highway. It receives water from Huai Ag and supplies water through irrigation canals to seven villages, i.e. Ban Tha Luang, Ban Ya Kha, Ban Non Kha, Ban Nong Waeng, Ban Thap Ba, Ban Han Noi, and Ban Han Yai. However, it was found that not all seven villages actually receive a water supply from the irrigation canals, because the reservoir is a small one and cannot supply water to all the villages, even in the wet season.

Another important feature of this reservoir is that it contains saline water, because of the salty soil. Therefore, the quality of water supply is not good for agriculture. However, in the wet season the rain water helps to dilute the salty water and makes it good enough to be used for agriculture.

Due to the fact that this reservoir has a very low capacity to supply water for the whole agricultural area, it is therefore not necessary to make surveys of all the villages in the area.

The features of the La Loeng Wai Reservoir are indicated below.

Drainage area above dam site = 156 km²
Retention level = +160.50 m (msl)
Dead storage elevation = +158.00 m (msl)
Storage capacity at retention level = 3.45 mem
Dead storage volume = 0.06 mem
Surface area of lake at retention level = 2.75 km²
Elevation at the top of embankment = +162.00 m (msl)

The mean daily variation of water surface elevation in the La Loeng Wai Reservoir is shown in graph Fig. 3.

The rainfall data for the La Loeng Wai irrigation area is as follows.

<u>Month</u>	<u>Mean Monthly Rainfall in mm</u>	<u>Remarks</u>
Jan	8.4	
Feb	15.2	The period of record is from 1952-1975
Mar	44.1	
Apr	66.3	
May	169.8	
Jun	147.5	
Jul	137.2	
Aug	185.0	

<u>Month</u>	<u>Mean Monthly Rainfall in mm</u>	<u>Remarks</u>
Sept	314.6	
Oct	85.9	
Nov	10.7	
Dec	4.1	
	1,188.8	

(v) Present situation of Ban Ya Kha.

This village consists of 108 households out of which 80 are agricultural households and 28 are non-agricultural households. The total population is 680.

This village is quite old, having been established for more than 110 years. Most houses are typical north-eastern style. The condition of the road into the village is not very good. The physical layout of the households in the village is well planned which implies that some kind of social development has taken place. However, no other development projects have been implemented.

The scarcity of fresh water for consumption in the village is evident. People in the village have to walk a long way into the fields to get fresh water at the tube well about 2 km. from the village. The quality of water is good enough, but infection may occur if the water is not boiled before drinking.

In the dry season the reservoir is dry. Some people move to look for work outside the village, but the movement is rather temporary.

(vi) Social information.

Most households in this village are engaged in glutinous rice farming. Because of the bad quality of water it was noticed that the productivity per rai is rather low compared with other project areas.

In the dry season, the supply of water in La Loeng Wai Reservoir is not enough for rice growing, because the Reservoir itself is too shallow and too small for that purpose.

Judging from the household conditions in this village, this village is rather poor. There is no public health center in the village. This may be due to the fact that this village is very close to Amphur Pol where villagers can use the health facilities at the Amphur Pol Health Center.

This village has 112 H/H. 80 H/H are engaged in part-time farming. 30 H/H are hired labourers. 4 H/H operate businesses.

About 30 farmers belong to an Agricultural Co-operative. 50 people have joined W.U.A. and more than 10 people have joined a farmers' group.

This village was established more than 100 years ago, the villagers coming from many places. The majority came from Ban Ya which is situated 4 km to the south of the present village.

The reason for setting up the village is not clear. A part of the village is in the benefit area of La Loeng Wai.

The La Loeng Wai irrigation project releases water only during the rainy season, from May to September.

In the past 10 years there have been 2 drought years and 2 flood years. The flood years caused no damage to the crops, but the 1971 drought year damaged about 50 % of crops and the 1973 drought year damaged 70 % of crops, because the other 50 % of the area receives water from the La Loeng Wai project.

Most of the farmers are land owners; only 3 families are tenants. These are share tenants paying $\frac{1}{3}$ of their harvest to the landlord as rental.

Majority of farmers occupy 10-15 rai. There are some farmers farming larger areas up to 100 rai.

There are 4 villagers operating businesses. There are 30 h/h whose farmers hire labourers.

Most farmers about 90 % of H/H apply chemical fertilizer to the paddy fields. Paddy fields in the irrigated area with fertilizer give a yield of 40 tong/rai. Irrigated paddy fields with the fertilizer give a yield of 20 tang/rai. Paddy fields in the irrigation project with fertilizer give a yield of 20 tang/rai.

(vii) Water users association.

Mr. Subin Pannon, the President of La Loeng Wai Water Users' Association, at Ban Ya Kha village, Amphur Phol was interviewed. This Association registered with the Ministry of Education on November 16, 1967. The idea of setting up a Water Users' Association was originated by Royal Irrigation Department officers, the objectives being as follows;

1. To improve the efficiency in water use.
2. To maintain canal conditions for mutual benefit.
3. To improve water use and main crop cultivation in order to obtain higher income.

4. To eliminate problems in buying and selling agricultural output as well as consumer goods.
5. To promote human relations and unity among members.
6. To meet, discuss and exchange views on non-political aspects.

Mr. Subin is the first President of this Association. In Ban Ya Kha village there are 70 members. Each year there are one or two meetings. Normally when the members resign from the Association they never inform the Association. The result is the registered member list at the Association is not accurate. The membership fee is supposed to be $\text{฿} 50$ but only $\text{฿} 20$ can be collected. This fee is collected only once, when the member first joins. When members need water, they write a letter to the Chief Engineer in charge of that area. This letter is signed by the President of Water Users' Association then sent to the officer in charge of La Loeng Wai Tank. It is forwarded to the Chief Engineer for approval, then the water is released.

(viii) Marketing and agricultural co-operative.

Paddy fields in the benefit area without fertilizer give a yield of 10 tang/rai.

Tapioca with fertilizer gives a yield of 6 ton/rai. Tapioca without fertilizer gives a yield of 3 ton/rai.

Farmers usually start land preparation in April and seed bedding in May, trasnplanting in July and harvesting in December.

Tapioca is usually planted in November and harvested after 10-12 months.

Farm labourers in the village get $\text{฿} 25$ plus breakfast and lunch a day or $\text{฿} 3,000$ /year. Draft animals cost 60 tang of rice for rental per season.

Unskilled labourers get $\text{฿} 25$ in the village, $\text{฿} 30$ in the neighbouring town, and $\text{฿} 50$ in Bangkok.

Skilled labourers get $\text{฿} 35-40$ in the village and $\text{฿} 40-50$ in the neighbouring town and $\text{฿} 100$ in Bangkok.

About 13 % of the farmers get from the Agricultural Co-operative with rate of 12 %/year.

About 10 % of the farming villagers borrow money from middlemen with an interest rate of 5 % per month, and 15 % borrow money from friends or relatives at 5 % interest.

Almost all of the rice and tapioca is sold to middlemen. Farmers do not want to sell to the co-operative. Selling rice to the co-operative gets a higher price, but there are many disadvantages, including:

1. The farmer has to transport the rice to the co-operative office.
2. The co-operative operates only during official hours which is not convenient for farmers.
3. Selling rice to the co-operative does not yield payment immediately.

About 90 % of farmers buy fertilizer from the co-operative. This is because the quality of the fertilizer bought from the co-operative is reliable.

The customs of inheritance in Nong Ya Kha are the same as in Nong Ya Phraek.

The most needed improvements for the village are:

1. road construction and improvement,
2. water resource development.

(ix) Brief general information on Ban Ya Kha.

The village area receives water supply for agriculture from La Loeng Wai Reservoir. The water from this reservoir is saline but it can be used for rice cultivation.

(i) Households and population.

Table 53

3	Ban Ya Kha	Mr. Muk Srichai	103 registered households	129	80 %
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(ii)

Table 54

3	Ya Kha	<ol style="list-style-type: none"> 1. Glutinous rice for domestic consumption. 2. Tapioca grown in upland areas for cash income. 3. A small amount of vegetables for the local market and domestic consumption.
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(iii)

Table 55

3	Ya Kha	<ol style="list-style-type: none"> 1. Most of the non-agricultural workers in this project area are wage labourers in tapioca processing plants. 2. Because of the considerable distance from the city of Khon Kaen, very few people go to look for work there.
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(iv)

Table 56

3	Ya Kha	<ol style="list-style-type: none">1. Quite a lot of people look for work outside the village, especially at nearby tapioca plants, and in nearby cities.2. They work as hired labourers, i.e., manual labourers in tapioca fields, wage labourers in the city of Korat, etc.3. Some people go as far as Loi Province to work as farm labourers.4. Most of them return in the wet season.5. Permanent migration is surprisingly low.
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(v)

Table 57

3	Ya Kha	<ol style="list-style-type: none">1. The condition of the houses in this village is rather poor compared with the villages previously considered.2. Many houses were built from cheap material available in the area.3. There are a few modern houses which belong to the government officials who own a large amount of land in the area.
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(vi)

Table 58

3	Ya Kha	<ol style="list-style-type: none">1. This village is in a similar situation as Nong Ya Phraek concerning debts.2. Most of the debts arise from the need for investment in upland crops.3. The problem of debts here is not as serious as in Nong Ya Phraek.
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(vii)

Table 59

3	Ya Kha	<ol style="list-style-type: none">1. There is public health office in the village.2. The nearest health facilities are at amphur Phol, which is about 3 km from the village.
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(viii)

Table 60

3	Ya Kha	<ol style="list-style-type: none">1. Water for domestic use comes from the pond near the village.2. A few households can afford to build a tank to keep rain water for drinking, but most households cannot afford this and must rely on pond water and well water for drinking and other domestic uses.3. Only a few well-to-do households have modern toilets. Most households in this area still dig a hole in the ground to use as a toilet.
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(ix)

Table 61

3	Ya Kha	<ol style="list-style-type: none">1. There is one primary school at Ya Kha village which provides 6 years of compulsory education.2. Some parents send their children to secondary school at Amphur Phol and Khon Kaen, but the distance discourages such action.3. Most parents send their children only to Amphur Phol.4. The percentage of children going to higher education after compulsory education is small.
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6-4 Research project No. 4.

• Project region (Nakhon Ratchasina Province).

Huai Sap Pradu Tank irrigation project.

• Research villages:

Ban Du Sans
Ban Non Khum
Ban Maklua Mai
Ban Khok Sung
Ban Sikhun

(1) The general situation of Huai Sap Pradu Tank irrigation project.

(i) Location and general information.

The fourth project selected is "Huai Sap Pradu Tank Irrigation Project" where the project area of 12,000 rai is located in two Districts. They are Sikhui and Sung Noen of Nakhon Ratchasina Province. The project was begun in 1969 and the distribution system completed in 1975. The drainage area above the dam site is 168 square kilometers. The reservoir capacity is 27.68 mil.m³. of which 25.5 mil.m³. is usable water. It is said that, since the completion of the dam, the reservoir refill has never reached design capacity. The maximum reported was only 22 mil.m³. while the average annual reservoir refill was around 15 mil.m³. Due to consecutive dry years from 1978 to 1980 the reservoir is now at its minimum level.

The Huai Sap Pradu project is an ideal one for the research study as it has important aspects to integrated small-scale rural development. The water users' association is one of the most active means of raising the activity of the farmers to help solve water use problems within the project areas. Agricultural Co-operatives at district level both at Sikhui and Sung Noen Districts are well developed and effectively operated. These two activities are considered as the best ones for the research work in this project area.

(ii) Irrigation level

From the irrigation point of view the area covered by the right main canal from Km. 0+000 to Km. 18+000 will be used as the area for the study of water use/control. A water balance study in the reservoir is also planned.

(iii) Water management

It is proposed to install water level recorders at both left and right main canals, on the first to third laterals of the right main canal and at Ka. 18+000 to check the irrigation water used in the specific area. It is proposed to collect rainfall data at the headwork and in the center of the basin where the resettlement village is located. Necessary meteorological

data will also be collected at the headwork site. This research project on one of the most active water users' association has been selected at "Huai Sap Pradu Tank Irrigation Project" located in Sikhiu District, Nakornratchasima Province.

