ANNEX H PROJECT IMPLEMENTATION

ANNEX H. PROJECT IMPLEMENTATION

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Fig. H-1-1 WORK SCHEDULE FOR DETAILED DESIGN WORK

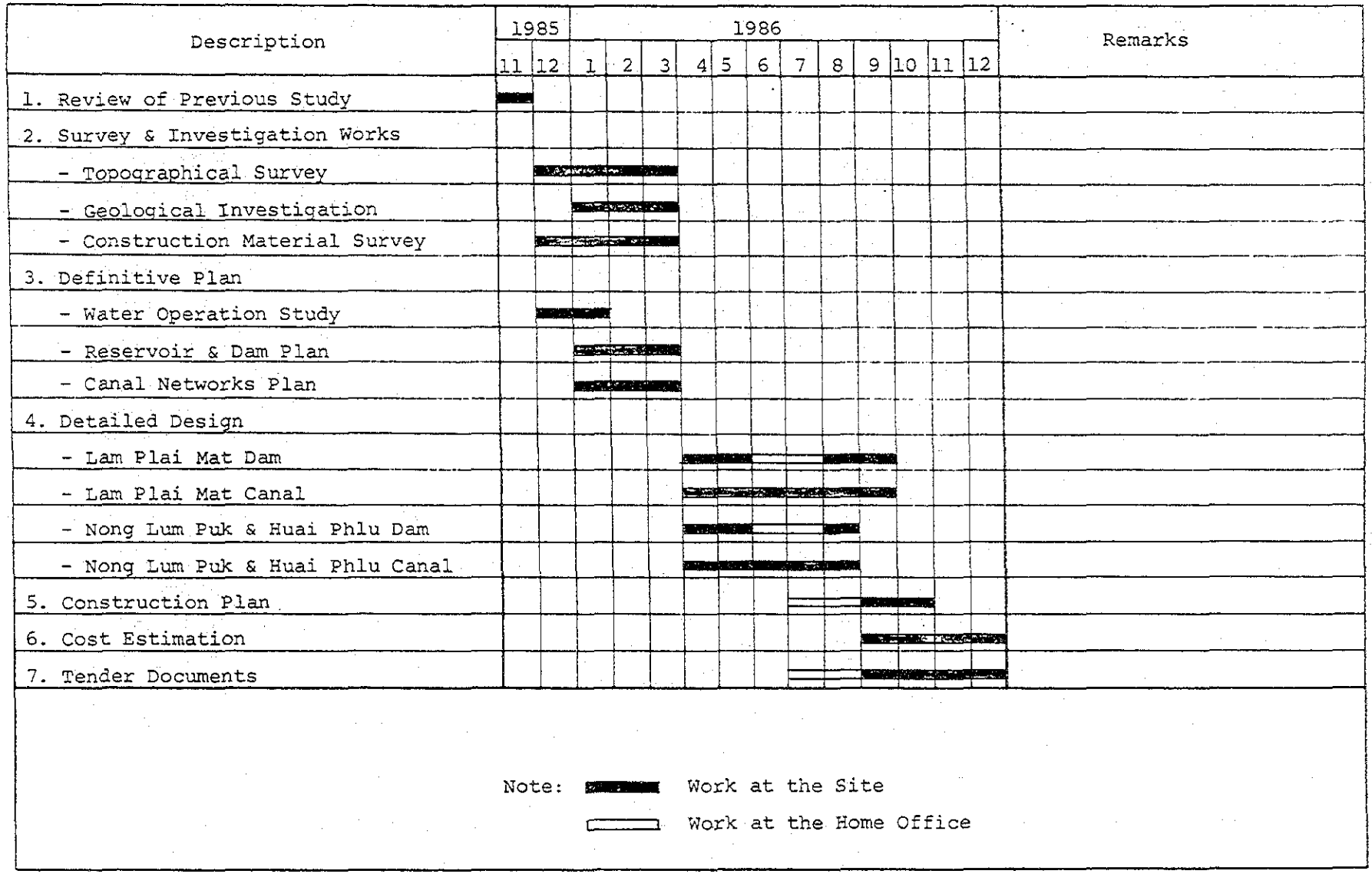

Fig. H-1-2 MANNING SCHEDULE FOR DETAILED DESIGN

Engineering Staff		Man - Month				1985		1986												Number of Trip
		Foreign		Local	Total	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
		Site	Home																	
Team Leader	(F)	12	2	-	14															2
Hydrogist	(F)	3	-	-	3															1
Engineering Geologist	(F)	4	-	-	4															1
- ditto -	(L)	-	-	4	4															-
Soil Mechanist	(F)	5	-	-	5															1
Irrigation Engineer	(F)	6	-	-	6															1
- ditto -	(L)	-	-	6	6															-
Design Eng. Dam, 2 persons	(F)	16	4	-	20															4
- ditto -	(L)	-	-	10	10															-
Design Eng. Diversion	(F)	8	2	-	10															2
Design Eng. Canal, 2 persons	(F)	20	-	-	20															2
- ditto - 5 persons	(L)	-	-	50	50															-
Construction Planner	(F)	2	2	-	4															1
Cost Estimator	(F)	4	-	-	4															1
Specification	(F)	4	2	-	6															1
Tender Documents	(F)	4	-	-	4															1
Total		88	12	70	170															18

F : Foreign

L : Local

Note : Work at the Site

Work at the Home Office

Fig. H-1-3 MANNING SCHEDULE FOR SUPERVISION

Engineering Staff		Man - Month			1987						1988						1989						1990						1991						Number of Trip
		Foreign	Local	Total	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	
Civil Engineer for Tendering	(F)	6	-	6																															1
Resident Eng. for Supervise	(F)	42	-	42																															3
Supervisor for Dam	(F)	34	-	34																															3
- ditto -	(L)	-	30	30																															-
Supervisor for Canal	(F)	34	-	34																															3
- ditto - 2 persons	(L)	-	68	68																															-
Laboratory Engineer	(L)	-	30	30																															-
Total		116	128	244																															10

F : Foreign

L : Local

Table H-1-1 OPERATION AND MAINTENANCE COST

(฿ '000)

Description	Lam Plai Mat	Nong Lum Puk	Huai Phlu
1. Equipment Purchasing Cost	14,260	-	-
2. Annual Operation and Maintenance Cost			
i) Salaries and Wages	3,043	131	178
ii) Fuel & Repair for Equipment	2,636	87	203
iii) Material Supplies 1/	2,693	163	301
iv) General Expenditure 2/	251	11	20
Total	8,623	392	702

Note : 1/ Civil Cost x 0.005 (0.5 %)

Lam Plai Mat 538,539 x 0.005 = 2,693

Nong Lum Puk 32,570 x 0.005 = 163

Huai Phlu 60,270 x 0.005 = 301

2/ [i) + ii) + iii)] x 0.03 (3.0 %)

Table H-1-2 SALARIES AND WAGES FOR O/M

(฿ '000)

Description	No. of Personnel	Salary per Annum	Total Salary per Annum
1. Lam Plai Mat			
System Superintendent	1	60	60
Water Master	2	45	90
Zoneman	6	36	216
Gate Tender	45	33	1,485
Mechanic	1	36	36
Operator for Equipment	5	33	165
Driver	5	24	120
Electrician	1	33	33
Clerk	1	26	26
Administrative Officer	1	36	36
Accountant	1	36	36
Store Keeper	1	30	30
Typist	1	26	26
Janitor	1	18	18
Watchman	1	18	18
Casual Employees	90 x 120	(฿ 60/day)	648
Total			3,043
2. Hong Lum Puk			
Zoneman	1	36	36
Gate Tender	2	33	66
Casual Employees	4 x 120	(฿ 60/day)	29
Total			131
3. Huai Phlu			
Zoneman	1	36	36
Gate Tender	3	33	99
Casual Employees	6 x 120	(฿ 60/day)	43
Total			178

Table H-1-3 O/M EQUIPMENTS

(฿ '000)