The observation instruments are as follows:

Table 62

Project No. 4	<ol style="list-style-type: none"> 1) Rainfall recorder and Pan evaporation at Dam site 2) Water level staff gauge in the reservoir. 	<ol style="list-style-type: none"> 1) Meterological station at dam site composed of: <ul style="list-style-type: none"> - Sunshine recorder - Temperature measurements - Humidity measurements - Wind velocity measurements 2) It is proposed to install one Rainfall recorder or non-recorder upstream of the reservoir. 3) It is proposed to install six water recorders on the canal system of the project area. <ul style="list-style-type: none"> - The first recorder at the head of the left main canal - The second recorder at the head of the right main canal - The third recorder at the head of the 1L-1R lateral - The fourth recorder at the head of the 2L-1R lateral - The fifth recorder at the head of the 3L-1R lateral - And the last one at Km.+18+000 of the right main canal.
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Features of the Huai Sap Pradu Reservoir:

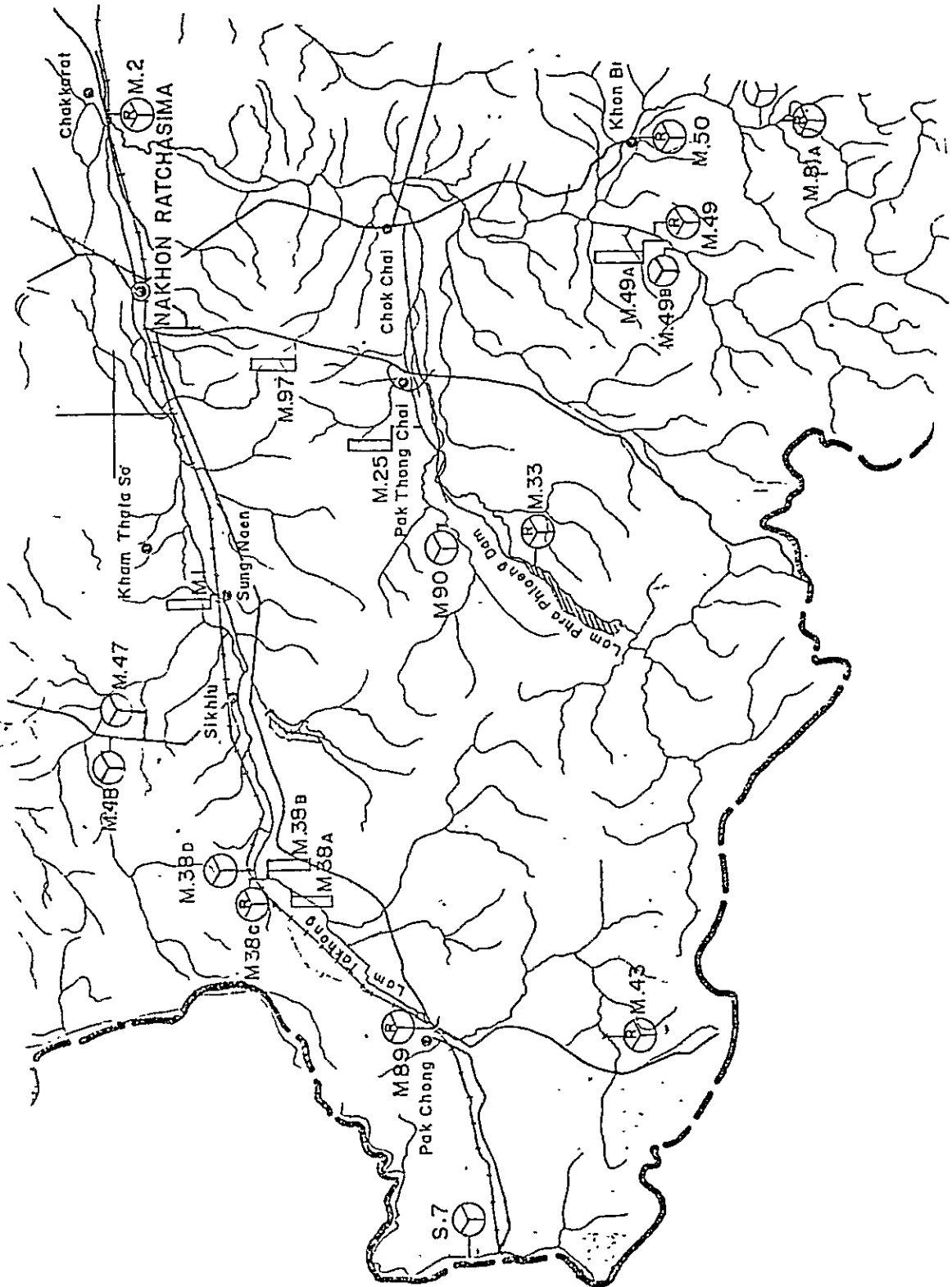
Catchment area above dam site = 170 km²

Retention level = +245.00 m (msl)

Elevation at the top of dam = +247.50 m (msl)

Storage capacity at retention level = 28.6 mem

Fig.34 OBSERVATION SITES



Dead storage elevation = +236.00 m (msl)

Dead storage volume = 1.5 mem

Surface area of lake at retention level = 6 km²

Mean daily variation of water surface elevation in Huai Sap Pradu reservoir for various years are shown in graph Fig. 4.

Data on climatic conditions for this research project can be obtained from three stations at Soeng Neng District, Srikui District and Sap Pradu Headwork to represent the climate of the Huai Sap Pradu irrigated area which is indicated in Table 63.

Table 63 Climatic data for Project No. 4

Month	Mean Monthly ¹⁾	Mean Monthly ²⁾	Mean Monthly ³⁾
	Rainfall mm	Temperature °c	Evaporation mm
Jan	2.1	24.0	115.2
Feb	22.1	25.2	122.7
Mar	40.4	24.4	151.7
Apr	80.9	28.5	163.8
May	168.4	28.1	145.2
Jun	86.2	28.3	143.5
Jul	112.9	28.3	146.9
Aug	101.6	27.1	132.3
Sept	284.3	26.4	100.7
Oct	149.2	25.1	98.7
Nov	31.2	25.3	94.7
Dec	0.6	25.2	110.4

Remarks

1) Records from average of three rotation at Sap Pradu Dam site, Soeng Neng & Sri Kui District, period of record 24 years.

2) Records for years 1971-1980 at Lam Takong Project.

3) Records for years 1971-1980 at Lam Takong Project.

(iv) General situation of Huai Sap Pradu Tank irrigation project.

The project area consists of 7 villages, i.e. Ban Nong Jok, Ban Rai, Ban Sikieu (2nd and 4th villages), Ban Non Kum, Ban Ma Klua Mai, Ban Kai Santi

Fig. 35 MAP OF AMPHUR SUNG NOEN, NAKHON RATCHASIMA

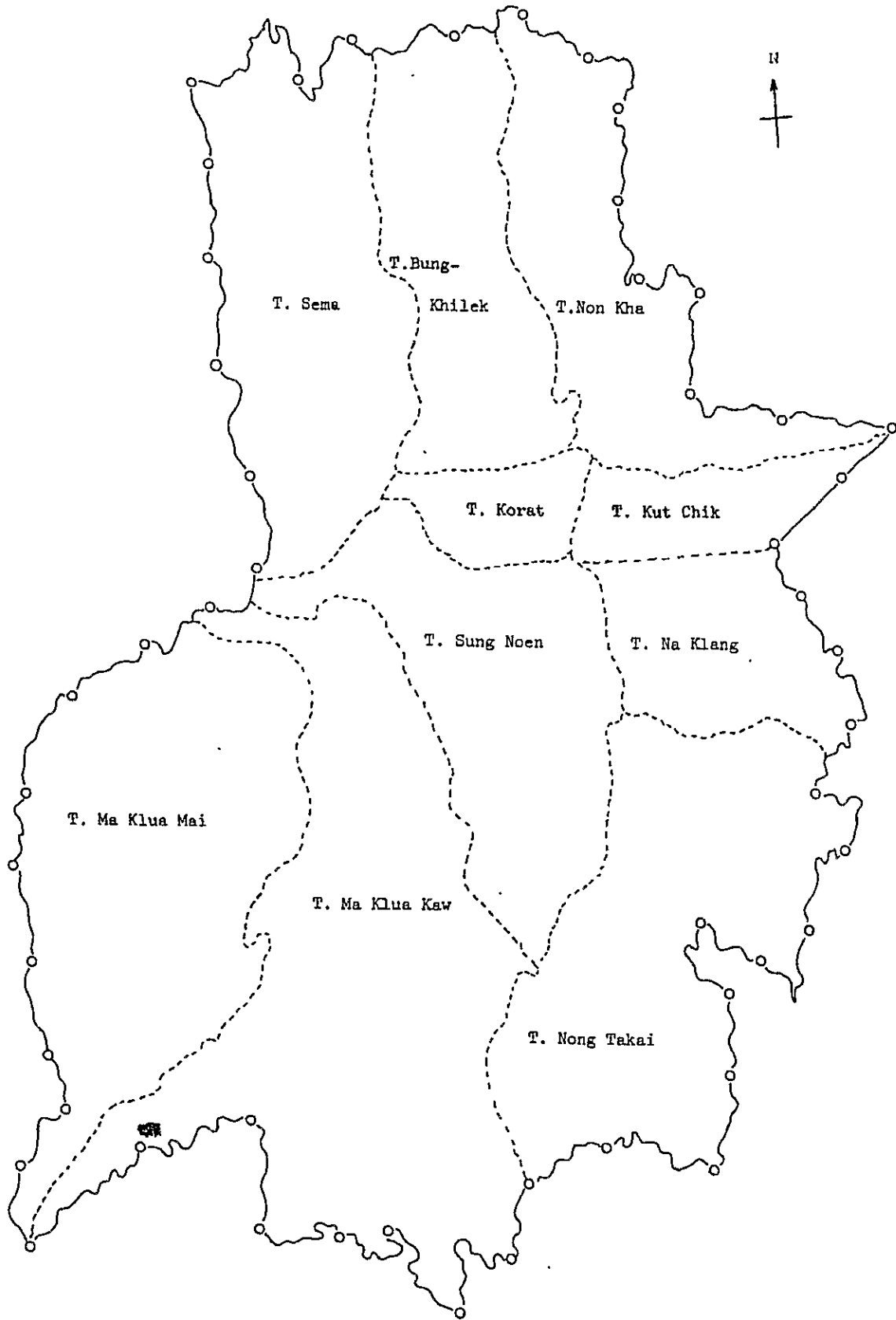
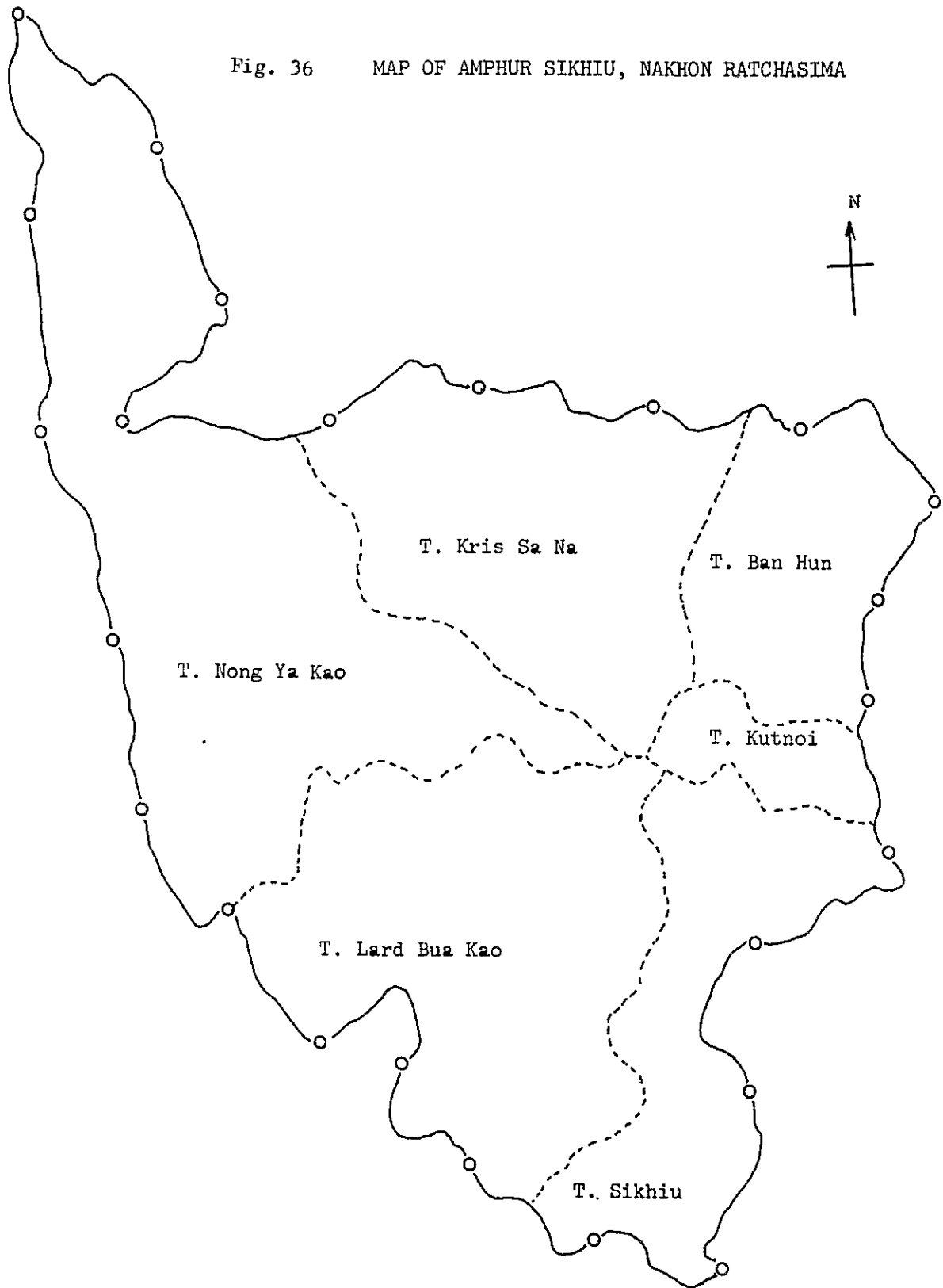


Fig. 36 MAP OF AMPHUR SIKHIU, NAKHON RATCHASIMA



and Ban Pai Khok Sung. This area receives water from two sources, Subpradu Irrigation Reservoir and Lam Takong River. Therefore, some areas receive water from Lam Takong River and only Ban Non Kum and Ban Ma Klua Mai are supplied by the Subpradu Irrigation Project.

Project area No. 4 covers two Amphurs, Sikieu and Sung Noen. There is a successful Water Users' Association at Subpradu Reservoir. Those households who use water from the Subpradu Reservoir must register to be members of the Water Users' Association.

Most people in this project area are engaged in agriculture, especially rice farming. There are some upland crops, such as kenaf, tapioca, maize, and sugar cane all over the upland areas. The most important characteristic of the rice farming in this area is that the farm products are mainly for the market, not for domestic consumption.

This area is close to Bangkok. Some influences of modernization easily affect the area. There are a lot of home-made trucks using small water-pump engines as a source of driving power. The total cost for building a truck like this is about 50,000 baht. This kind of home-made truck has been increasing in number every year.

Another interesting thing is that at Ban Ma Klua Mai there is a nursery run by an official from the Department of Community Development together with some female volunteers. There are about 20 children in the nursery.

(v) Present state of the research villages.

The main objective was to carry out intensive surveys on the economic and social situations of all villages with agricultural areas under irrigation from Hui Subpradu Reservoir. From the surveys it was found that some parts of five villages are under irrigation from Subpradu Reservoir, i.e. Ban Si Kew, Ban Non Kum, Ban Ma Klua Mai, Ban Khok Sung, and Ban Rai.

a. Ban Si Kew

This village consists of 4 small groups of households, but only groups 2 and 4 receive water supply from Subpradu. There are more than 500 households in this village and only 22 receive water from Huai Subpradu.

Ban Si Kew is more urbanized than the previous villages visited. It is located very close to the Amphur Si Kew. Electricity and water supplies are available to all houses. Most houses are built in the modern style. The way of life of the people in this village appears to be modernized urban.

Considering the general conditions of the households in the village, it would appear that the people are changing quickly. A lot of people may not

engage in Agriculture any longer. However, it would be interesting to study in more detail this changing way of life.

b. Ban Non Kum

This village consists of 200 households, and 80 percent of the total are agricultural households. The condition of the road into the village is very good. Electricity and water supplies are available to all households. Houses are in good condition and rather modern in style. Television sets can be seen in many houses. This village also looks more urbanized than those in Khon Kaen and Karasin.

The farmland is 2,200 rai, Thailand upland are p-f 700 ri. There are 320 h/h, making a population of 1,561 in this village.

Farmers prepare land for cultivation in July, seedbedding is done in July, transplanting in August, harvesting in December, and nonbedding in December to May.

Tapioca farmers hire labour by area; for example, planting 1 rai = 200 ฿, a tractor for land preparation is 130 ฿/rai.

There is a co-operative in the village, with about 22 members. There are also farmers group for peanut farmers with 30 members and a water users association with more than 100 members and BAAC groups of 30 members.

The irrigated area is 2,200 rai, of which 1,200 rai is under Sap Pradu irrigation, and 1,000 rai is under Lum Takong Reservoir irrigation.

The irrigation calendar for both projects is July and Aug. which is not consistent with the cropping calendar of the farmers.

In the past 10 years there has been only one drought year. and damage was only 30 % and there was no flood year.

Of the population about 25 % are tenants; 75 % of these are part tenants and 25 % are full tenants the land rent is a 50 % share of the crop.

The maximum farm size is more than 100 rai minimum is 10 rai, with an average of 40 rai.

There is an exchange labour system here.

In the wet season, 20 % of farmland grows high yielding variety, with rice yields of 60 tang/rai for fertilized fields and for the nonfertilized field, 40 tang/rai.

Fields which yield only 30 kg/rai of tapioca without fertilizer yield 2000 kg/rai with fertilizer.

Farmers prepare for land cultivation in July, seed bedding is done in July, transplanting in August, harvesting in December and nonbedding in

December to May.

Tapioca farmed hire labour by area; for example, planting, 1 rai = 200 ฿; a tractor for land preparation is 130 ฿/rai.

There is a co-operative in the village with a membership of about 50 people. Most farmers sell rice and purchase fertilizer from middleman; very few deal with co-operatives.

Co-operatives buy rice at higher prices and sell fertilizer at lower prices but the procedure is complicated.

The custom of inheritance in this village is a little different from other villages; namely (1) they stick to the law to avoid confusion.

(2) every children gets the same proportion, except the youngest daughter who gets the most.

The problem of co-operatives is that many members misunderstand the role of the co-operative.

After irrigation, rice yields double; the yield was 25 tang/rai before irrigation, and 50 tang/rai after irrigation.

c. Ban Ma Klue Mai

This village consists of 180 households, and 80 percent of the total are agricultural households. The total population is 2600. This village is located near the highway. Most people in this village work in the agricultural sector. Only 20 percent of the total population of the village work in non-agricultural sectors.

Even though most of the area of the village receives water from Huai Subpradu Reservoir, there are some 20 to 30 percent of the population who have moved to work elsewhere, most of them young men and women.

Subpradu Reservoir is only small-scale. It is therefore not possible to supply water for agriculture to all areas in the dry season. People then find jobs outside the village.

d. Ban Khok Sung.

This village consists of 98 households out of which 90 are agricultural households and 8 are non-agricultural households. The total population is approximately 500. Only 50 percent of the village area receives water from Sabpradu Reservoir.

The general characteristics of the households in the village are different from Ban Si Kew and Ban Non Kum. This village looks more rural than the above two villages, because of the longer distance to the Amphur. It can

be seen that distance is one important factor that determines the way of life of the people.

d. Ban Rai

This village consists of 31 households. Most of them are agricultural households. The total population is approximately 180. Ban Rai and Ban Khok Sung are located very closely together, but on different sides of the river.

There are only 10 households that occupy farmland under the irrigation system of Subpradu Reservoir. The village is very small.

There are three important conclusions, which should be stated here. Firstly, distance is one important factor that determines the economic behaviour of the village people in the North-east. Those village which are close to the city are likely to be changing their way of life quickly. Secondly, in irrigated areas there is a smaller amount of labour movement than in rain-fed areas. Thirdly, exchange labour no longer exists in these areas.

(vi) Brief information on the general state of Ban Non Kum and Ban Mu Klua Mai.

Non Kum is the sixth village in Tambol Si Kieu, Amphur Si Kieu, Korat. It is located about 40 km from the city of Korat on the Korat-Saraburi highway.

This village receives water for agriculture from two sources: Subpradu Irrigation Reservoir and Lam Ta Kong. Subpradu Irrigation Reservoir provides water to only 50 % of the agricultural area of this village. The rest of the village area receives water from Lam Takong and rainfall.

Maklua Mai, consisting of two groups of households-Maklua Mai group 1 and Maklua Mai group 2, is located about 40 km from Korat on the Korat-Saraburi highway.

Subpradu Irrigation Reservoir provides water supply for agriculture to 50 % of the village area. The rest of the village area is either rain-fed or irrigated by Lam Takong.

(i) Households and population.

Table 64

Ban Non Kum	Mr. Chanai Juachantuk	267 registered households	1,717	80 %
Ban Maklua Mai 1st group	Mr. Siri Wangsungnocn	238 registered households	1,283	80 %
Ban Maklua Mai 2nd group	Mr. Udom Wichit	172 registered households	890	80 %

(ii)

Table 65

4	Non Kum	<ol style="list-style-type: none"> 1. Rice for domestic consumption and for sale 2. Vegetables in small amounts for domestic consumption and local market. 3. No upland crops in this village area but some households grow tapioca in the other village areas.
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Table 66

Ma Klua Mai 1st and 2nd group	<ol style="list-style-type: none"> 1. Rice in lowland areas 2. Tapioca in upland areas 3. Rice for domestic consumption and for sale 4. Glutinous rice is cultivated in very small amounts just for making sweets and puddings. <p><u>Remarks:</u></p> <ol style="list-style-type: none"> 1) In project No. 4 some differences from other project areas can be seen. Project No. 4 grows mainly rice as in the central part of Thailand, which differs from other project areas. 2) Nearly all project areas grow rice for domestic consumption and if there are some surplus left, then it is sold to the market. 3) The area for growing rice can be cultivated only in the wet season even in fully irrigated areas. Only a small plot of land is used to grow rice for the
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second time in the dry season. The reason may be that the production of rice is enough for domestic consumption, therefore, there is no need to grow rice for the second time.

- 4) The area used for growing rice will not be used for growing upland crops. This characteristic is true for all four project areas. Then, after the rice has been harvested, the land is left fallow until the next season.

(iii)

Table 67

4	Non Kum	<p>5) Tenants are very small in number in all project areas. Most households occupy their own agricultural land.</p> <ol style="list-style-type: none"> 1. Those who occupy no land work as skilled labourers in construction and small agro-industries nearby. 2. In the dry season many people look for wage labour in the city.
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Table 68

Ban Maklua Mai	<ol style="list-style-type: none"> 1. 20-30 % of the population go to work in non-agricultural sectors in the city of Korat. 2. In the dry season many people in the village work in tapioca processing plants nearby. <p><u>Remarks:</u></p> <ol style="list-style-type: none"> 1) Few people in the project areas work in non-agricultural sectors. 2) Those who work in non-agricultural sectors are government officials, teachers, wage labourers in tapioca plants and in service sectors in nearby city. 3) Because the non-agricultural sectors in the North-east are quite small, the people do not have many choices. 4) Non-agricultural work is temporary, especially in the dry season.
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(iv)

Table 69

Non Kum	<ol style="list-style-type: none">1. The population movement is also high.2. Many people work in Si Kieu city.3. There are many tapioca processing plants in the area so, in the dry season, many people work in these plants.4. Permanent migration is low.
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Table 70

Maklua Mai	<ol style="list-style-type: none">1. The population movement is very high in this village.2. Those who move to work outside the village go as far as the Middle East.3. More than 100 people have already gone to work in Saudi Arabia, and sent money back to build new houses for their families.4. A lot of new houses are being built in this village.
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Table 71

4	<p><u>Remarks:</u></p> <ol style="list-style-type: none">1) Population movement is high or low in both irrigated and rain-fed areas depending on the availability of jobs in surrounding areas and the conditions of agriculture in the villages themselves.2) From the surveys both irrigated and rain-fed areas have a high level of population movement.3) There is one exception, Don Kloi, which has a slightly lower level of population movement.4) Reasons for these differences will be investigated later on, in phase II.5) Permanent migration is very low in all areas. But in Maklua Mai there is a tendency of migration away, in the future.
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(v)

Table 72

	Non Kum	<ol style="list-style-type: none">1. Most houses in this village appear to be better than those in Khon-Karn and Karasin.2. There are many large modern houses in the village showing better economic conditions of the owners.3. Most houses were built with rather good materials.
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Table 73

	Maklua Mai	<ol style="list-style-type: none">1. This village shows a surprising number of new houses under construction.2. The owners of these new houses are apparently working in the Middle East. <p><u>Rmarks:</u></p> <ol style="list-style-type: none">1) Among the four projects as mentioned above, project No. 4 seems to have the best housing conditions.2) This may be because this area is well irrigated and the farmers' organization is very strong, and because this area is close to Bangkok and the communication is effective in introducing modernization.3) Project No. 4 appears to be rice producers for market. Many cash crops are also cultivated intensively in the area.
4		

(vi)

Table 74

	Non Kum	<ol style="list-style-type: none">1. The problem of debts is not serious in Ban Non Kum.2. Those households who have some debts are the ones who are investing in farming, so the debts can be paid without difficulty.
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Table 75

Maklua Mai	<ol style="list-style-type: none"> 1. Maklua Mai is in the same situation as Non Kum. Most debts are for agricultural investment. 2. Because of the existing co-operatives in the area, farmers borrow from the co-operatives for their investment. 3. Only some farmers borrow from the money lenders when there is an urgent need for money. <p><u>Remarks:</u></p> <ol style="list-style-type: none"> 1) As regards the debts problem, the areas with the most trouble are the rain-fed areas. 2) In areas where co-operatives are efficient the debts problem is very small. 3) However the information on debts of farmers in these areas will be studied in detail before making any conclusions.
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(vii)

Table 76

Non Kum	<ol style="list-style-type: none"> 1. This village receives water supply for domestic use from a pipe water line provided by the Sikieu Water Authority. Therefore the domestic water supply here is plentiful and clean enough for drinking. 2. Although piped water is available, because of the high cost of installation, not all households in the village use piped water. Some households still use well water. 3. Most households use modern style toilets. Only a few households still use traditional toilets.
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(viii)

Table 77

4	Non Kum	1. There is one public health office.
	Maklua Mai	1. There is one public health office which was built by Mr. Yos Peikumpha, the leader of the village.

Maklua Mai	<ol style="list-style-type: none"> 1. This village also has a piped water supply for domestic use. 2. There is also an area where underground water rises and can be used for domestic consumption. 3. Most households can afford to have piped water supply connected to their own houses. 4. Modern toilets are common in this area. <p><u>Remarks:</u></p> <ol style="list-style-type: none"> 1) Sanitary conditions are related to the economic well-being of the household. 2) Those villages where most people are relatively rich have got a clean water supply and use modern toilets. 3) Most irrigated areas seem to have better sanitary conditions than the rain-fed areas. 4) Sanitary conditions are also related to the distance of the village from the main city. 5) It can be seen that Nong Ya Phraok and Ya Ka are far away from the city and therefore cannot get piped water supply for domestic use.
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(ix)

Table 78

Non Kum	<ol style="list-style-type: none"> 1. This village has got a big primary school with about 700 students and 32 teachers. 2. This school provides 6 years of education. 3. Most parents send their children to secondary school at Amphur Sikieue. 4. Quite a large number of students go to study in Korat.
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Table 79

Maklua Mai	<ol style="list-style-type: none"> 1. The primary school at Maklua Mai village is also large providing 12 teachers and 12 classrooms. 2. The school comprises 250 students. 3. There is a government agency nursery room providing pre-school education.
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	<p><u>Remarks:</u></p> <ol style="list-style-type: none">1) Education and economic well-being of the population are interrelated.2) The areas of good economic conditions have a high percentage of students in secondary education.3) However, other factors also determine the intention of parents regarding their childrens' education.4) Only primary education is provided at village level. This is rather broad and too general.
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7. SURVEY ON THE TOBAN IRRIGATION DISTRICT AND A COMPARISON WITH NORTH-EAST THAILAND.

7-1 The history of integrated small-scale rural development in the Toban district

The purpose of comparative research on integrated small-scale rural development in the Toban district and North-east Thailand is to compare paddy fields, the history of rural development, water control, farmers' co-operatives and the economic situation generally. The history of Japanese technical development with regard to rural development is defined systematically, and this will give many guidelines on small-scale rural development in the future in North-east Thailand. The development plans of some large-scale development projects which have been carried out in developed countries so far consist of the construction of a large reservoir upstream, the construction of diversion works, main canal and branch canals, and finally a land consolidation project, and sometimes these have been developed with the help of support from foreign countries.