Description	Q'ty	Unit Cost	Total Cost	Fuel & Repair	
				Fuel	Repair
Motor Grader, 125 HP	3	1,200	3,600	395	252
Loader Backhoe Combination	2	710	1,420	244	99
Flat Bed Truck, 4 ton	6	210	1,260	465	88
Pick-up Truck	6	200	1,200	158	84
Station Wagon, 4 x 4	3	450	1,350	103	95
Motor Bicycle, 125 cc	20	21	420	113	29
Diesel Generating Set, 15 KVA	2	100	200	82	12
Diesel Generating Set, 5 KVA	2	60	120	27	7
300 A-DC Arc Welder	2	180	360	7	25
Ø 4" Centrifugal Pump	3	85	255	15	18
Ø 3" Centrifugal Pump	3	70	210	15	15
Concrete Mixer, 7 cu.ft.	2	120	240	7	17
Air Compressor, 15 cfm	2	25	50	5	4
Air Compressor, 170 cfm	2	250	500	7	35
Back-fill Vibrating Tamper	6	19	114	5	7
Conc. Vibrator, 1/2"	5	21	105	3	6
Gas Welding & Cutting Outfit	2	16	32	7	2
Electric hand drill, 1/2"	2	71	142	-	7
Electric bench drill, 1/2"	2	141	282	-	20
Electric portable grinder	2	92	184	-	13
Electric bench grinder W/brush	2	260	520	-	36
Hydraulic jack, 10 ton	2	71	142	-	10
Hydraulic jack, 5 ton	2	47	94	-	5
Chain hoist, 5 ton	2	470	940	-	56
Hand toil set for field workshop	2	260	520	-	36
Total			14,260	1,658	978

* Fuel & Repair

- Nong Lum Puk (1,658 + 978) x 300/9,100 = 87
- Huai Phlu (1,658 + 978) x 700/9,100 = 203

ANNEX I PROJECT JUSTIFICATION

ANNEX I. PROJECT JUSTIFICATION

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1 PROJECT JUSTIFICATION

1.1, Price Analysis

Table 1-1-1 Farm-gate Prices of Agricultural Inputs and Outputs

Items		Unit	Financial	Economic
A. Inputs				
1. Seeds	a) Paddy (Without P.)	฿/kg	4.0	7.4
	b) Paddy (With P.)	"	5.5	10.1
	c) Groundnut	"	15.0	20.9
	d) Mungbean	"	13.0	13.0
	e) Tomato	"	1,800.0	1,800.0
	f) Baby Corn	"	10.0	10.0
	g) Shallot	"	8.0	8.0
	h) Chili	"	900.0	900.0
2. Fertilizer	a) 16-20-0	"	5.0	6.3
	b) 45-0-0	"	6.0	9.1
	c) 15-15-15	"	6.0	6.5
	d) 21-0-0	"	3.5	4.2
	e) 0-0-60	"	3.5	4.6
	f) Urea	"	6.0	9.3
	f) Lime	"	3.2	4.2
3. Labor		฿/man-day	30.0	20.0
4. Animals for land preparation		฿/day	113	113
B. Agricultural Outputs				
	a) Paddy (Photo sensitive)	฿/ton	2,670	4,925
	b) Paddy (Non-photo sensitive)	"	2,560	4,720
	c) Groundnut	"	5,150	7,180
	d) Mungbean	"	6,000	6,000
	e) Tomato	"	1,000	1,000
	f) Baby Corn	"	30,000	30,000
	g) Shallot (dry)	"	5,000	5,000
	h) Chili	"	8,500	8,500
C. Others	a) Freshwater Fish (WO)	฿/kg	25.5	24.0
	b) Freshwater Fish (W)	"	26.6	25.0

Table I-1-2 Economic Price of Paddy

Items	Unit	Economic Price
1) IBRD projection price in 1995 in 1981 constant price (5% broken white rice, FOB Bangkok)	US$/ton	418
2) Converted in 1983 constant price (x 1.102*1)	US$/ton	460
3) Converted to Thai Baht (US$ 1 = ฿ 23)	฿/ton	10,580
4) Average exported price*2	฿/ton	8,675
5) Shadow rate*3 of ฿ 800 of handling charge and others	฿/ton	550
6) Shadow rate*4 of ฿ 260 of transportation charge*5 from rice mill in the Project Area to Bangkok	฿/ton	200
7) Milled price of rice	฿/ton	7,925
8) Ex-milled price of rice	฿/ton	5,230
9) Shadow rate*6 of ฿ 370 of milling cost	฿/ton	265
10) Shadow rate*4 of ฿ 50 of transportation cost	฿/ton	40
11) Farm-gate price of paddy	฿/ton	2,670

Note : *1 ... IBRD International Inflation Index

*2 ... Grade differential of average exported rice price from non-glutinous white rice 5% broken is 82%.

*3 ... 0.69 of conversion factor for middleman's margin is applied to convert to economic price.

*4 ... 0.76 of conversion factor for transport is applied to convert to economic price.

*5 ... Distance of Project Area from Bangkok is 370km, and average transportation cost per ton and kilometer is ฿ 0.70. (Data is based on ETO rate)

*6 ... 0.72 of conversion factor for milling margin is applied to convert to economic price.

Table I-1-3 Economic Price of Groundnut

Items	Unit	Economic Price
1) IBRD projection price in 1995 in 1981 constant price (Shelled, CIF Europ)	US$/ton	581
2) Converted in 1983 constant price (x 1.102)	US$/ton	640
3) Fright and insurance charge	US$/ton	50
4) FOB price at Bangkok	US$/ton	590
5) Converted to Thai Baht (US$ 1 = ฿ 23)	฿/ton	13,570
6) Shadow rate*1 of ฿ 1,360 of handling charge and others	฿/ton	940
7) Shadow rate*2 of ฿ 260 of transportation charge	฿/ton	200
8) Price of shelled nuts	฿/ton	12,430
9) Price of unshelled nut*3	฿/ton	7,490
10) Shadow rate*4 of ฿ 375 of shelling cost	฿/ton	270
11) Shadow rate*2 of ฿ 50 of transportation charge	฿/ton	40
12) Farm-gate price of groundnut	฿/ton	7,180

Note : *1 ... 0.69 of conversion factor for middleman's margin is applied to convert to economic price.

*2 ... 0.76 of conversion factor for transport is applied to convert to economic price.

*3 ... The shelling ratio of groundnut with shell is 60%. (data source : Depertment of Extension, MOAC)

*4 ... 0.72 of conversion factor for milling margin is applied to convert to economic price.

Table I-1-4 Economic Price of Fertilizer

Items	Unit	1. Urea	2. DAP	3. Potassium choloride
1) IBRD projection price in 1995 in 1981 constant price	US$/ton	275	324	110
2) Converted in 1983 constant price (x 1.102)	US$/ton	303	357	121
3) International transport and handling	US$/ton	50	50	50
4) CIF price, Bangkok port	US$/ton	353	407	171
5) Convert to Thai Baht (US$ 1 = ฿ 23)	฿/ton	8,120	9,360	3,930
6) Shadow rate*1 of handling charge and others (10% of CIF price)	฿/ton	560	645	270
7) Shadow rate*2 of ฿ 260 of transportation charge from Bangkok to the Project Area	฿/ton	200	200	200
8) Shadow rate*1 of transport and handling charge to the farms (5% of local market price and ฿ 50 of transportation cost)	฿/ton	375	425	205
9) Farm-gate price of fertilizer	฿/ton	9,255	10,630	4,605
10) Farm-gate price of nutrient price of fertilizer	฿/ton	20,120*3	15,230*4	7,680*5

Note : *1 ... 0.69 of conversion factor for middleman's margin is applied to convert to economic price.

*2 ... 0.76 of conversion factor for transport is applied to convert to economic price.

*3 ... Nutrient price of Nitrogen (46% of N)

*4 ... Nutrient price of Phosphorous (N.P.K. ratio is 18-46-0)

*5 ... Nutrient price of Potassium (60% of P_2O_5)

Table I-1-5 Farm-gate Price of Fresh-water Fish
- Farm Price in 1983 -

Fish Species	Percentage of quantity (%) *1	Unit Price	
		Financial (฿/kg) *2	Economic (฿/kg) *3
I. Present & Without Project			
1. Tilapias	15.3	20.2	
2. Common carp	52.0	24.8	
3. Silver carp	18.4	30.4	
4. Cat fish -pla duk-	6.6	26.3	
5. Snake head fish	5.6	29.9	
6. Others	2.1	22.1	
Total	100.0	25.5	24.0
II. With Project			
A. Detritus feeder group (Silver carp group & Others)	40	27.0	
B. Plankton feeder group (Chinese carp & Others)	30	27.8	
C. Functional group (Grass carp, Common carp & Others)	30	25.1	
Total	100	26.6	25.0

Note: *1 --- Percentage of fish quantity at present is based on Paddy field culture in Northern Region of "Fresh-water Fish-farm Production, 1981" Fisheries Economics and Planning Sub-Division, Department of Fisheries, M.O.A.C.

*2 --- Based on farm price of fresh water fish of "Price of Agricultural Products, 1979-1981" Office of Agricultural Economics, M.O.A.C.

*3 --- 0.94 of Conversion factor for consumption was applied to convert to economic price of fish.

Table 1-1-6 Economic Wage Rate at Present and Without Project

Item	Area	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
A. Monthly Requirement per Hectare *1 (man-days/ha)														
a) Paddy	1.0	12.2	5.3	0.1	0.1	1.5	7.6	12.7	15.6	5.3	4.2	2.5	17.2	81.3
b) Cassava	1.0	1.7	10.7	12.1	3.2	13.5	6.6	14.5	6.5	4.8	8.3	8.7	2.5	93.1
c) Maize	1.0	0.0	0.0	2.1	1.0	3.8	7.9	12.0	6.0	11.9	7.2	4.4	9.9	66.2
B. Total Monthly Requirement of Sample Village *2 (man-days)														
a) Paddy	214.3	2,614	1,136	21	21	321	1,629	2,722	3,343	1,136	900	536	3,686	18,065
b) Cassava	77.2	131	826	934	247	1,042	510	1,119	502	371	641	672	193	7,188
c) Maize & Others	38.3	0	0	80	38	146	303	460	230	456	276	169	379	2,537
Total	329.8	2,745	1,962	1,035	306	1,509	2,442	4,301	4,075	1,963	1,817	1,377	4,258	27,790
C. Percentage of Potential Full Employment (Monthly labor supply*3=100)		50.7	36.2	19.1	6.7	27.9	45.1	79.4	75.3	36.3	33.6	25.4	78.6	
D. Economic Wage Rate (B/man-day)		20	19	17	15	18	20	26	25	19	19	18	26	Average 20

Source : *1 ... Farm Survey in the Project Area

*2 ... Four sample villages in the upper and midstream of Lam Plai Mat Sub-Project

*3 ... Monthly labor supply in the four villgaes is considered 5,415 man-days.

Age class	Persons	day/month	Total man-days
15 - 19	43	10	430
20 - 49	185	25	4,625
50 - 59	36	10	360
Total	264		5,415

Table I-2-1 Irrigation Benefits from Crop Production, Lam Plai Mat Sub-Project

Benefit Categories	Total Area (ha)	Crops	Area by Crops (%)	Area by Crops ha	Yield (tons/ha)	Production (tons)	Financial GPV ('000 ฿)	Financial Production Cost ('000 ฿)	Financial NPV ('000 ฿)	Financial Benefits ฿/ha	Economic GPV ('000 ฿)	Economic Production Cost ('000 ฿)	Economic NPV ('000 ฿)	Economic Benefits ฿/ha
1. Wet Season Paddy in the Ordinary Service Units														
a) Without Project	9,294	i) Un-harvest Area	(12.3)	1,143	-	-	-	2,449	-2,449		-	3,893	-3,893	
		ii) Harvest Area	(62.9)	5,846	1.33	7,775	20,759	13,372	7,387		38,292	24,451	13,841	
		Total	(75.2)	6,989	-	7,775	20,759	15,821	4,938		38,292	28,344	9,948	
b) With Project	8,736	i) Photo Sensitive	(50.0)	4,368	3.50	15,288	40,819	22,486	18,333		75,293	32,506	42,787	
		ii) Non-photo Sensitive	(50.0)	4,368	4.00	17,472	44,728	24,841	19,887		82,468	34,123	48,345	
		Total	(100.0)	8,736	-	32,760	85,547	47,327	38,220	33,282	157,761	66,629	91,132	81,184
										฿/ha				฿/ha
										(3,657)				(8,921)
2. Dry Season Field Crops in the Muban Cooperative Service Units														
a) Without Project	800	i) Groundnut	(18.1)	145	2.40	348	1,792	787	1,005		2,498	1,213	1,285	
		ii) Mungbean	(10.4)	83	1.00	83	498	272	226		498	386	112	
		iii) Tomato	(12.8)	102	25.00	2,550	2,550	866	1,684		2,550	1,552	998	
		iv) Baby Corn	(16.5)	132	0.40	53	1,590	610	980		1,590	955	635	
		v) Shallot	(31.8)	255	5.00	1,270	6,350	2,469	3,881		6,350	3,149	3,201	
		vi) Chilli	(10.4)	83	12.00	996	8,466	803	7,663	฿/ha	8,466	1,629	6,837	฿/ha
		Total	(100.0)	800	-	-	21,246	5,807	15,439	(1,697)	21,952	8,884	15,068	(1,436)
										15,439				13,068
3. Muban Collective Seedling Plots for Wet Season rainfed Paddy Outside the Service Units														
a) Without Project	2,020	i) Un-harvest Area	(12.3)	248	-	-	-	531	-531		-	845	-845	
		ii) Harvest Area	(62.9)	1,271	1.33	1,690	4,512	2,906	1,606		8,323	5,291	3,032	
		Total	(75.2)	1,519	-		4,512	3,437	1,075		8,323	6,136	2,187	
b) With Project	2,020	i) Un-harvest Area	(13.5)	273	-	-	-	585	-585		-	930	-930	
		ii) Harvest Area	(69.2)	1,398	1.40	1,957	5,225	3,566	1,859	฿/ha	9,638	6,127	3,511	฿/ha
		Total	(82.7)	1,671	-		5,225	3,951	1,274	(22)	9,638	7,057	2,581	(43)
										199				394
4. Muban Collective Seedling Plots for Wet Season rainfed Paddy Inside the Service Units														
a) Without Project	386	i) Un-harvest Area	(12.3)	48	-	-	-	105	-105		-	163	-163	
		ii) Harvest Area	(62.9)	243	1.33	323	862	555	307		1,591	1,011	580	
		Total	(75.2)	291	-		862	658	204		1,591	1,174	417	
b) With Project	364	i) Un-harvest Area	(13.5)	49	-	-	-	105	-105		-	167	-167	
		ii) Harvest Area	(69.2)	252	1.40	353	943	607	336	฿/ha	1,739	1,105	634	฿/ha
		Total	(82.7)	301	-		943	712	231	(3)	1,739	1,272	467	(5)
										27				50

Table 1-2-2 Irrigation Benefits from Crop Production, Nong Lumphuk Sub-Project

Benefit Categories	Total Area (ha)	Crops	Area by Crops (%)	Area by Crops ha	Yield (tons/ha)	Production (tons)	Financial GPV	Financial Production Cost	Financial NPV	Financial Benefits	Economic GPV	Economic Production Cost	Economic NPV	Economic Benefits
							('000 ฿)							
1. Wet Season Paddy in the Ordinary Service Units														
a) Without Project	303	i) Un-harvest Area	(11.5)	35	-	-	-	75	75		-	119	-119	
		ii) Harvest Area	(65.7)	199	1.42	283	755	486	269		1,394	890	504	
		Total	(77.2)	234	-	283	755	561	194		1,394	1,009	385	
b) With Project	285	i) Photo Sensitive	(50.0)	142	3.50	497	1,327	731	596		2,447	1,057	1,390	
		ii) Non-photo Sensitive	(50.0)	143	4.00	568	1,454	807	647	฿/ha (3,497)	2,681	1,110	1,571	฿/ha (8,587)
		Total	(100.0)	285	-	1,065	2,781	1,538	1,243	1,049	5,128	2,167	2,961	2,576
2. Dry Season Field Crops in the Muban Cooperative Service Units														
a) With Project	30	i) Groundnut	(17.5)	5.3	2.40	13	67	29	38		93	45	48	
		ii) Mungbean	(13.4)	4.0	1.00	4	24	13	11		24	19	5	
		iii) Tomato	(12.4)	3.7	25.00	93	93	32	61		93	57	36	
		iv) Baby Corn	(16.0)	4.8	0.40	2	60	23	37		60	36	24	
		v) Shallot	(30.7)	9.2	5.00	46	230	89	141	฿/ha	230	114	116	฿/ha
		vi) Chilli	(10.0)	3.0	12.00	36	306	29	277	(1,883)	306	59	247	(1,587)
		Total	(100.0)	30.0	-		780	215	562	565	806	330	476	476
3. Muban Collective Seedling Plots for Wet Season rainfed Paddy Outside the Service Units														
a) Without Project	120	i) Un-harvest Area	(11.5)	14	-	-	-	30	-30		-	48	-48	
		ii) Harvest Area	(65.7)	79	1.42	112	299	193	106		551	352	199	
		Total	(77.2)	93	-		299	223	76		551	400	151	
b) With Project	120	i) Un-harvest Area	(12.6)	15	-	-	-	32	-32	฿/ha	-	51	-51	฿/ha
		ii) Harvest Area	(72.3)	87	1.49	130	347	224	123	(50)	640	409	231	(97)
		Total	(84.9)	102	-		347	256	91	15	640	460	180	29
4. Muban Collective Seedling Plots for Wet Season rainfed Paddy Inside the Service Units														
a) Without Project	16	i) Un-harvest Area	(11.5)	1	-	-	-	6	-6		-	7	-7	
		ii) Harvest Area	(65.7)	11	1.42	16	43	28	15		80	51	29	
		Total	(77.2)	12	-		43	34	9		80	58	22	
b) With Project	15	i) Un-harvest Area	(12.6)	2	-	-	-	4	-4	฿/ha	-	7	-7	
		ii) Harvest Area	(72.3)	11	1.49	16	43	28	15	(7)	80	51	29	
		Total	(84.9)	12	-		43	32	11	2	80	58	22	0