But, from the viewpoint of general rural development, there have arisen many important unsolved problems. The method described above is an effective development measure if there is enough money, and the rural society has the potential of being able to adopt new techniques immediately. What is the most reasonable development scale for a developing region? For example, the Aichi irrigation project and the Toyokawa irrigation project in Japan are defined as large projects. The Toban irrigation project which was picked as the survey district, about 1,000 years ago, developed from a very small scale project, over several hundred years it developed to medium scale, and nowadays, it is a large scale project. This can be said to be definitely in the Japanese style.

Concerning the history of the Toban district, three stages, from the beginning of irrigation to the end of the Edo period, from the Meiji era to World War II, from World War II to now, can be defined from the point of view of rural development. The analysis point is based on small-scale water use and a farmers' co-operative, and as a back-up, history, culture, economics, society and education were studied.

(1) History of the small-scale rural development in the Toban district before Meiji era (First stage).

a) No memories of rain-fed paddy field

In the Toban district, in the first stage, there were no rain-fed paddy fields. If the paddy irrigation season is from June to September (from

months), the growing season is 150 days. On the other hand, from the point of view of rainfall during 150 days, it is about only 1000 mm in Toban. Even if the average consumption of water a day is 16 mm/day, the required water depth during the irrigation season is:

$$16 \times 120 = 1920 \text{ mm}$$

From this, in the Toban district, it could be said that genuine rain-fed paddy fields had not been formed from the beginning. For formation of rain-fed paddy fields, geographical factors would be necessary which could flow into paddy from outside catchment area.

b) Group-scale paddy field in the low land.

The Toban district consists of an uneven plateau, but in its basin or lowland, there is an area which recovers water from the high land. This partial lowland could be a natural paddy field area, and it seems that this had the first stage of paddy fields. This area was never large, but this area probably became the origin of the community. Otherwise natural ponds and springs seem to have been the beginning of irrigation.

c) Group-scale irrigation development based on a weir.

Getting water from branches by simple weirs, irrigation canals and paddy fields would be formed as plot to plot paddy irrigation. In North-east Thailand, there are no weirs installed to gain water from the branch of river in a small-scale, the Toban district is the plateau which expands eastern part of Kako-river, and are covered with many branches. As these small branches simple weirs were easily constructed, and so diversion of irrigation water was achieved. In this period, typical paddy fields had already been made and a small canal was irrigating the paddy field. High land where water did not flow became upland farms, and the areas in which water flowed became paddy fields.

Small rivers flowed stably during the year, but mostly flood discharge flowed into the sea. The rate of water use in weir form was about several percent of the yearly flow. Weirs were made of wood, and about once a year, they were easily broken by flooding, so that for the next irrigation season reconstruction was needed. To sum up, in the Toban district, without artificial irrigation facilities, paddy fields could not be sustained.

d) Group-scale irrigation development based on a small reservoir.

The first small reservoir was constructed about 700 years ago. From this time until the Meiji era (1880) the development of this area pro-

gressed smoothly, and many small reservoirs were made. Now, in the Toban district (8,000 ha) there are 5,000 reservoirs but most of them were constructed before the end of the Edo period. Concerning the small reservoirs at that time, not just one but several small reservoirs were built in one time by farmers' groups in villages.

e) A reservoir system with mutual linkage.

This group irrigation development had a typical pattern as follows: Small-scale irrigation had a reservoir system in parallel and in series. In this period the idea of linkage-conception was used entirely. Another pattern was the reservoir located along the canal receiving water from a weir in the river. At the beginning, the road was fairly poor like a lane in which a human-being could pass, just like a path between rice fields.

Commune organization in the Toban district was being developed along the river, in the nearby low-lands and high-lands. The type was a center-gathering commune, and this pattern can be easily distinguished in North-east Thailand.

The group irrigation projects had close connections with each other and developed into a small scale irrigation project. In the commune which was developed in the first stage, there were many "public co-operations" which were supported by the then feudal clan-government. An example of the support was that farmer's could cut and utilize the natural trees without compensation, and a farmer could build a house by himself. The first settlers were almost relatives to each other, so co-operation in the commune was very strong.

(2) The Toban district in the Meiji era (2nd stage).

As a method of farmer's mutual help, "A mutual financing association" existed. Through the village headman they had a relationship with the central government.

For water management, there was already a system. This control system seems to have be a "village headman" style. As a representative who could control directly water management a "head farmer" was elected. There were occupations such as "Oomizuire" and "Komizuire". "Oomizuire" took care of water from a reservoir and controlled a reservoir, and "Komizuire" managed the water supply in paddy fields. Real power concerning irrigation water control was completely given to "Mizuire".

The connection among several group projects created a small scale project according to topographic characteristics. A small-scale project was generally organized as "University and independent unit". Characteristics of

the water control-system were as follows;

- a) For the water control of a small-scale project, its unit was perfect.
- b) There were exclusive water utilization rights, from other water control systems.
- c) The water control system was completely managed in a consistent and fair way and also it guaranteed profits for the farmers' group.
- d) The water use association knew about the details of the paddy field area, and also detailed data of irrigation several hundred years ago remained. That shows this had the function of a registry office of village property. Therefore, data of water management was perfect. Sometimes, this association gave information on the economic situation to the government.
- e) Water rights were already in existence in this period. The farmers who participated in construction of reservoir could use the reservoir water.
- f) Just before the rice transplanting, after the inspection of reservoir and paddy field head man had regulated the reasonable area of paddy rice for transplanted. The conception "Fair water diversion" was adopted for water management. One day drought damage occurred for all area as water control was managed completely fair to the all beneficiary.
- g) The benefit area was limited in each reservoir every year.
- h) Overcoming the drought disaster the number of small reservoir was gradually increased, so the irrigation effect based on a reservoir was understood. It is clear that over a long period small-scale integrated rural development took place in the Toban area.
- i) Over a period of 1000 years, it seems that the development of irrigation techniques actively took place.

A farmers' cooperative which needed present democratic management didn't exist. Practically, those activities performed as a mutual support activity traditionally in the village from the viewpoint of moral. Religion was Buddhism, so this activity strongly influenced the culture ideology in the Toban district.

(3) Integrated rural development from the Meiji era to World War II
(2nd stage).

(a) Water management from the Meiji era to World War II.

The water management law in the Meiji period was established as an origin of water users association under the Arem adjustment law. But there were few newly developed irrigation areas. Intensive land use became the most important problem. In this water use development an especially important problem was the existence of a land-owner. The water management budget was prepared by the land-owner and peasants didn't need to pay for that. One characteristic of this period was re-development as a middle-scale development based on linkage between small-scale developments getting financial support from the government. The linkage method has special features for development as follows:

- i Increasing the weir diversion from the river, main canal and laterals, they increased the strength of the reservoir effect.
- ii Connection of reservoirs between different basins with connection canals.
- iii Increase of water control association was accepted to raise the level of property.
- iv New construction of middle scale irrigation projects.

Although it was directly a farmers' co-operative, state policy had guided the first portion of agricultural co-operatives. It was called an industrial association. But the depression in agriculture in the Taisho era was very serious. In the Showa era, the nation became militaristic. In this period, industrial development gradually influenced agriculture.

b) Small-scale rural development from the Meiji-era to World War II.

A small-scale rural development based on a reservoir in Toban was developed based on farm-water control, but two patterns of irrigation season paddy rice and winter term barley were existing, and there were minor increases in the area. In this period the land use adjustment among reservoirs developed through mutual linkage, then a middle-scale rural development developed. At that time, water use was managed by farmers under financial support of a land owner. Peasant farmers increased. The relationship between land owners and peasant farmers caused integrated rural development. Compulsory education was until the sixth grade of elementary school.

(4) Integrated rural development after World War II (3rd stage).

i) Water management after World War II in the Toban district.

After World War II, the farm land development law was set up as everybody became a land owner. This is a land reclamation law. Those had improved also water control, for example, Yoshida land improvement district and Kako-land improvement district. The features of water management are as follows:

a. Irrigation management based on a reservoir.

b. Water management of reservoir is by "Oomizuire", water supply of field ditches is by "Komizuire". They had absolute power over the water problem.

c. Water management charge is collected from farmers in proportion to paddy field area and one hectare costs about 110,000 yen per year (1980).

d. Old land reform district sometimes had their property, and generally a new land reform district didn't have common property.

e. In a land reform district, 12 people were selected by an association member's election as a trustee, and the representative was selected by a trustee's mutual election.

f. Reservoirs were loaned by the association for fish farming.

g. The beneficiaries of each reservoir and the benefit area were stable and did not change when there was a drought year or a flood year.

h. The benefit area of a reservoir constructed by farmers' efforts was performed under the permission of the government of the time and government support was limited to only those farmers who participated in construction of the canal.

i. On a small-scale, water use association management was performed by the farmers.

j. For big development of the Toban irrigation project nowadays, land reform district among many small-scales and middle-scales were united. The Toban irrigation united land reform district combined each small land reform district which was already existing as a substructure. This re-development used linkage-conception with a more and more complicated system. The daily water consumption was planned as 16 mm/day. In this new land

reform district, there are 8,000 ha's farm-land 4 big reservoirs and 5,000 small reservoirs and for the management of the project an electronic computer was introduced.

ii) Farmers' co-operative after World War II.

Soon after World War II, a farmers' co-operative started. Its characteristics were as follows:

- a. The members of the farmers' co-operative and the member of the water users' association are completely the same.
- b. Full member of the farmers's co-operative is a person who has more than 0.5 ha's farmland.
- c. An associate member of the farmers' co-operative is a person who wants to join the farmers' co-operative and anybody, not only farmers but also town workers, can join.
- d. Management of the farmers' co-operative was to satisfy the idea of purposed activity of union member. The activities include credit, accounts, education, rice-center, market, gasoline-stand, fertilizer, agricultural medicines, vehicle repair shop, agricultural machinery, purchase of rice and flowers.
- e. Management of the farmers' co-operative is good.

7-2 Field survey of the Toban district.

(1) Social problems in the Toban-district and small-scale rural development.

a. Education

Six grades of Elementary school and three grades of junior high school are compulsory education. More than 90 % go to high school and more than 60 % to college.

b. Farm activity.

A small-scale development unit has been the unit of farm-activity in various phases. Mutual help in this development-unit is especially strong.

c. There are many festival in which farmers perform and participate.

d. Cultural activity of the farmers' co-operative has a big influence on farmers' activities.

e. When it is a big-scale unit (village, town, city) over small unit, functions are for management purposes.

f. It is difficult to own agricultural engines jointly among families.

g. Only water management is good in co-operation. In this operation there are a fair play and mutual understand.

(2) Field survey of the Toban district.

The purpose of this report is to express the brief impression during the stay in Japan. The technical details of the Toban area project need analysis of hydrological data and some details of operation, therefore the evaluation result of the Toban project will be submitted later.

(i) The Toban area.

This area was selected for a comparative study on integrated small scale rural development between North-east Thailand and the Toban area in Japan.

The Toban area is located on the left bank of the Kakogawa river within the eastern part of Harima district, this district belonging to Hyogto Prefecture. The total area of Toban is 1,160 km²; about 23 % or 265 km² of the Toban area has been used for agricultural production, and most of the crop in this area is rice. A pond and irrigation system was created by the farmers who set up the group and gradually developed the land for crops by using some techniques of irrigation. After the Second World War, land reform was established by law, and all the farmers became owners of agricultural land. The group of farmers started to set up the water user association and proceeded with the activity of co-operatives. The pond and irrigation systems are the property of the water user association, which in principle, belong to the farmers.

For this reason, all farmers appreciate the agricultural land, pond and irrigation system. Therefore the Toban area has been selected as a representative example of high irrigation efficiency and excellent activity in water user associations and co-operatives.

(ii) Hydraulic laboratory

The Hydraulic Laboratory of Kyoto University is located in Maizuru city. This laboratory was successful in solving the problem of variable discharge into the irrigation canal, due to the fluctuation of water surface elevation in the reservoir. The Principle of maintaining constant discharge from the reservoir is to develop an automatic float instrument for the Toban irrigation project and install it at the head regulator of the irrigation canal. The float instrument will automatically control the requirement of discharge.

(iii) The Toban irrigation project.

This project is the biggest in Japan, and is one of the examples in which humans triumph over nature. The purpose is to assess the performance of farming and irrigation within the selected area of the Toban project, and compare with the research area in North-east Thailand, specifically:

- a) To determine cropping patterns, yields, cost of production and net income of farmers in the units.
- b) To estimate water use, water use efficiency and water adequacy of the unit throughout the season.
- c) To find the costs of providing irrigation to the units.
- d) To estimate the value of agricultural production per cubic meter of water used in the units.

The farmers group in the Toban area is very co-operative for the water user association and co-operative.

7-3 Agricultural development in the Toban district.

(1) Agricultural development in Japan.

To begin with, the agricultural development in Japan and that in Thailand has been completely different in many aspects. The main differences are as follows;

- a) The Japanese agriculture is aimed at self-sufficiency, while the Thai agriculture is export-orientated. This difference of policies has completely different implications. The Japanese Government is in a better position with regard to controlling farm prices; it can go as far as the farm-price guarantees, making a stable supply since the World War II. As for Thailand, the farm-price is a very sensitive issue putting all political groups in an

embarrassing situation. In the first place, if farmers are paid higher, the farm-price will automatically rise and, as a consequence, exports will suffer, while at the same time, general domestic consumers will cry out to the Government through various kinds of mass media. In the second place, if the farmers are poorly paid rural trouble will emerge and it is said that rural insurgence is the negative part of the farmers groups for Thailand.

b) The social evolution of Japan helped facilitate internal development.

People have been free to organize themselves especially in the rural area. The informal organization of hundreds of water users' associations is a case in point. This has taught the people the benefits of group organization. When the Co-operative Society Law was enacted in 1900, it was not so difficult for farmers to grasp the concepts of co-operative principles. As for Thailand, the farmers were not free to organize themselves to solve their own problems; they were always forced to turn to the Government for help. When the co-operative movement spread to Thailand in the Reign of King Rama VI, it was forced on the farmers only for the purpose of mutual guarantee for individual debts made with commercial banks. Later on, farmers believed only that co-operatives were established in order that they could easily borrow money.