Table I-2-3 Irrigation Benefits from Crop Production, Huai Phlu Sub-Project

Benefit Categories	Total Area (ha)	Crops	Area by Crops (%)	ha	Yield (tons/ha)	Production (tons)	Financial GPV	Financial Production Cost	Financial NPV	Financial Benefits	Economic GPV	Economic Production Cost	Economic NPV	Economic Benefits
							('000 ฿)				('000 ฿)			
1. Wet Season Paddy in the Ordinary Service Units														
a) Without Project	630	i) Un-harvest Area	(3.4)	21	-	-	-	45	-45		-	72	-72	
		ii) Harvest Area	(70.0)	441	1.21	534	1,425	918	507		2,630	1,679	951	
		Total	(73.4)	462	-	534	1,425	963	462		2,630	1,751	879	
b) With Project	594	i) Photo Sensitive	(50.0)	297	3.50	1,040	2,776	1,529	1,247	฿/ha	5,121	2,210	2,911	฿/ha
		ii) Non-photo Sensitive	(50.0)	297	4.10	1,218	3,119	1,732	1,387	(3,103)	5,749	2,379	3,370	(7,717)
		Total	(100.0)	594	-	2,258	5,895	3,261	2,634	2,172	10,870	4,589	6,281	5,402
2. Dry Season Field Crops in the Muban Cooperative Service Units														
a) With Project	40	i) Groundnut	(17.6)	7.0	2.40	17	88	39	49		122	59	63	
		ii) Mungbean	(10.2)	4.1	1.00	4	24	13	11		24	19	5	
		iii) Tomato	(12.5)	5.0	25.00	125	125	42	83		125	76	49	
		iv) Baby Corn	(16.1)	6.4	0.40	3	90	35	55		90	54	36	
		v) Shallot	(31.0)	12.4	5.00	62	310	121	189	฿/ha	310	154	156	฿/ha
		vi) Chilli	(10.1)	4.0	12.00	48	408	39	369	(1,080)	408	78	330	(915)
		Total	(97.5)	39.0	-	-	1,045	289	756	756	1,079	440	639	639
3. Muban Collective Seedling Plots for Wet Season rainfed Paddy Outside the Service Units														
a) Wihtout Project	48	i) Un-harvest Area	(3.4)	2	-	-	-	4	-4		-	7	-7	
		ii) Harvest Area	(70.0)	34	1.21	41	109	70	39		202	129	73	
		Total	(73.4)	36	-		109	74	35		202	136	66	
b) With Project	48	i) Un-harvest Area	(3.7)	2	-	-	-	4	-4	฿/ha	-	7	-7	฿/ha
		ii) Harvest Area	(77.0)	37	1.27	47	125	81	44	(7)	231	148	83	(14)
		Total	(80.7)	39	-		125	85	40	5	231	155	76	10
4. Muban Collective Seedling Plots for Wet Season rainfed Paddy Inside the Service Units														
a) Without Project	112	i) Un-harvest Area	(3.4)	4	-	-	-	9	-9		-	14	-14	
		ii) Harvest Area	(70.0)	78	1.21	94	251	162	89		463	296	167	
		Total	(73.4)	82	-		251	171	80		463	310	153	
b) With Project	106	i) Un-harvest Area	(3.7)	4	-	-	-	9	-9	฿/ha	-	14	-14	฿/ha
		ii) Harvest Area	(77.0)	82	1.27	104	278	179	99	(14)	513	327	186	(27)
		Total	(80.7)	86	-		278	188	90	10	513	341	172	19

Figure I-1-1 Opportunity Cost of Labor

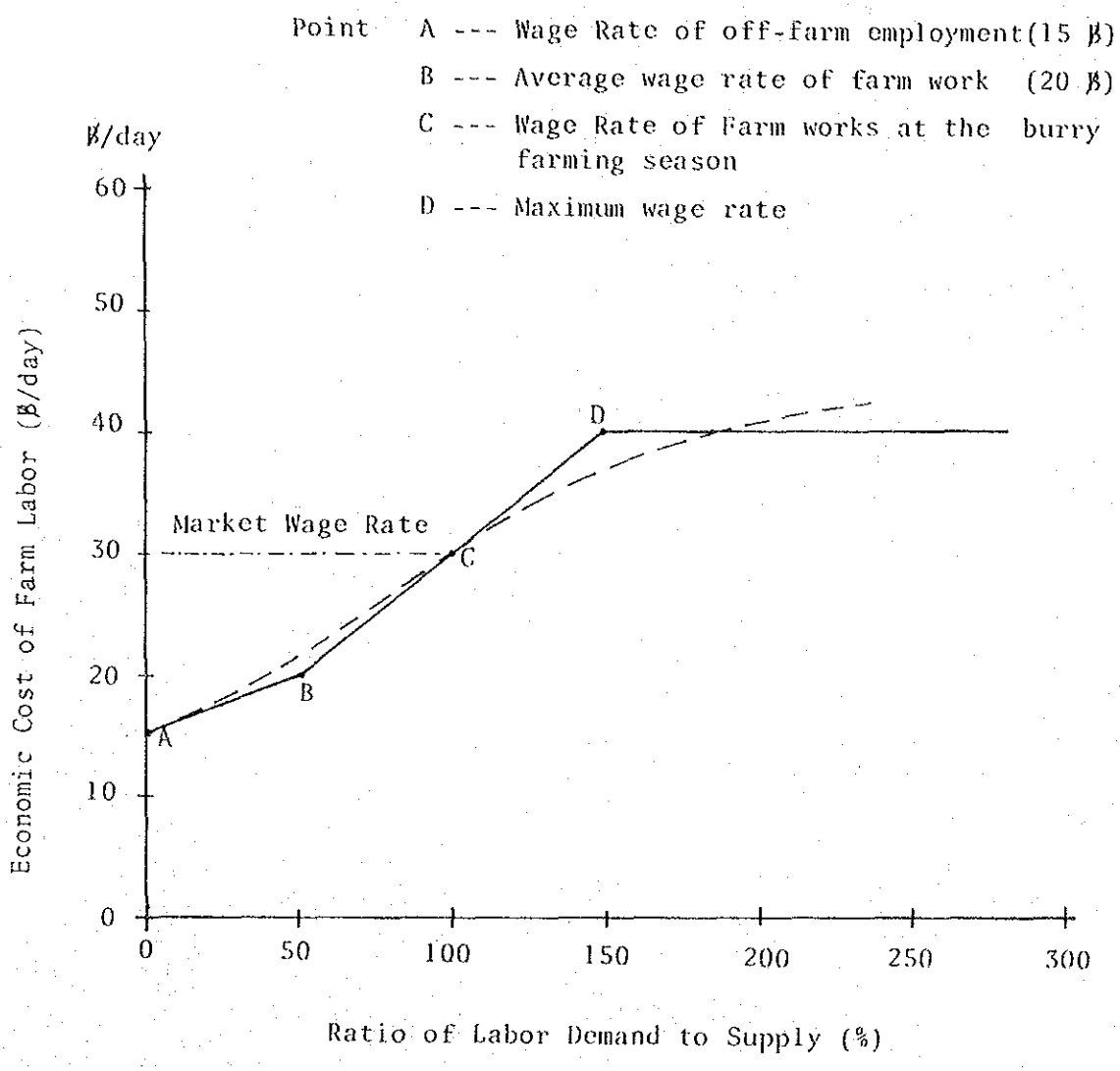


Table I-2-4 Crop Budgets per Hectare

- Present and Without Profit -

Items	1.Paddy		2. Paddy (Un-harvested Area)		2.Cassava		4. Maize	
	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.
1.Yield(tons/ha)	----1.42----		-	-	---10.69----		----1.80---	
2.Farm-gate price (฿/ton)	2,670	4,925	-	-	735	735	2,230	3,000
3.GPV(฿/ha)	3,791	6,994	-	-	7,857	7,857	4,014	7,225
4.Production Cost								
a)Seed	320	592	320	592	407	374	32	29
b)Fertilizer	64	94	32	47	0	0	0	0
c)Pesticide	0	0	0	0	0	0	0	0
d)Animal	1,356	1,356	1,356	1,356	1,582	1,582	1,356	1,356
e)Labor *1	480	1,920	240	1,003	1,350	1,876	885	1,439
f)Others *2	222	504	195	408	334	509	227	209
Sub-total	2,442	4,466	2,143	3,406	3,673	4,341	2,500	3,033
5.NPV(฿/ha)	1,349	2,528	-2,143	-3,406	4,184	3,516	1,514	4,192
(Percent of NPV)	35.6	36.1	-	-	53.3	44.7	37.7	58.0

Note: *1 --- Hired labor (Financial base),
total labor (Economic base)

*2 --- 0.92 of SCF was applied to convert economic price.

Table I-2-5 Crop Budgets per Hectare
- With Project -

Items	1. Rice - Photo sensitive -		2. Rice - Non-photo sensitive -		3. Groundnut		4. Mungbean		5. Tomato		6. Baby Corn		7. Shallot		8. Chili	
	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.
1. Yield (ton/ha)	----3.50---		----4.00---		----2.40---		----1.00---		---25.00---		----0.40---		----5.00---		---12.00---	
2. Farm-gate Price (B/ton)	2,670	4,925	2,560	4,720	5,150	7,180	6,000	6,000	1,000	1,000	30,000	30,000	5,000	5,000	8,500	8,500
3. GPV (B/ha)	9,345	17,238	10,240	18,880	12,360	17,232	6,000	6,000	25,000	25,000	12,000	12,000	25,000	25,000	102,000	102,000
4. Production Cost (B/ha)																
a) seed	220	404	220	404	1,875	2,613	325	325	360	360	360	360	3,000	3,000	360	360
b) Fertilizer	1,100	1,825	1,615	2,172	600	650	900	975	2,570	3,045	1,600	2,016	3,084	3,429	3,600	4,160
c) Pesticide	100	92	75	69	235	216	115	106	500	460	360	331	300	276	540	497
d) Animal	2,689	2,689	2,689	2,689	2,226	2,226	1,639	1,639	4,294	4,294	1,865	1,865	2,452	2,452	4,294	4,294
e) Labor	571	2,002	571	2,002	-	2,210	-	1,340	-	6,340	-	2,250	-	2,430	-	9,500
f) Others	468	430	517	476	494	454	298	274	772	710	419	385	884	813	879	808
Sub-total	5,148	7,442	5,687	7,812	5,430	8,369	3,277	4,659	8,496	15,209	4,604	7,207	9,720	12,400	9,673	19,619
5. NPV (B/ha)	4,197	9,796	4,553	11,068	6,930	8,863	2,725	1,341	16,504	9,791	7,396	4,793	15,280	12,600	92,327	82,381
(Percent of NPV)	44.9	56.8	44.5	58.6	56.1	51.4	45.4	22.4	66.0	39.2	61.6	19.2	61.1	50.4	90.5	80.8
6. Total Labor Requirement (man-days)	-----100.1----		-----100.1---		-----110.5---		------67.0---		------317.0----		-----112.5----		------121.5---		----2,114.7---	
7. Per Capita Productivity (B)	41.9	97.9	45.5	110.6	62.7	80.2	40.6	20.0	52.1	30.9	65.7	42.6	125.8	103.7	43.7	39.0

Table I-2-6 Domestic Water Use Benefits by Sub-Project

(unit ; 000฿)

Items	1. Lam Plai Mat Sub-Project 1-1.Upper stream	1-2. Midstream	Total	2. Nong Lumphuk Sub-Project	3. Huai Phlu Sub-Project
1. Total Beneficial Families in Future	2,656	6,590	9,246	934	1,000
2. Benefit from Domestic Water *1 (000฿)	422	1,048	1,470	149	159

Note : *1 ... Annual benefit from domestic water use per family is estimated 159 ฿.

Table I-2-7 Drinking Water Benefit for Animals

Items	1. Lam Plai Mat Sub-Project 1-1.Upper stream	1-2. Midstream	Total	2. Nong Lumphuk Sub-Project	3. Huai Phlu Sub-Project
1. Buffalo					
a) No. of head in future	2,300	11,200	13,500	400	900
b) Annual Benefit *1	21	101	122	4	8
2. Cattle					
a) No. of head in future	228	1,873	2,161	132	23
b) Annual Benefit *1	2	19	21	1	0
Total Benefit	23	120	143	5	8

Note : *1 ... Annual benefit for buffalo and cattle are estimated ฿ 9.0 and ฿ 10.2 per head.

Table I-2-8 Domestic Water Use Benefits from Village Pond

Items	Labor Requirement (hrs/family) 1. Drinking Water	2. Other Water	Total Requirement dayly	Annual *1	Annual Benefit (฿/family)
1. Wihtout Project	0.507	0.642	1.149	191.9	159 *2
2. With Project	0.233	0.536	0.769	128.4	

Note : *1 ... Expected benefit period of domestic water use is totaly 167 days, since December to the middle of May.

*2 ... Annual Benefit pre a family is estimated 159 ฿.
$(191.9^{hr} - 128.4^{hr}) \times 20฿/8 \text{ hours} = 159 ฿$

Source : Farm Economic Survey

Table I-2-9 Animal Drinking Water Supply Benefit

Items	Labor Requirement hrs/ton *1	฿/ton	฿/head/year Buffalo	Cattle	Annual Benefit (฿/animal) Buffalo	Cattle
1. Without Project	2.63	6.58	54.9	62.6	9.0	
2. With Project	2.20	5.50	45.9	52.4		

Note : *1 ... Quality of animals drinking water is considered equally other domestic water for human.

*2 ... Expected benefit period of animals drinking water is considered 167 days, same of the benefit period of humans domestic water use.

Annual water consumption for animals

a) Buffalo ... 8.35 tons (50ℓ/day)

b) Cattle ... 9.52 tons (57ℓ/day)

Table I-2-10 Estimation of Labor Requirement of Domestic Water

Season	Labour Requirement Per House (hr/day/house) Drinking Water	Other Domestic Water	Total (A)	Per Ton (hr/ton) (A)/0.275*1
1. Dry Season*2	0.507	0.642	1.149	4.18
2. Wet Season*3	0.233	0.536	0.769	2.29

Note : *1 ... Average water consumption per house

$$\frac{45\ell/\text{day}}{\text{Water requirement per a person}} \times \frac{6.1}{\text{Average family size of sample farm}} = 275\ell/\text{house}$$