(c) In Japan, industrialization and urbanization have speeded up the country's development.

Employment opportunities in industrial and service sectors were open wide for rural labourers. Since an average landholding per farm-household was only 1 or 2 hectares in 1977, and even as low as 0.98 hectare in 1960, the sole agricultural income accounting only for 37 % of household expenses in 1977, and 61 % in 1960, this justified the increase of part-time farmers in Japan. Usually, the strong and tough members in the families go out and look for urban jobs; housewives and the aged stay at home. This proved to be correct when villages in the Toban area were visited. The whole family joints in with the farming especially during the weekend. This consequently justifies the use of machines on the farm. In Thailand, the situations are different and the regional imbalance between Bangkok and the other provinces has played a major role in development. Urbanization and industrialization are concentrated only in Bangkok and the surrounding provinces, especially in Samutprakarn Province. This phenomenon is of course due to various socio-economic reasons. The point to be made here is that rural labourers move to Bangkok for extra income during the off-season

period and become cheap labour to be easily exploited by townsmen. They return to the farms for cultivation. This kind of behaviour should also be defined as part-time farming; the difference is that urban places of work for Thai farmers are far away from home and they need to take risks in finding jobs. If not employed, they may have to stay hungry for a long time. Because the daily wage in Thailand is very low for unskilled workers, the rural labourers sometimes cannot even have enough for their own living. In this case, which is quite usual, part-time farmers in Thailand are not able to increase household income sufficiently. This is undoubtedly different from the Japanese case.

(d) With regard to the irrigation system, the paddy fields are all irrigated in Japan while in Thailand only 20 percent of arable land is irrigated and the rest is subject to rain. Water supply has been used economically with its rotation in the fields in Japan. This water supply has been properly managed because Japan has developed hundreds of water users' associations since more than 100 years ago. Japanese farmers and water operators have been trying continuously to make, keep and improve the paddy fields. In Thailand, water users' associations are not as effective as those in Japan. Therefore the water supply has been used uneconomically despite the water shortage in some seasons.

(e) The average land-holding in Japan, especially in the Toban Area is remarkably low, when compared to Thailand. In this aspect Thailand should be in a better position for agricultural development in the future as farmers have more land to work with. However, this is not so important.

(f) It was fortunate for Japan to have successfully completed the land reform project within a very short period of time in 1949. It was in fact a very opportune moment to start this difficult project immediately after the end of the Second World War, since, by that time, the old landlords must have been so alarmed that any land-price offered was presumably acceptable to them. In other words, probably there were very few land-price conflicts between the old feudal lords and the Government. Had the land reform not been carried out successfully after the Second World War, Japanese agriculture would not have been so advanced as today. It was, on the contrary, unfortunate that Thailand was not able to do the same thing. At present any proposal concerning land reform is very embarrassing for the political groups to decide because they might lose their support among the upper

classes. Actually there is now a state law on land reform but only a very small budget is annually allocated to the Land Reform Office. This would seem to be a very important factor in starting the development of agriculture effectively.

The impression is that the Japanese Government and Japanese bureaucracy are very active and well-prepared for rural development projects. It can be concluded that when there is an irrigation project, like that in the Toban area, they will prepare and plan for other related activities such as the unification of the water users' associations in the benefit area. This is quite remarkable. It is to be presumed that all rural development activities can be coordinated only when the Government and bureaucracy are working as one organization. For Thailand, such an experience is harder to come by.

(2) Development in the Toban District.

With regard to the field trips in rural Japan, especially in the Toban area, many things can be learned and possibly adopted in Thailand. Examples are as follows:

(a) In North-east Thailand usually the water supply is scarce and unpredictable for some years, so a water self-sufficiency policy in each village should be the right policy for successful rural development. This implies that Thai farmers should be encouraged to jointly develop as many ponds as possible in their own village by all means. The Government should, of course, play a crucial part in this kind of self-development project but not intensively intervene in their management.

(b) As this stage of development is completed, the water users' associations should be organized very rapidly.

The farmers must, as a prerequisite, be told about the usefulness of the associations so that they will be co-operative and, later on, willing to participate in the associations. The purely rain-fed areas will therefore become smaller and smaller as they are replaced by irrigated areas and consequently rain should be only supplementary to cultivation, and no longer the main input factor as it is today.

(c) Agricultural co-operatives in Thailand, as they are at present, are too weak to successfully carry out anything. It is not necessary to go into the reasons causing their failure, but there is a necessity to re-organize them in the same way as we develop water users associations, which has already been discussed above.

The Thailand's Co-operative Society Law 1968 is quite out-of-date; it should be revised again. (Actually this Co-operative Society Law is under revision by the Government but not yet promulgated.) In Japan, there are now at least two co-operative society laws; the original one was promulgated in 1900 and the second one, which concerns itself completely with agricultural co-operatives, was promulgated only after the Second World War in 1947. The Agricultural Co-operative Society Law was originally aimed at sustaining and developing farm management and the livelihood of owner-farmers who got their lands after the Second World War by land reformation. It is therefore a good idea to have a separate general co-operative society law and a separate agricultural co-operative society law, since their rules and regulations cannot be based on the same principles.

(d) At the national level, the Government of Japan has been paying much attention to the agricultural sector especially since the Second World War. The nationwide land reform project was completed within a year in 1949 by the order of the American Occupation Army. Then, land consolidation projects were undertaken by the Japanese Government throughout the country except in Kyoto, which started the project this year (1980) on an extensive scale. The land consolidation project is the most important factor in making the irrigation project much more efficient; that is to say, to supply the same amount of water, more benefit areas are gained since the ownership of cultivated land is re-arranged properly to suit the set-up of the irrigation system. Unfortunately the Thai Government has been very unstable during the last 49 years (1932-1980), and, as a consequence, the rural development was for a long time neglected. However, the present situation is forcing the Government to pay serious attention to the rural economy. However, its bureaucracy is now already uncontrollable and there is much interference by many influential third parties, either secretly or publicly. This embarrassing situation must first be overcome or else the rural development projects will only be a fantasy; the Japanese experience should be cited as a relevant example.

(e) Rural Japan, especially the Toban area, has developed plenty of small traditional ponds.

These ponds have in turn supplied adequate water for village-farm irrigation for at least the last 100 years. Together with this development, water users' associations have also been gradually organized. The associations usually managed the use of water fairly and properly among farmers

who were more or less forced by circumstances to be registered as members (if they were not members, they were not allowed to use water from those ponds). As it were, the practical right to use water from ponds has been given to the associations. The associations, in turn, can decide the rate of water charge per unit of cultivated land. The money received is accumulated in the associations to cover administrative costs and for other development projects in the future. In this way, the associations are very active in water management. This rural development pattern can hardly be developed in Thailand, but not because of the lack of the farmers' co-operative sense. In fact, before 1932, Thai farmers were bound by the law to work for the monarchy quite regularly and they were not paid (free labour). Owing to this reason, they had no opportunity to join in with real co-operative work. Besides, "divide and rule" was at that time taken as the ruler's motto and people consequently stayed more apart from one another. This latter reason would seem to be applicable even now. Farmers in Thailand cannot organize themselves to undertake public works on their own initiative and without the Government's guidance. To change this out-of-date attitude takes time but it is quite worthwhile in the long run.

(f) "Self-help through mutual help" is inherent in the Japanese farmers' organizations (water users' associations and agricultural co-operatives). Through this understanding, each member realizes that if individual benefit is to be achieved, one must co-operate. At the Yoshida water users' association, Mike city, it was learned that there were several floods in former times and some damaged the village tank; the people were organized to rebuild their tank by their own initiative and without the government's help. That's why the tank still remains today. In some drought years, they convene meetings to set a priority of limited use of cultivated land, despite private land ownership. This is quite surprising. In addition to these findings, cost sharing for public works in their village has been practised for a long time. Out of all the co-operative principles universally accepted, this principle is the most difficult to comprehend and even harder to put into practice.

7-4 Water Users' Association in the Toban District

The surveys on farmers' organizations in the Toban area, Hyogo Prefecture, in Japan during September 15 - October 31, 1980 have made it possible to perceive a rural development pattern in Japan. As for a Japanese farmer, water is at the beginning considered a valuable thing which is of

first necessity for farm production. In the Toban area, one-third of the area is either ponds or reservoirs, which might be very small or large. Most of these ponds were in fact dug by co-operative human labour. Normally the local government owns the reservoirs but the right to use the water usually belongs to the water users' associations. Since plenty of small traditional ponds have been developed in rural Japan, they have in turn supplied adequate water for village-farm irrigation for several hundred years. Together with this development, water users' associations have also been gradually organized. The associations usually manage the use of water fairly and properly among farmers, who were more or less forced by circumstances to be registered as members. If they were not members, they were not allowed to use water from those ponds. As mentioned earlier, the practical right to use water from ponds has been given to associations. The associations, in turn, can decide the rate of water charge per unit of cultivated land. The money received is accumulated in the associations to cover administrative cost and for other development projects in the future. In this way, the Japanese water users associations have been very active in water management. As for Thailand, water users' associations are registered with the Ministry of Education, but they work very closely with the Royal Irrigation Department. Since the time of their legal establishment, the registration fee of only ฿ 20 per head is allowed to be collected from those who want to be members. The Associations' main expenditure item is the Government registration fee of ฿ 500. Since the right to use water from public reservoirs is not exclusively restricted to water users' associations, they cannot be more efficient than they are today. It is a good news that a water charge is from now to be gradually collected from members at a maximum of ฿ 20 per rai. One positive effect is that farmers will not use water for cultivation carelessly as in the past. Statistics suggest that if water is economically used, 60 % of the water supply can be saved. From the rural development aspect, the improvement of water users' associations should be therefore one of the answers.

In North-east Thailand, water supply has been scarce and unpredictable for some years. The water self-sufficiency policy in each village should be the right policy for successful rural development. This implies that Thai farmers should be encouraged to jointly develop as many ponds as possible in their own village by any means. The Government should, of course, play a crucial part in this kind of self-development project but not intensively intervene in their management. As this stage of development is completed,

users' associations should be organized very rapidly. Farmers must, as a prerequisite, be told about the usefulness of the associations so that they will be more co-operative and, later on, willing to participate in the associations. In principle, the purely rain-fed areas must therefore become smaller and smaller and be replaced by irrigated areas. Rain should be only supplementary to the cultivation and no longer the main input factor as it is today.

7-5 Agricultural Co-operatives.

The agricultural co-operative movement in Japan is regarded as one of those propulsive development organizations. The modern co-operative movement in Japan started after 1900 when the Co-operative Society Law was enacted. This Law authorized the formation of four types of co-operatives, i.e. credit, marketing, purchasing and processing. A few years after that, the Central Co-operative Union was established, at which time its devoted leaders availed themselves of the establishment in inaugurating an energetic campaign to form co-operatives on a nationwide scale. In 1906 credit societies were authorized to perform the additional function of marketing business. Thus, the nucleus of the present-day type of multi-purpose co-operative society was formed. With the outbreak of World War II, co-operatives were reorganized into compulsory organizations in order to meet the demands of a war-time controlled economy. Coupled with this, the policy of obligatory membership substantially altered the co-operative nature of the movement. In 1947, the Agricultural Co-operative Society Law was promulgated with a view to sustaining and developing farm management and livelihood of owner-farmers who got their lands after World War II by land reformation. The Law provided that agricultural co-operatives be managed on co-operative principles.*

At present the multi-purpose co-operatives form the main current in the Japanese agricultural co-operatives movement as in Thailand. Actually there are some single-purpose agricultural co-operatives, which are organized to concentrate on the marketing of products from certain specific sectors, such as fruit and vegetables, livestock raising; but, all in all, almost all of the co-operatives' members are concurrently members of multi-purpose agricultural co-operatives.

* quoted from "The Central Union of Agricultural Co-operatives, Agricultural Co-operative Movement in Japan, (1980) p.7

In Thailand, the co-operative movement was also inaugurated by the Government but initially in the form of Raiffeisen co-operatives. This is a kind of credit society with a very small membership in the rural area and the liability is unlimited. So it was at that time quite appropriate to use co-operatives as a credit guarantee mechanism. The very first co-operative society in Thailand was founded in the Province of Phitsanulok on the 26th of February 1916; this date has been proclaimed "Co-operatives' Day" in Thailand. The co-operatives' promotion work was first under the authority of the Ministry of Finance at the sectional level. The work was later expanded step by step from the Department of Co-operatives to the Ministry of Co-operatives. During the Sarit Tanarat regime, the co-operative work was degraded and passed over to a newly founded Ministry of National Development at the departmental level. At present, the work is taken care of by the Co-operatives Promotion Department in the Ministry of Agriculture and Co-operatives. As the earlier co-operatives' objective was mainly aimed at giving credit to poor members and other business was not mentioned at all, or even restricted, this image has since given a very false impression to farmers in general. Co-operatives at that time had to comply with the Association Act of 1914 and no other types of co-operative could be registered, only Raiffeisen co-operatives. The first co-operative society Law in Thailand was enacted in 1928. This law paved the way for the registration of other types of co-operative. This law was revised three times during 1933-1935. This first co-operative society law had been applied for many years since then. In 1968, a new co-operative society law was enacted instead and the law has been used since then. In 1980, a new co-operative system was planned by the National Economic and Social Development Board and, as a consequence, a corresponding new law will soon come into being.

If Japan is taken as our reference, the success of co-operatives especially in the agricultural sector must have been one of the key contributors to her appreciable rural development. The social evolution of Japan helped facilitate internal development. Japanese people have been freer to organize themselves especially in the rural areas. In terms of co-operative consciousness, this occurred in Japan even before the first co-operative was established. This can be easily explained: the informal organization of hundreds of water users' associations had occurred over at least the previous 100 years; it had already taught the rural people the benefit of group organization. When the Japanese Co-operative Society Law was enacted in 1900, it was not so difficult for farmers to grasp the

concepts of Co-operative principles. As for Thailand, the farmers have never realized the benefit of group organization and always mistake agricultural co-operatives for government agencies. This could be due to the fact that when the co-operative movement spread to Thailand in the Reign of King Rama VI, it was forced on Thai farmers only for the purposes of a mutual guarantee for individual debts made with commercial banks. Later on, Thai farmers only understood that co-operatives were established in order that they could easily borrow money.