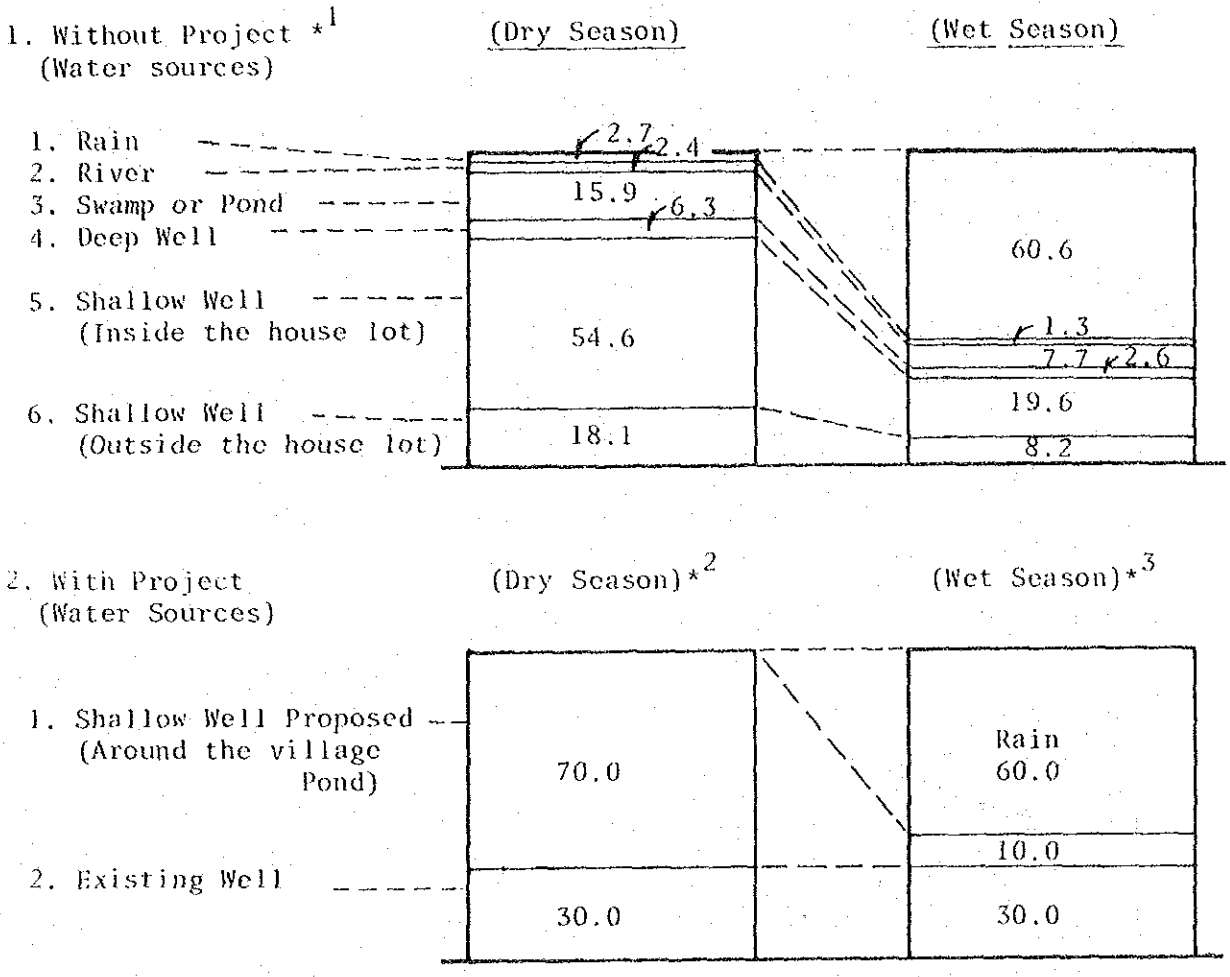
Source : ARD, Ministry of Interior

*2 ... Total of water source

*3 ... Only deep and shallow well

Figure I-2-1 Seasonal Changes of Domestic Water Sources

(Total Water Requirement=100)



Note : *1...Figures are based on the result of Farm Survey in the Project Area. Dry Season Figures are the average of February, March and April and wet season figures are that of August, September and October.

*2...Existing water sources (mainly shallow well) which are used even in the wet season at present will be used in both seasons with the Project. But the major part of the water sources in the dry season at present (shallow well) which are not used in the wet season will be substituted with water of shallow well proposed around the Village Pond due to the better quality and stable quantity.

*3...Procuring condition of domestic water in the wet season at present is considered to remain the same in the said season with the Project. The water benefit in the wet season with Project is estimated very small even though the most villagers use the water of proposed shallow well.

Table I-2-11 Procuring Condition of Domestic Water*1

- Three Month Average of Sample Farm -

Sub-Project	Drinking Water: Households	Drinking Water: Distance (m) (one way)	Drinking Water: Labor (hr/month)	other Domestic Water: Households	other Domestic Water: Distance (m) (one way)	other Domestic Water: Labor (hr/month)
A. Dry Season*2 (Total of Water Source)						
I. Lam Plai Mat Sub-Project						
1-1. Upper stream	29	4,585	773	37	5,000	754
1-2. Midstream	37	12,125	602	47	12,358	945
1-3. Lower stream	41	4,813	302	42	4,821	632
Total	107	22,533	1,677	126	22,179	2,331
II. Nong Lumphuk Sub-Project	38	10,207	665	47	9,258	904
III. Huai Phlu Sub-Project						
3-1. Upper stream	30	6,030	332	32	4,050	516
3-2. Lower stream	25	8,484	365	29	8,614	757
Total	55	14,514	697	61	12,664	1,273
TOTAL	200	47,254	3,039	234	44,101	4,508
Average (Per house & per day)		236	0.507		188	0.642
B. Wet Season*3 (Total of water source)						
I. Lam Plai Mat Sub-Project						
1-1. Upper stream	2	130	30	10	1,007	62
1-2. Midstream	3	1,526	17	20	5,991	437
1-3. Lower stream	9	1,207	46	18	2,122	320
Total	14	2,863	93	48	9,120	819
II. Nong Lumphuk Sub-Project	6	2,070	51	28	4,735	286
III. Huai Phlu Sub-Project						
3-1. Upper stream	5	1,107	20	15	2,023	134
3-2. Lower stream	2	401	28	13	3,040	412
Total	7	1,508	48	28	5,063	546
TOTAL	27	6,441	192	104	18,918	1,651
Average (Per house & per day)		239	0.237		182	0.529
C. Wet Season*3 (Only Deep and Shallow Well)						
I. Lam Plai Mat Sub-Project						
1-1. Upper stream	2	130	30	6	553	46
1-2. Midstream	3	1,527	17	14	4,286	245
1-3. Lower stream	9	1,207	46	16	1,882	277
Total	14	2,864	93	36	6,721	568
II. Nong Lumphuk Sub-Project	1	160	13	13	805	140
III. Huai Phlu Sub-Project						
3-1. Upper stream	5	1,107	20	13	1,193	104
3-2. Lower stream	2	401	28	11	2,880	362
Total	7	1,508	48	24	4,793	466
TOTAL	22	4,532	153	73	12,319	1,174
Average (Per house & per day)		206	0.233		169	0.536

Note : *1 ... Excluding rain and shallow well water of inside the house lot.
*2 ... Dry Season ——> February, March and April
*3 ... Wet Season ----> August, September and October

Table I-2-12 Benefit from Fresh Water Fish Culture in the Muban Pond

Items	1. Lam Plai Mat Sub-Project			2. Nong Lumphuk Sub-Project	3. Huai Phlu Sub-Project
	1-1. Upper stream	1-2. Midstream	Total		
1. Area of Muban Pond (ha)	12.0	33.6	45.6	4.8	6.4
2. Fish Production *1 (tons)	30	84	114	12	16
3. Value of Fish (000฿)					
a) Evaluated with Market Price *2	750	2,100	2,850	300	400
b) Production Cost in the Muban Pond *2	173	483	656	69	92
Defence of Cost (a) - (b) (=Benefit)	577	1,617	2,194	231	308

Note : *1 ... Production yield is considered 2,500 kg/ha.

*2 ... 25 ฿ /kg of economic farm-gate price of freshwater fish is applied.

*3 ... Economic value of fish production cost in the Muban Pond is estimated 5.75 ฿ /kg.

Table L-2-13 Production Cost of Fish Culture for Muban Pond

- With Project -

(unit : ฿/1.6 ha)

Items	Financial	Economic
A. Fixed Cost of Fishery Sub-Committee		
(1) Salary for manager 1 person x 500฿@month x 12 months	6,000	5,520*1
(2) Depreciation expenses for seine net seine net 15,000฿@unit/5 years = 3,000	3,000	2,760*2
(3) Accumulated fund for Ponds repair 1 % of gross fish production (2,500kg x 25฿/kg x 0.01)	625	550*3
(4) Others{((1)+(2)+(3)) x 0.05}	481	443*2
Total	10,106	9,272
B. Variable Cost		
(5) Fry 16,000$^{m^2}$ x 2^{fry} x 0.1$^{฿/fry}$	-	3,200
(6) Laborer 490 man-days x 30฿@day	14,700	9,849
° Receiving fry 1 day x 5 persons = 5		
° Nursing fry 30 days x 2 persons = 60		
° Transplant 1 day x 5 persons = 5		
° Fertilizing 180 days x 2 persons = 360		
° Harvesting 4 times x 15 persons = 60		
(7) Others {((5)+(6)) x 0.05}	735	676*1
Total	15,435	13,725
TOTAL	25,541	22,997
Production Cost per hectare (฿/ha)	15,963	14,373
GPV (฿/ha)	66,500	62,500
NPV (฿/ha)	50,537	48,127
NPV rate (%)	76.0	77.0

Note : *1 ... 0.94 of Conversion Factor for Consumer goods is applied.
*2 ... 0.92 of Standard Conversion Factor is applied.
*3 ... 0.88 Conversion Factor for Construction is applied.
*4 ... 0.67 of Conversion Factor for Un-skilled labor is applied.

Table I-2-14 Fish Culture Benefit from Dam Reservoir

Sub-Project	Area of Dam Reservoir(ha) *1	Fish Yield (kg/ha) *2	Production (tons)	GPV (000฿)	Production Cost (000฿)	NPV -Benefit- (000฿)
I. Lam Plai Mat	1,040	100	104	2,600	513	2,087
II. Nong Lumphuk	120	200	24	600	118	482
III. Huai Phlu	144	200	29	725	143	582

Note : *1 ... Area of full water level

*2 ... Fish yield was dicided through the discussion with staff of Department of Fishery and the existing fish culture in the dam reservoir.

Table I-2-15 Production Cost of Fish Culture for Nong Lumphuk Dam Reservoir - With Project -

(unit : ฿/120 ha)

Items	Financial	Economic
A. Fixed Cost of Fishery Sub-Committee		
(1) Salary for manager and assistants 1 manager 500฿@month x 12 months 1 assistant 200฿@month x 12 months	9,600	9,024 *1
(2) Depreciation expenses for seine net Seine net 15,000฿@2 unit/5 years	6,000	5,520 *2
(3) Others {(1) + (2)} x 0.05	780	718 *2
Sub-Total	16,380	15,262
B. Variable Cost		
(1) Labor 4,800 man-days x 30฿@day Harvesting 12 months x 4 times x 100 persons	144,000	96,480 *3
(2) Others (1) x 0.05	7,200	6,624 *2
Sub-Total	151,200	103,104
Total	167,580	118,366
Production Cost per Hectare (฿/ha)	1,397	986
GPV (200 kg/ha) (฿/ha)	5,320	5,000
NPV (฿/ha)	3,923	4,014
NPV rate (%)	73.7	80.3

Note : *1 ... 0.94 of Conversion Factor for Consumer Goods is applied.
*2 ... 0.92 of Standard Conversion Factor is applied.
*3 ... 0.67 of Conversion Factor for Un-skilled labor is applied.

Table I-2-16 Crop Production in the Dam Reservoir

- Economic -

Item	1. Lam Plai Mat Sub-Project	2. Nong Lumphuk Sub-Project	3. Huai Phlu Sub-Project	Overall
1. Gross Area of the Dam Reservoir (ha)	1,170	149	180	1,499
2. Without Project				
2-1. Cropping Area (ha)				
a) Cassava	936	99	144	1,179
b) Paddy	-	20	-	20
Total	936	119	144	1,199
2-2. Gross Production Value ('000฿)				
a) Cassava	7,354	778	1,131	9,263
b) Paddy	-	92	-	92
Total	7,354	870	1,131	9,355
2-3. Net Production Value ('000฿)				
a) Cassava	3,287	348	506	4,141
b) Paddy	-	25	-	25
Total	3,287	373	506	4,166
3. With Project				
3-1. Cropping Area of Maize (ha)	-	42	80	122
3-2. Gross Production Value ('000฿)	-	303	578	881
3-3. Net Production Value ('000฿)	-	176	335	511

Table I-2-17 Benefits by Sub-project

(Unit: 000฿)

Benefit Categories	1.Lam Plai Mat Sub-project (9,100 ha)		2.Nong Lumphuk Sub-project (300 ha)		3.Huai Phlu Sub-project (700 ha)		Overall (10,100 ha)	
	Total	฿/ha	Total	฿/ha	Total	฿/ha	Total	฿/ha
1. Irrigation for wet season paddy in the Ordinary Service Units and Muban Cooperative Service Units	81,184 (80.7%)	8,921	2,576 (62.5%)	8,587	5,402 (72.4%)	7,717	89,162 (79.5%)	8,828
2. Irrigation for dry season field crops in the Muban Cooperative Service Units	13,068 (13.0)	1,436	476 (11.5)	1,587	639 (8.6)	913	14,182 (12.6)	1,404
3. Irrigation for Muban Collective Seedling Plots for wet season rainfed paddy outside the service units	394 (0.4)	43	29 (0.7)	97	10 (0.1)	14	433 (0.4)	43
4. Irrigation for Muban Collective Seedling Plots in the Muban Cooperative Service Units for wet season rainfed paddy inside the service units	50 (0.0)	5	0 (-)	0	19 (0.3)	27	69 (0.1)	7
5. Water supply for drinking and domestic use for Muban people through the Muban ponds and successive commural facilities	1,470 (1.5)	162	149 (3.6)	497	159 (2.1)	227	1,778 (1.6)	176
6. Water supply for drinking for Muban buffalo and cattle through the Muban Ponds and successive commural facilities	143 (0.1)	16	5 (0.1)	17	8 (0.1)	12	156 (0.1)	15
7. Fishery in the Moban Ponds	2,194 (2.2)	241	231 (5.6)	770	308 (4.1)	440	2,733 (2.4)	271
8. Fishery in the RID-constructed reservoirs	2,087 (2.1)	229	482 (11.7)	1,606	582 (7.8)	832	3,151 (2.8)	312
9. Offshore field crops cultivation on the upper land of the reservoir site area	- (-)	-	176 (4.3)	587	335 (4.5)	479	511 (0.5)	51
Sub-Total	100,590 (100.0)	11,054	4,124 (100.0)	13,747	7,462 (100.0)	10,660	112,175 (100.0)	11,106
10. Minus benefit (Cassava production in the dam reservoir without Project)	3,287	361	348	1,160	506	723	4,141	410
Total Benefit	97,303	10,693	3,776	12,588	6,956	9,937	108,034	10,696

Table I-2-18 Beneficial Household by Benefit Categories

(Unit: households)

Benefit Categories	1. Lam Plai Mat Sub-project	2. Nong Lum-phuk Sub-project	3. Huai Phlu Sub-project	Total
1. Irrigation for wet season paddy in the Ordinary Service Units and Muban Cooperative Service Units	5,665	444	377	6,486
2. Irrigation for dry season field crops in the Muban Cooperative Service Units	2,540	102	136	2,778
3. Irrigation for Muban Collective Seedling Plots for wet season rainfed paddy outside the service units	5,665	444	377	6,486
4. Irrigation for Muban Collective Seedling Plots in the Muban Cooperative Service Units for wet season rainfed paddy inside the service units	5,665	444	377	6,486
5. Water supply for drinking and domestic use for Muban people through the Muban ponds and successive commural facilities	7,581 (42,050*1 56,400*2)	766 (4,262*1 5,700*2)	815 (4,488*1 6,100*2)	9,162 (50,800*1 68,200*2)
6. Water supply for drinking for Muban buffalo and cattle through the Muban Ponds and successive commural facilities	6,811 (B;13,711 C; 2,154 *3)	686 (B;465 C;132 *3)	694 (B;1,405 C; 118 *3)	8,191 (B;15,581 C; 2,404 *3)
7. Fishery in the Muban Ponds	7,581	766	815	9,162
8. Fishery in the RID-constructed reservoirs	9,202	766	955	10,923
9. reservoirs at low water level	5,665	444	377	6,486

Note: *1 ----- Population in 1983
*2 ----- Beneficiary population in 1993
*3 ----- Number of head of Buffalo and Cattle