Careful attention should from now on be paid to the forming of real farmers' organizations with minimum intervention from the Government. According to the field surveys during 1980 in many provinces, especially in Petchaburi, Korat and Khonkaen, in which some agricultural co-operatives have even been awarded first prizes for their business success, the heads of the provincial offices of the Co-operatives Promotion Department always have their large office desks put right in the co-operatives' offices and wait to inspect and sign documents for their approval. Quite often they can overrule the decisions of the co-operatives' boards of directors and, of course, of co-operatives' managers as well. This involvement must be gradually abolished and replaced by the training of co-operative managements in order that they can really take over the responsibilities in due time.

In Japan, there are now at least two co-operative society laws: the original one was promulgated in 1900 and the second one, which concerns itself completely with agricultural co-operatives, was promulgated only after the Second World War in 1947. The Agricultural Co-operative Society Law of Japan was originally aimed at sustaining and developing farm management and the livelihood of owner-farmers who got their lands after the Second World War by land reformation. Whatever the original aim was, the idea of having a separate general co-operative society law and a separate agricultural co-operatives law must be a good one since their rules and regulations sometimes cannot be on the same principles. In Thailand, there is one law on co-operatives, promulgated in 1968; this law is quite out-of-date and should therefore be revised and, if possible, separated into two laws, one concerning itself with general co-operatives other agricultural co-operatives, and the other one with agricultural co-operatives only. Actually, this Co-operative Society Law of Thailand is now under revision by the Government but has not yet been promulgated.

(i) Self help among Farmers.

"Self-help through mutual help" is inherent in the Japanese farmers' organizations, namely water users' associations and agricultural co-operatives. By understanding this, each member realizes that if individual benefit is to be achieved, one must co-operate. At the Yoshida water users' association in Miki City, it was learned that there had been several floods in former times and some damaged the village tank; the people organized themselves to rebuild their tank on their own initiative and without the government's help. That is why the tank still remains. In some drought years, they must convene meetings to set a priority of limited use of cultivated land, despite private land ownership. Sometimes, cost sharing for public works in their village have been practised. Of all the co-operative principles universally accepted, the principle of "self-help through mutual help" is the most difficult to comprehend and even harder to put into practice.

The Government of Japan has been paying much attention to the agricultural sector, especially since the Second World War. The nationwide land reform project was completed within a year in 1949 by the order of the American Occupation Army. Then, land consolidation projects were undertaken by the Japanese Government throughout the country except in Kyoto, which started the project in 1980 on an extensive scale. The land consolidation project is the most important factor in making the irrigation project must more efficient; that is to say, to supply the same amount of water, more benefit areas are gained since the ownership of cultivated land is re-arranged properly to suit the set-up of the irrigation system. Unfortunately the Thai Government has been very unstable during the last 49 years (1932-1981) and, as a consequence, the rural development was for a long time neglected. However, the present situation is forcing the Thai Government to pay much more attention to the rural economy. But this policy is subject to doubt because its bureaucracy is now already uncontrollable and there is too much interference by many influential third parties, either secretly or publicly. This embarrassing situation must first be overcome or else the rural development projects will only be a fantasy.

(ii) The Japanese Experience.

On the whole, the Japanese experience in rural development should be adopted, with some reservations because the agricultural development in Japan and that of Thailand are more or less similar in many aspects. The main differences are as follows:

Japanese agriculture is aimed at self-sufficiency, while the Thai

agriculture is aimed at foreign exchange earnings. This difference of policies reflects different implications. The Japanese Government is in a better position to control farm prices; it can go as far as farm-price guarantees resulting in a stable supply since World War II. As regards Thailand, farm supplies are subject to price fluctuations and become a very sensitive issue putting all political groups or parties in an embarrassing situation. In the first place, if farmers are paid more, the farm prices will automatically rise and, as a consequence, exports will be reduced, while at the same time, general domestic consumers will cry out to the Government against high prices through various kinds of mass media. As an alternative, if farmers are paid less a rural disaster will occur widening the income gap between the urban rich and the rural poor. The Thai Government must of course be decisive in the ranking of important policies and be determined to execute them accordingly.

In Japan, industrialization and urbanization have speeded up the country's development. As a consequence, the employment opportunities in industrial and service sectors are much greater for rural people. Since an average landholding per farm household was only 1.2 hectares in 1977, or even as low as 0.98 hectare in 1960, the small amount of agricultural income accounting for only 37 % of household expenses in 1977, or 61 % in 1960, justified the increase of part-time farmers for Japan. Usually the young ones in the families go out and look for urban jobs, and housewives and the aged normally stay home. This was proved correct when some villages were visited in the Toban area of Hyogo Prefecture of Japan. Owing to the above reason, whole families can join in with the farming together only for a short period of time, particularly at weekends. This consequently justifies the intensive use of machines on their farms. The situation in Thailand is very different. Urbanization and industrialization is concentrated only in Bangkok and the surrounding provinces. Therefore rural people must move to Bangkok for extra income during off-season periods and become cheap labour, easily exploited by townsmen. Because the daily wage in Thailand is very low for unskilled workers, the rural people sometimes cannot even earn enough for their own living. In this case, which is quite common, part-time farmers in Thailand are not able to increase household income sufficiently. This is undoubtedly different from the Japanese case.

With regard to the irrigation system, the paddy fields are all irrigated in Japan while in Thailand only 20 % of arable land is irrigated and the rest is subject to rain. Water supply has been managed economically because

Japan has developed hundreds of water users associations since more than 100 years ago. The members of the associations regularly join together for maintaining and improving the irrigation system in their own villages. In Thailand, water users' associations are not as efficient as those in Japan. Therefore the water supply has been used uneconomically despite the water shortages in some years. It is a move in the right direction that the Thai Government will from now on improve the efficiency of water users' associations by establishing water users' groups in order to be able to have an effective water charge for water users for production purposes. The water users' groups are not at all in conflict with the associations since each association will from now on be divided into many groups. For example in the Subpradu Association in Korat it has been divided into 86 groups. Therefore it can be seen that each group is very small indeed (5-6 members) and every group will be under the administration of the Subpradu Water Users' Association. If water is charged for, farmers will have to use water more economically.

It was fortunate for Japan to have successfully completed the land reform project within a very short period of time in 1949. It was in fact a very opportune moment to start this difficult task immediately after the end of the Second World War since, by that time, the old landlords must have been so alarmed that any land-price offered was presumably acceptable to them. In other words, probably there were very few land-price conflicts between the old feudal lords and the Government. Had the land reform not been carried out successfully after the Second World War, Japanese agriculture would not have been so advanced as today. It was, on the contrary, very unfortunate that Thailand was not able to do the same thing. At present any proposal concerning land reform is very embarrassing for the political groups to decide because they might lose their support among the upper classes. Actually there is now a state law on land reform, but only a very small budget is annually allocated to the Land Reform Office. This would seem to be a very important factor in starting the development of agriculture effectively.

The impression is that the Japanese Government and Japanese bureaucracy are very active and well-prepared for rural development projects. It can be concluded that when there is an irrigation project, like that in the Toban area, they will prepare and plan for other related activities such as the unification of the water users' associations in the benefit area. This is quite remarkable. It is to be presumed that all rural development activities can be coordinated only when the Government and bureaucracy are working as

one organization. It is, therefore, harder to adopt this Japanese experience in Thailand.

7-6 A comparison of rural development between the Toban area and North-east Thailand.

Perhaps the most significant aspect in the agricultural development experience in Japan, relevant to Thailand today, is the way in which agricultural technology was developed in a manner consistent with the resources, and endowments of the economy.

Encountered by the limited amount of arable land, Japanese agricultural growth was brought about primarily by the increase in land productivity through innovations in land-saving technology. The core of the land-saving innovations was primarily the progress of biological technology represented by seed improvement which increased the yield response to a higher level of fertilization. The biological advancement, complemented by improvement in the land infrastructure (especially irrigation and drainage facilities), has permitted the rapid growth in agricultural output in spite of severe constraints on the supply of land.

Thailand, which is already facing population pressure on the land, has the rather high rate of population growth of 2.5 percent per annum. If this rate is sustained, the population pressure in the rural sector will lead to further deterioration in the land/population ratio.

Considering the trends in relative resource endowments in Thailand, the Japanese experience in overcoming land constraint by developing land-saving technology is highly relevant. Indeed, the Japanese development in land infrastructure and seed-fertilizer technology should be considered a forerunner of the "green revolution" in Thailand and other Asian countries.

It is interesting to note that there is a sharp contrast in the pattern of agricultural growth in Japan and the United States. In the United States it was primarily the progress of mechanization which facilitated the expansion of agricultural production and productivity by increasing the area operated per worker. Thus, the pattern of agricultural growth in the United States is less relevant to Thailand mainly due to the difference in factor endowment between the two countries. In fact the relatively poor growth performance of Thai agriculture is accounted for by the incapability of increasing production per unit of cultivated land area.

(i) The Toban Experience Relevant to Northeast Thailand

The Toban area has recently experienced remarkable progress in industrialization and urbanization which has had a strong influence on the agricultural sector. The increasing demand for land for non-agricultural use has forced land out of agricultural areas resulting in price hikes on the ever shrinking land area remaining in the agricultural sector.

In this situation further growth in agricultural output could not be possible without introducing land-saving and yield-increasing technology. To introduce technology of this kind, the farmers in the Toban area have resorted to developing the agricultural infrastructure in irrigation and water control.

Nowadays about one-fifth of the total arable area is taken up by small reservoirs. These reservoirs were largely constructed and maintained by local farmers who organized themselves into water user associations. The history of development and the scale of operation of the present day water user associations in the Toban area is very impressive. The associations assume complete control of water distribution, determine water rights, collect water charges, maintain water distribution systems, settle disputes over water usage, and so on.

As a result, the low precipitation area of Toban has been converted into a area of fertile soil suitable for intensive agricultural production.

The conditions for the successful development in land-saving technology in the Toban area can be identified as the relatively well-developed irrigation systems and the agrarian institutions consistent with such technology.

Until recent decades, the agriculture of North-east Thailand was characterized by an elastic supply of land. Growth in production was achieved at relatively little cost by expanding the cultivation frontier. However, this route to agricultural growth became increasingly costly as the remaining land resources were exploited, and the population continued to accumulate in the rural sector as the increase in urban non-farming employment failed to keep up with the annual population growth rate of over three percent. As the population has increased, the arable land has become limited and the lack of cultivated land has become serious. The period of gaining increased production through exploitation of new land is at an end. The test is now to increase productivity on the land under cultivation. Developing land-saving technology that is designed to overcome the constraints of land resources on agricultural production is relevant to North-east Thailand.

Investment in irrigation infrastructure is essential as it is a prerequisite for the diffusion of the seed-fertilizer technology of the land-saving type.

The Toban experience suggests a general potentiality for irrigation development in North-east Thailand which has a comparable topography and similar quantity of rainfall. Moreover, irrigation development in North-east Thailand is a timely subject as it is a popular issue in and political circles.

With respect to the promotion of rural institutions, it appears that North-east Thailand benefits from the land tenure situation as being characterized by small-scale owner operators. There is a negligible percentage of tenant farmers and absentee landlords. The relatively equal land distribution among owner operators is a prerequisite for healthy rural institution development.

(ii) Technology Transfer

There are exists a huge technology gap between the developed and the less developed regions of the world. By closing this gap the backward areas should be able to attain a high rate of growth in agricultural output and productivity.

However, the technology transfer requires tremendous effort in the adaptation and assimilation process. Until the rural people are ready to organize themselves to handle adequately such activities, the government will have to mobilize development funds and administrative capacity for this purpose. As agriculture in North-east Thailand is in the early stages of development, the government will have to take the initiative for technology transfer and see to it that farmers benefit from it.

Moreover, technology transfer usually introduces the problem of adjustment of rural institutions in response to technological change. The adjustment of rural institutions usually involves a substantial time lag. If the change in technology is too rapid, there is a danger that the conflict between agricultural technology and rural institutions might generate serious social tension which can develop into political instability.

In this respect, it appears that the Toban area benefitted from the gradual adjustments in rural institutions over a long span of time in response to the very gradual progress in agricultural technology. The direction of technical progress in modern agriculture in Toban is essentially the extension of progress achieved in the past. Consequently, the recent

acceleration in technical progress and productivity growth in agriculture in the Toban area did not require drastic changes in agrarian structure and rural institutions.

North-east Thailand is experiencing an entirely different situation. The pattern of agricultural growth in North-east Thailand has been the expansion of cultivation frontiers as discussed earlier. The society of North-east Thailand is not accustomed to adjusting to such changes in land-saving technology. The adjustment process will not be as smooth.

8. THE IMPORTANCE OF THE INTRODUCTION OF THE TOBAN MODEL EXPERIMENTAL
VILLAGE TO NORTH-EAST THAILAND.

8-1 Poor village development from the standpoint of integrated group scale rural development.

As defined in chapter 1, the measures for integrated small-scale rural development should be adopted for the development of poor or poorer villages in North-east Thailand. Concerning the scale of poor rural development the village (small) scale is too large, but the group scale is suitable scale.

The practical model for integrated group scale rural development can be seen in the first stage development period in the Toban district in Japan.

The expected effect of the introduction of the Toban model in poorer villages in North-east Thailand is shown as follows:

- a. Irrigation water can be stored in their own paddy fields getting the water from the same farmer's rain-fed paddy field. To store the water in group scale reservoirs, waste water from paddy fields and ground water can be collected.
- b. One farmers' group project can be set up.
- c. The animal-drawn machine to dig small reservoir.
- d. Concerning minor earth works, for example, construction of ditches, etc. these can be carried out by farmers' group it using primitive tools provided.
- e. The group scale reservoir can be used for various purposes.

The idea above mentioned has not existed in North-east Thailand, but the introduction of this idea would be most important for rural development at the poor level.

8-2 The importance of the establishment of the "group irrigation project" in Thailand.

So far irrigation projects in Thailand are classified by the Government as follows:

- a. Large scale irrigation project.
- b. Middle scale irrigation project.
- c. Small scale irrigation project.

The total amount of construction cost from water resource facilities to small canals is completely paid by the Government. This reports definition on "group scale irrigation project" is as follows:

- a. Group reservoir is dig by the Government.
- b. Ditch construction by farmers' group.
- c. Operation and maintenance by farms' group.

For the group scale irrigation project the group reservoir and ditches and water utilization rights belong to the farmers themselves.

If this "group scale irrigation project" is introduced to the political system of Thai Government steady rural development in North-east Thailand can be expected in the future.

The idea would be confirmed through the study of the "Toban model experimental village" this year.

8-3 Survey on poorer villages in North-east Thailand.

(1) The measures by the Thai Government.

There are several measures which are adopted by the Thai Government, as follows:

- (i) Irrigation development.
 - a. Large scale irrigation project.
 - b. Middle scale irrigation project.
 - c. Small scale irrigation project (max 2,000,000 ฿).
- (ii) Community development.
 - a. Credit union
 - b. Rice bank.
 - c. Domestic tank.
 - d. Road construction

(iii) Farmers' organizations.

a. Water users' associations.

b. Agricultural co-operatives.

c. Farmers' groups.

Also there are 5 levels for expression of poorness: best, good, middle, poor and poorest. According to these classifications, the villages at the best, good and middle levels would be suitable for the adoption of measures above-mentioned. Then a consideration of which measures to apply to villages, at the poor and poorest levels becomes the most important research problem for the research team.

After two years research, the solutions are as follows:

a. The number one priority to develop the poor and poorest village is to introduce new water resources so that farmland can survive drought disasters.

b. The development unit for integrated rural development should be smaller than the scale of the small irrigation project defined by the RID as the smallest development unit by the government.

c. For integrated rural development of poor villages in North-east Thailand, the introduction of the Toban model group scale irrigation project should be studied.

d. The effectiveness of the Toban model for the development of poor villages should be checked through the "Toban Model Experimental village" in an actual poor village in North-east Thailand.

(2) Discussions with the villagers.

The team also conducted a preliminary survey on the selection of a site for construction of one family pond for experimental purposes. This idea of digging a family pond will be one of the water harvesting techniques that may be applied to rural development in the rain-fed area. The complete utilization of seasonal rain water can be expected in such a development. It may be stated that this is a likely application of one of the Toban Models in North-east Thailand. The success of such an application relies on several relevant factors which are to be carefully studied during the experiment.

The experiment will aim at digging a small farm pond on each individual farmland owned by one family. The pond should have sufficient capacity to supplement the prolonged shortage of rainfall during the growing season. The matter has been discussed with the engineering members of the Research Team on several occasions concerning the possibility of forming a farmers' group for construction of the pond by mutual exchange of labour.

After long discussion, in summary, the farmers agreed with the idea and they believed that such a measure will help improve the rice cultivation. To dig ponds by exchange of labour has the distinct disadvantage regarding construction time in that it will take a very long time to complete a large number of ponds if the number in the family is large. The last family pond may not be completed until several years later. The family who gets the first pond will have a much greater advantage over the one whose pond is constructed last. For this reason it seems that the mutual exchange of labour is a subject of disagreement. The problem can easily be solved if hired labour is applied. However, payment for pond construction by hired labour is beyond the ability of any family. The question needs additional detailed consideration on several points before actual implementation can be made.

From the detailed surveys and interviews made with the villagers of different villages in different provinces and on various occasions during the field trips in this fiscal year it was found that the rural development at village level has been carried out with considerable degree of progress. The most developed village is usually the one which received a large amount of financial input from outside sources. It requires also technical assistance to be conducted concurrently in the development programme. Without financial support the progress is rather slow and the family income of the villagers is only slowly improved. The geographical setting of the village is another important factor that delays the progress of rural development as there may not be a suitable site for a water development project which is one of the primary requirements.

(3) Poor villages in Khon Kaen Province.

There are several poor villages convenient for the experiment on the adoption of the Toban Model of rural development in which an irrigation tank is dug using villagers mutual co-operation.

(a) First village.

The first candidate for the experimental village is located 30 km from

Khon Kaen city. There are 50 households. The village is completely in a rain-fed area, but the number of family is too large for the experiment.

(b) Second village.

The location of this village is 35 km from Khon Kaen city. There are only 22 households. The village headman and his 2 assistants are very good, and they are very co-operative with regard to the experimental village performance, so it was decided that the village should be the experimental village on the Toban Model.

1. Name of the Toban Model experimental village
Ban
2. Number of families: 22
(30 years ago: 50 families)
3. History of village
100 years old.
4. Headman : one
Assistant: two
5. Total area of rain-fed paddy fields
50 ha
6. Distribution of each section of paddy
field: 0.5 rai, they are not clustered in a group.
7. Paddy field:
entirely rain-fed.
8. Income
best : 10,000 ฿/year.
other: 10,000 ฿ ~ 2,000 ฿.

8-4 The idea of the Toban Model experimental village.

In order to upgrade the potential of farmers' living situation in poor villages, the Toban farmers' experiences are very useful for adoption by the North-east Thailand rural people.

In the Toban irrigation project there are 5,000 tanks in the benefit area of 10,000 ha. Most of the benefit area consists of paddy fields.

Several farmers' families are operating one group scale reservoir by themselves. Also these tanks were constructed by a farmers' group more than 100 years before. They were able to dig the small canal and ditches for their own paddy fields by themselves.

The introduction of the Toban Model into the pioneer experimental village at the poor level in North-east Thailand is as follows:

(i) The development of a group scale reservoir.

To develop family level agriculture from the standpoint of integrated small scale rural development the following measures can be adopted.

- a. The families in the experimental village should be rain-fed paddy rice farmers.
- b. Each family or family group will have at least one group scale reservoir (tank).
- c. Each tank should have the capacity to irrigate their own paddy fields when a drought occurs in the rainy season as a result of no rainfall. The tank can store ground water also.
- d. Farmers can do intensive agriculture when they have a tank.
- e. Farmers can use the tank for the various purposes: for example, paddy rice irrigation, upland crop irrigation, fishery, duck raising and buffalo raising.
- f. Farmers can use their higher land which is constructed from the soil excavated from the tank for fruit and vegetable production for the improvement of farmers' health.
- g. From the standpoint of cost estimation for all the villagers, sometimes, the total construction cost for all the tanks for all the farmers is cheaper than the cost of one village scale project (a small scale irrigation project by the Thai Government)
- h. Farmers can get stable agricultural production in drought years.
- i. The total agricultural production will be raised steadily.

(ii) Researchers of the Toban Model.

a. Leader Kiyoshi Torii

b. Members Kyoto University:

Isao Minami

Masayoshi Miyoshi

Kiyoshi Kamegai

Yoshishige Furukawa

Royal Irrigation Department:

Damrong Jaraswathana

Prasert Milintangul

c. Criteria of the Toban Model.

A Sociological model.

i Farmer sets up one group

ii One representative of group

iii Mutual help for construction work of irrigation
ditch and tank

B Technical model.

i Family or families have one tank

ii The tank is construct by farmers' mutual co-operation
(or by another agency).

iii Farmer or farmers' group construct various ditches for
irrigation and drainage.

C Budget support.

a) One Bulldozer can be provided (or tank can be roughly dug
by another agency)

b) Many primitive earth working tools can be provided.

D Present agricultural situation.

i Rainfed paddy field.

ii Not far from research sites (No. 1 ~ No. 4)

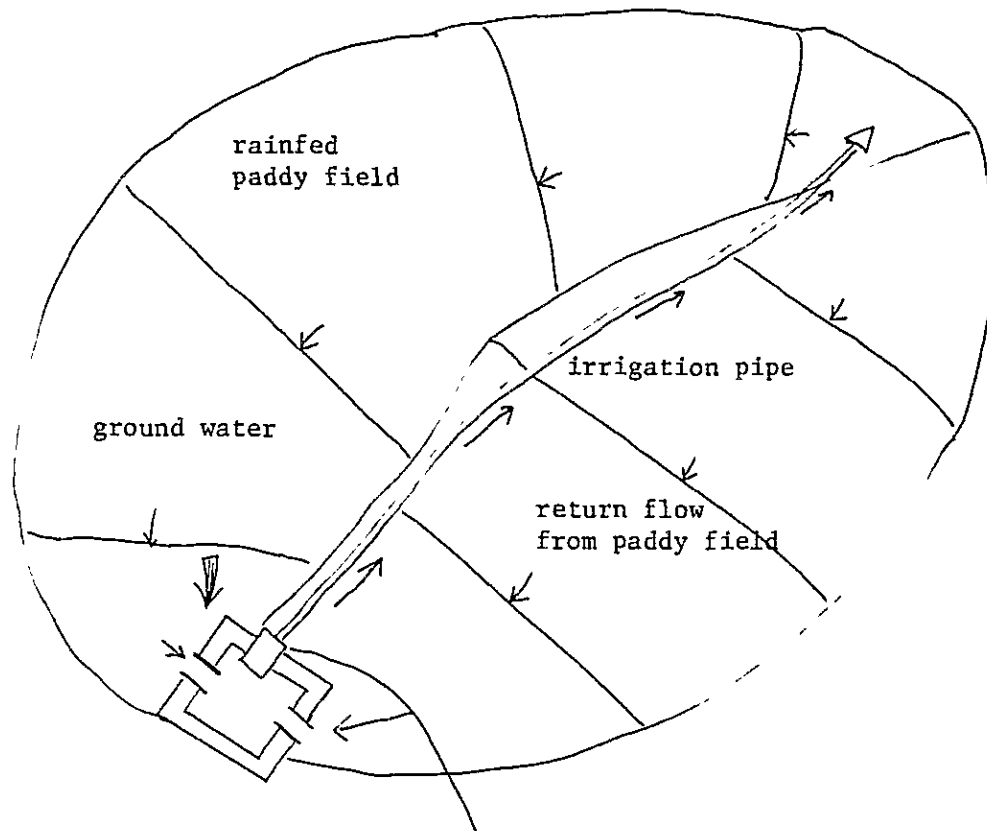
E Village

i Poor village or poorer village.

ii Number of villagers less than 20 households.

(iii) Structure and plan of tank

Fig. 37



Unplanned for fruit
and vegetable

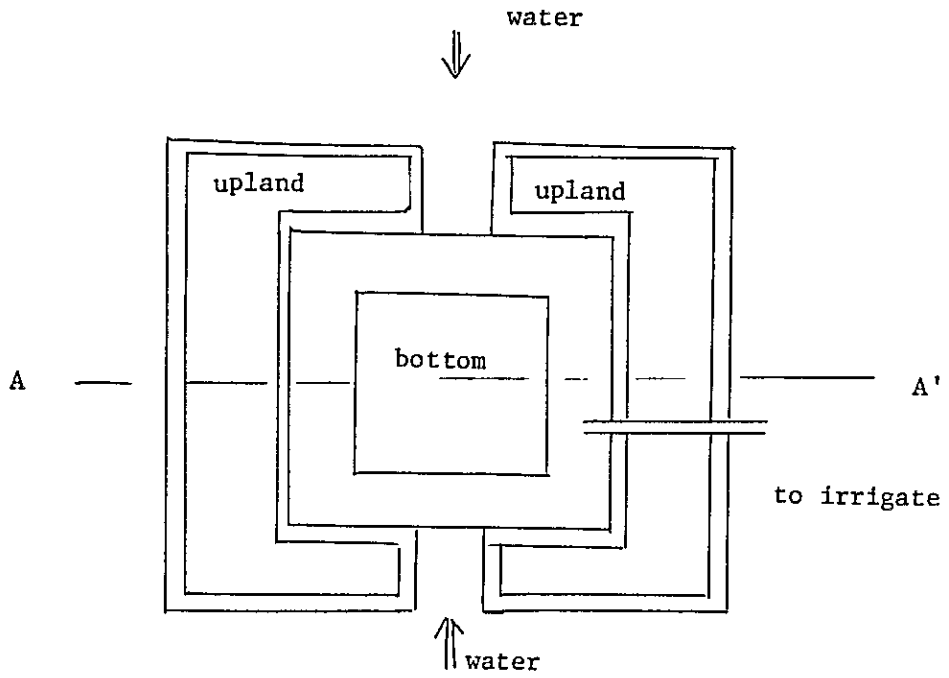
tank

lift of water to irrigate

open to get drain water from own paddy
field

- 1 Type A: storage of return flow from paddy field.
- 2 Type B: storage of return flow plus ground water.
- 3 Type C: has additional inflow from other person's paddy fields.
- 4 Type D: has additional inflow from river through connection canals.

plan of tank



A - A' section

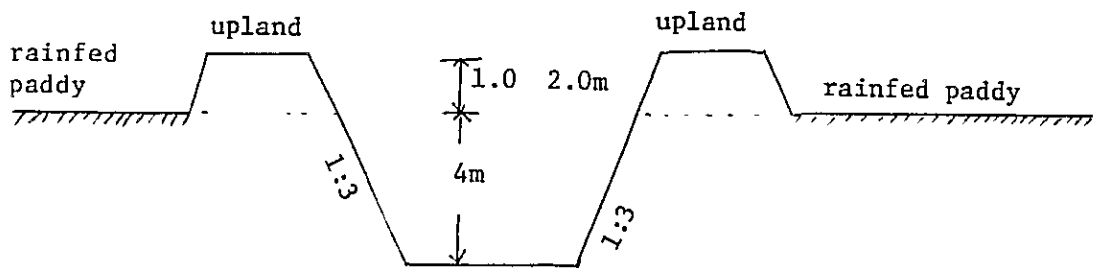


Fig. 38

9. MISCELLANEOUS

(1)

MEMORANDUM
BETWEEN THE JAPANESE CONSULTATION TEAM
FACULTY OF ECONOMICS,
AND THE CHULALONGKORN UNIVERSITY OF THAILAND
ON THE JOINT STUDY PROJECT
FOR INTEGRATED SMALL-SCALE RURAL DEVELOPMENT IN NORTH-EAST THAILAND.

With reference to the "Summary Record of Discussion Between the Thai and Japanese Delegations on Technical Cooperation", signed in Bangkok on May 16, 1980, the Japanese Consultation Team (hereinafter referred to as "the Toban") organized by the Japan International Co-operation Agency (hereinafter referred to as "JICA") and headed by Dr. Isao Minami, Professor at the Faculty of Agriculture, Kyoto University, visited Thailand from July 1, 1980 to July 8, 1980 for the purpose of working out the details of the technical co-operation concerning the joint study project for Integrated Small-scale Rural Development in Northeast Thailand (hereinafter referred to as "the Project").

During its stay in Thailand, the Team exchanged views and had a series of discussions with the members of the Chulalongkorn University, headed by Dr. Chatthip Nartsupha, Dean of the Faculty of Economics, Chulalongkorn University, and the members of the Royal Irrigation Department of Thailand, represented by Mr. Damrong Jaraswathana, Director of the Hydrology Division, Royal Irrigation Department, on the theme, objectives, study framework, schedule and the other items of the Project.

As a result of the discussions, both parties have jointly formulated "The Outline of the Joint Study Project for Integrated Small-scale Rural Development in North-east Thailand", which is attached hereto.

Bangkok, July 7, 1980

Isao Minami
Leader, Japanese Consultation Team
Japan International Co-operation Agency

Chatthip Nartsupha
Dean, Faculty of Economics,
Chulalongkorn University

IV. STUDY FRAMEWORK.

1. Scope of Study.

The Project will cover the following study items:

- 1) To analyze the development process of the Toban area in Japan and construct the Toban Model.
- 2) To review and analyze the rural development activities implemented in North-east Thailand.
- 3) To identify the similarities and differences in the factors involved in the Toban Model and the cases of North-east Thailand.
- 4) To analyze the critical factors and their linkages inherent in the cases of North-east Thailand in the light of the relationship between the water use/control patterns and farmers' co-operatives.
- 5) To develop the appropriate models for planning and implementing integrated small-scale development in North-east Thailand.
- 6) To propose the model programs for integrated rural development on a small scale in North-east Thailand.

2. Project Teams and Participating Organizations.

The Project will be implemented jointly by the Japanese Study Team and the Thai Study Team. The Japanese Study Team will consist of the members of JICA and the Faculty of Agriculture, Kyoto University. JICA is the executing organization of the Japanese Government for its technical co-operation with developing countries. The Faculty of Agriculture, Kyoto University, is the major source of Japanese experts.

The Thai Study Team will consist of the members of the Faculty of Economics of Chulalongkorn University, and the Royal Irrigation Department of Thailand. The Faculty of Economics, Chulalongkorn University, is the source of Thai experts and provides the office and other facilities necessary for the implementation of the Project. The Royal Irrigation Department is another source of Thai experts and provides the field facilities and relevant data and information available in the Department. Each team will consist of the following experts:

(1) The Japanese Study Team:

Team Leader

Co-ordinator

Experts in the field of:

General and Systematic Study of Agricultural Water Utilization

Agricultural Co-operatives

Agronomy (Crops, horticulture and livestock)

Irrigation

(2) The Thai Study Team:

Team Leader

Co-ordinator

Experts in the field of:

Agricultural Economics

Regional Economics and Co-operatives

Demographical Economics

Irrigation

Applied Hydrology

The role of the Team Leader and Co-ordinator will be concurrently undertaken by an expert in one of the above fields. As necessity arises, personnel not stipulated in the above will participate in the Project.

The Project implementation will involve the assignment of the Japanese experts in Thailand and the area study of the Thai experts in Japan. A tentative implementation schedule of these undertakings is shown below in section IX.

3. Project Phases

The implementation of the Project will be divided into three phases in accordance with the Japanese fiscal year.

(1) Phase 1 (from August, 1980 to March 31, 1981)

(2) Phase 2 (from April 1, 1981 to March 31, 1982)

(3) Phase 3 (from April 1, 1982 to March 31, 1983)

At the end of Phase 1 and Phase 2, the findings and results to date will be compiled in the Progress Reports. The Final Report present all the findings, results, proposals and recommendations at the end of Phase 3.

V. ADMINISTRATION OF THE PROJECT

The leader of the Japanese Study Team and the leader of the Thai Study Team will have joint overall responsibility for the implementation of the Project.

The Resident Representative of JICA in Bangkok, Thailand and the Dean of the Faculty of Economics, Chulalongkorn University will undertake the roles of advice and co-ordination for the successful implementation of the Project.

VI. EXPENSES OF THE PROJECT

Expenses for assignment of the Japanese experts in Thailand will be borne by the Government of Japan under the normal procedures of the Colombo Plan Technical Co-operation Scheme.

Expenses for area study of the Thai experts in Japan will be borne by the Government of Japan under the normal procedures of the Colombo Plan Technical Co-operation Scheme.

The budget to meet the local expenses necessary for the implementation of the Project will be provided to the Japanese Study Team by JICA in accordance with the laws and regulations in force in Japan. The budget to be provided by JICA for local expenses will exclude (1) housing allowance, (2) medical allowance, (3) import duties and local expenses for shipping of equipment and materials to be accompanied by the Japanese experts, (4) tax reimbursement for personal effects (including one vehicle) to be accompanied by a long-term assigned Japanese experts: all of these are to be provided by the Government of Thailand under the normal procedures of the Colombo Plan Technical Co-operation Scheme.

This budget, to be used exclusively for the implementation of the Project, will be managed by the leader of the Japanese Study Team (or the Japanese leader's designated representative) in consultation with the leader of the Thai Study Team (or the Thai leader's designated representative).

VII. DATA OWNERSHIP AND PUBLICATIONS

The data accumulated in the implementation of the Project will be jointly owned by the participating organizations (JICA, Kyoto University, Chulalongkorn University, and Royal Irrigation Department). When the reports are published and the findings, results and other information of the Project are presented in publication form, it is to be mentioned that the Project has been implemented by the participating organizations as a technical co-operation project on a Government-to-Government basis between

Japan and Thailand.

VIII. TENTATIVE NOMINATION OF EXPERTS TO BE ASSIGNED

The experts to be assigned to the Study Teams are tentatively nominated as follows.

1. Japanese Study Team:

(1) The Leader of the Japanese Team, concurrently with the Experts of General and Systematic Study of Agricultural Water Utilization:

Name: Isao MINAMI

Occupation: Professor, Faculty of Agriculture, Kyoto University.

(2) Agricultural Co-operatives:

Name: Masayoshi MIYOSHI and/or Kiyoshi KAMEGAI

Occupation: Professor, Faculty of Agriculture, Kyoto University.

(3) Agronomy (crops):

Name: Eiichi TAKAHASHI

Occupation: Professor, Faculty of Agriculture, Kyoto University.

(4) Irrigation, concurrently with the Co-ordinator:

Name: Kiyoshi TORII

Occupation: Assistant Professor, Faculty of Agriculture,
Kyoto University.

2. Thai Study Team:

(1) The Leader of the Thai Team, concurrently with the Expert of Agricultural Economics:

Name: Vivat SHOTELERSUK

Occupation: Assistant Professor, Faculty of Economics, Chulalongkorn
University.

(2) Regional Economics and Cooperatives:

Name: Prapant SVETANANT

Occupation: Associate Professor, Faculty of Economics, Chulalongkorn
University.

(3) Demographical Economics:

Names: Kieatviboon CHOMKHAIR

Occupation: Senior Lecturer, Faculty of Economics, Chulalongkorn University.

(4) Irrigation, Concurrently with the Co-ordinator:

Name: Damrong JARASWATHANA

Occupation: Director of Hydrology Division, Royal Irrigation Department.

(5) Applied Hydrology:

Name: Prasert MILINTANGUL

Occupation: Head of Research and Applied Hydrology Section, Royal Irrigation Department.

This tentative nomination of experts is subject to change in accordance with approval to be given by both Governments and with the progress of the implementation of the Project. As necessity arises, other personnel will participate in the Project.

IX. TENTATIVE IMPLEMENTATION SCHEDULE

A tentative implementation schedule is appended herewith. This tentative implementation schedule is subject to change in accordance with the approval to be given by both Governments and with the progress of the implementation of the Project.

Annex

Tentative Implementation Schedule (Assignment of Japanese Experts in Thailand and Study by Thai Experts in Japan)

Items	Year	Phase 1 - March 1981)	Phase 2 (April 1981-March 1982)	Phase 3 (April 1982-March 1983)
<u>Assignment of Japanese Experts in Thailand</u>				
(1) Team Leader (General & systematic Study of Agricultural Water Utilization)		1M Aug.	1M Aug.	1M Mar.
(2) Agricultural Co-operatives		1M Mar.	1M Mar.	1M Mar.
(3) Agronomy (crops)		1M	1M	1M
(4) Agronomy (Horticulture or Livestock)		1M	1M	1M
(5) Irrigation (Co-ordinator)		1M	12M	12M
		5M Nov.		
<u>Area Study by Thai Experts in Japan</u>				
(1) Team Leader (Agricultural Economics)		1.5M Sept.-Oct.		
(2) Regional Economics and Co-operatives		1.5M	1.5M Sept.-Oct.	
(3) Irrigation				
(4) Demographical Economics				
(5) Applied Hydrology		1.5M	1.5M	

Note: This Tentative Implementation Schedule is subject to change in accordance with the approval to be given by both Governments and with the progress of the implementation of the Project. Due to the single year budget system of the Government of Japan, this Tentative Implementation Schedule is subject to the allocation of the necessary budget to be made by the Government of Japan on an annual basis.

ATTENDANT LIST

- (1) Meeting held at the Faculty of Economics, Chulalongkorn University, on July 3, 1980.

The Japanese Consultation Team:

- (1) The Leader: Prof. Isao MINAMI
- (2) Co-ordinator: Mr. Takeshi NAKANO

The Thai Team:

- (1) The Dean, Faculty of Economics, Chulalongkorn University:
Dr. Chatthip NARTSUPHA
- (2) The Leader: Dr. Vivat SHOTELESUK
- (3) Co-ordinator: Mr. Damrong JARASURATHANA
- (4) Member: Mr. Prapant SVETANANT
- (5) Member: Mr. Kieatviboon CHOMKHAIR
- (6) Member: Mr. Prasert MILINTANGUL

- (2) Meeting held at the Department of Technical and Economic Co-operation, on July 4, 1980.

The Japanese Side:

- (1) The Leader of the Japanese Consultation Team:
Prof. Isao MINAMI
- (2) The Co-ordinator of the Japanese Consultation Team:
Mr. Takeshi NAKANO
- (3) The Senior Official of JICA Bangkok Office:
Mr. Takashi KANEKO

The Thai Side:

- (1) The Leader of the Thai Study Team:
Dr. Vivat SHOTELERSUK
- (2) The Co-ordinator of the Thai Study Team:
Mr. Damrong JARASURATHANA
- (3) The Member of the Thai Study Team:
Mr. Prapant SVETANANT

DTEC:

- (1) Mr. Pracha CHAOWASILP (Director of Colombo Plan Sub-Division, Division II of External Co-operation, DTEC)
- (2) Mr. Sutin SUSILA (Desk, Colombo Plan Sub-Division, Division II of External Co-operation, DTEC)

1. Tentative List of Equipment & Materials of the Co-operation Research Team Experts

Items	Unit	Date of Arrival	Remarks
1. Vehicle (microbus)	1	Nov., 1980	C.U.
2. Automatic Record Paper Reader	1	Apr., 1981	C.U.
3. Electric Typewrite	1	Nov., 1980	C.U.
4. Portable Copy Machine	1	Nov., 1980	C.U.
5. Small Electric Generator	1	Nov., 1980	C.U.
6. Radiation Meter	1	Nov., 1980	RID
7. Temperature & Humidity Meter	1	Nov., 1980	RID
8. Precipitation & Evaporation Meter	1	Nov., 1980	RID
9. Wind Velocity Meter	1	Nov., 1980	RID
10. Automatic Elevation Meter	5	Nov., 1980 & Apr., 1981	RID
11. Depth Meter of Paddy Field	4	Nov., 1980	RID
12. Autobicycle	2	Nov., 1980 & Apr., 1981	RID
13. Current Meter	1	Nov., 1980	RID
14. Portable Calculator	2	Nov., 1980	RID

2. Tentative List of Equipment to be Brought Into and Out of Thailand by the Japanese Experts (This equipment below will be sent back to Japan after the completion of the Project.)

Items	Unit	Date of Arrival	Remarks
1. Small Computer	1	Nov., 1980	C.U.
2. Water Quality Meter	3	Aug., 1980 & Mar., 1981	C.U.
3. Automatic Water Elevation Meter	10	Aug., 1980 & Mar., 1981	C.U.

3. Tentative Budget

(August, 1980-March 31, 1981)

(all in Baht)

Budget Items	Socio/Econ	Engineering	Total
1. Equipment and Materials	20,000	117,300	137,300
2. Stationery	17,000	-	17,000
3. In-city Transportation	7,000	-	7,000
4. Out of city Travel	132,600 *	-	132,600
5. Communication	5,000	-	5,000
6. Report Preparation	80,600	-	80,600
7. Labour	132,000	129,000	261,000
8. Miscellaneous	20,720	-	20,720
9 Total	414,920	246,300	661,220

Note: Accommodation & meals for a Thai Expert: ¥ 300 a day

JICA