I.3. Financial Anelysis

Table I-3-1 Farm Budgets for the Average Farm Size *

Items	Paddy Farm		Paddy + Upland Crop Farm	
	Present	With Project	Present	With Project
(1) Number of Sample Farm	16 (41%)		23 (59%)	
(2) Number of Family Member (person/farm)	6		6	
(3) Operated Land (ha)				
a. Paddy Field	2.30	2.19	2.10	2.00
b. Upland Field	-	-	1.20	1.20
Total	2.30	2.19	3.30	3.20
(4) Planted Area (ha)				
a. Paddy Wet Season	1.73	2.19	1.58	2.00
b. Cassaua	-	-	0.70	0.70
c. Maize	-	-	0.50	
d. Field Crops, Dry Season				
i. Groundnut	-	0.06	-	0.06
ii. Mungbean	-	0.03	-	0.03
iii. Tomato	-	0.04	-	0.04
iv. Baby Corn	-	0.05	-	0.05
v. Shallot	-	0.10	-	0.10
vi. Chili	-	0.03	-	0.03
sub-total	-	0.31	-	0.31
Total	-	2.52	-	
(5) Production (tons)				
a. Paddy, Wet Season	1.92	6.91	1.76	6.31
b. Cassaua	-	-	7.48	7.48
c. Maize	-	-	0.90	0.90
d. Field Crops, Dry Season				
i. Groundnut	-	1.44	-	1.44
ii. Mungbean	-	0.03	-	0.03
iii. Tomato	-	1.00	-	1.00
iv. Baby Corn	-	0.02	-	0.02
v. Shallot	-	0.50	-	0.50
vi. Chili	-	0.36	-	0.36
(6) Gros Income from Crop Production (B)				
a. Paddy, Wet Season	5,137	18,063	4,691	16,496
b. Cassaua	-	-	5,498	5,498
c. Maize	-	-	2,007	2,007
d. Field Crops, Dry Season				
i.Groundnut	-	864	-	864
ii. Mungbean	-	180	-	180
iii. Tomato	-	1,000	-	1,000
iv. Baby Corn	-	600	-	600
v. Shallot	-	2,500	-	2,500
vi. Chili	-	3,060	-	3,060
sub-total	-	8,204	-	8,204
Total	5,137	26,267	12,196	32,205
(7) Crop Production Cort (B)				
a. Paddy, Wet Season	3,915	10,239	3,575	9,351
b.Cassaua	-	-	2,568	2,568
c. Maize	-	-	1,250	1,250
d. Field Crops, Dry Season				
i. Groundnut	-	379	-	379
ii. Mungbean	-	98	-	98
iii. Tomato	-	340	-	340
iv. Baby Corn	-	230	-	230
v. Shallot	-	973	-	973
vi. Chili	-	291	-	291
sub-total	-	2,311	-	2,311
Total	3,915	12,550	7,393	15,480
(8) Net Income from Crops (B)	(11.2)	(33.5)	(7.8)	(27.1)
a. Paddy Wet Season	1,120	7,820	1,120	7,150
			(25.6)	(14.0)
b. Upland Crops	-	-	3,690	3,690
c. Field Crops, Dry Season				
Cropping in the Nulban Cooperative Sevice Unit	-	(25.2) 5,890	-	(22.3) 5,890
	(11.2)	(58.7)	(33.3)	(63.5)
Total	1,120	13,720	4,810	16,730
(9) Income from Livestock (B)	(26.6) 2,890	(12.4) 2,890	(20.0) 2,890	(11.0) 2,890
(10) Total of Agricultural Income (B)	(37.9) 4,110	(71.1) 16,610	(53.3) 7,700	(74.4) 19,620
(11) Off-farm Income (B)	(62.1) 6,740	(28.9) 6,740	(46.9) 6,740	(25.6) 6,740
(12) Farm Income (B)	(100.0)	(100.0)	(100.0)	(100.0)
a. Total	10,850	23,350	14,440	26,360
(Income per Capita)	(1,810)	(3,890)	(2,410)	(4,390)
b. Excludin Off-farm Income	4,110	16,610	7,700	19,620
(Income per Capita)	(690)	(2,770)	(1,280)	(3,270)
c. Excluding Field Crops Income	10,850	17,460	14,440	20,410
(Income per Capita)	(1,810)	(2,910)	(2,410)	(3,410)

Note : *... Result of the Farm survey in the Lam Plor Mat, Nong Pak and Huai Phlu Sub-Projects, the Farms in the upper stream in the Lam Plai Mat Sub-Project were considered average.

I.4. Economic Analysis

Table I-4-1 Implementation and Disbursement schedule for Nong Lum Puk and Huai Phlu Sub projects

I. Implementation Schedule

Description	1985	1986	1987	1988	1989
1. Loan Procedures					
2. Consultant Recruitment					
3. Detail Design					
4. Tender for Construction					
5. Construction					
a. Nong Lum Puk					
b. Huai Phlu					
6. O/M and Huban work					
a. Nong Lum Puk					
b. Huai Phlu					

II. Disbursement Schedule (unit B '000)

Description	Total	1985	1986	1987	1988	1989
1. Nong Lum Puk						
a. Major Work	32,570		6,000	23,310	3,260	
b. O/M & Muban Work	1,710			1,710		
c. O/M Equipment	430	-	-	-	430	-
d. Right of Way	300	-	300	-	-	-
e. Survey Work	600	600	-	-	-	-
f. Administration	1,050	200	400	400	50	-
g. Consultant	2,300	500	800	1,000	-	-
Base Cost	38,960	1,300	7,500	26,420	3,740	
Including Contingency	42,860	1,430	8,250	29,060	4,120	
2. Huai phlu						
a. Major Work	60,270	-	9,040	30,100	15,100	6,030
b. O/M & Mubon Work	4,560	-	-	-	4,560	-
c. O/M Equipment	1,000	-	-	-	1,000	-
d. Richt of Way	160	-	160	-	-	-
e. Survey Work	1,090	1,090	-	-	-	-
f. Administration	2,450	350	700	700	600	100
g. Consultant	5,400	1,000	1,700	2,000	700	-
Base Cost	74,930	2,440	11,600	32,800	21,960	6,130
Including Contingency	82,420	2,680	12,760	36,080	24,160	6,740

Table 1-4-2 Project Cost and Benefits, Lam Plai Mat Sub-project

(UNIT : MILLION BAHT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE -DISCOUNT RATE 8 %-		-DISCOUNT RATE 10 %-		-DISCOUNT RATE 12 %-	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1985	15.88	0.0	15.88	0.0	-15.88	15.88	0.0	15.88	0.0	15.88	0.0
2 1986	41.38	0.0	41.38	0.0	-41.38	35.48	0.0	34.20	0.0	32.99	0.0
3 1987	47.68	0.0	47.68	-3.29	-50.97	37.85	-2.61	35.82	-2.47	33.94	-2.34
4 1988	146.72	0.0	146.72	-3.29	-150.01	107.84	-2.42	100.21	-2.25	93.24	-2.09
5 1989	252.17	0.0	252.17	-3.29	-255.46	171.62	-2.24	156.58	-2.04	143.09	-1.87
6 1990	82.55	4.81	87.36	26.61	-60.75	55.05	16.77	49.31	15.02	44.26	13.48
7 1991	9.90	8.02	17.92	55.99	38.07	10.46	32.67	9.20	28.73	8.11	25.33
8 1992	0.0	8.02	8.02	72.37	64.35	4.33	39.10	3.74	33.76	3.24	29.23
9 1993	0.0	8.02	8.02	83.77	75.75	4.01	41.91	3.40	35.53	2.89	30.21
10 1994	10.79	8.02	18.81	90.46	71.65	8.71	41.90	7.25	34.88	6.06	29.13
11 1995	0.0	8.02	8.02	94.14	86.12	3.44	40.38	2.81	33.00	2.31	27.06
12 1996	0.0	8.02	8.02	96.45	88.43	3.18	38.30	2.56	30.73	2.06	24.76
13 1997	0.0	8.02	8.02	97.25	89.23	2.95	35.76	2.32	28.17	1.84	22.29
14 1998	0.0	8.02	8.02	97.28	89.26	2.73	33.12	2.11	25.62	1.64	19.91
15 1999	0.0	8.02	8.02	97.30	89.28	2.53	30.67	1.92	23.29	1.47	17.78
16 2000	10.79	8.02	18.81	97.30	78.49	5.49	28.40	4.09	21.18	3.07	15.87
17 2001	0.0	8.02	8.02	97.30	89.28	2.17	26.30	1.59	19.25	1.17	14.17
18 2002	0.0	8.02	8.02	97.30	89.28	2.01	24.35	1.44	17.50	1.04	12.65
19 2003	0.0	8.02	8.02	97.30	89.28	1.86	22.55	1.31	15.91	0.93	11.30
20 2004	0.0	8.02	8.02	97.30	89.28	1.72	20.88	1.19	14.46	0.83	10.09
21 2005	0.0	8.02	8.02	97.30	89.28	1.59	19.33	1.08	13.15	0.74	9.01
22 2006	10.79	8.02	18.81	97.30	78.49	3.46	17.90	2.31	11.95	1.55	8.04
23 2007	0.0	8.02	8.02	97.30	89.28	1.37	16.57	0.90	10.87	0.59	7.18
24 2008	0.0	8.02	8.02	97.30	89.28	1.26	15.34	0.81	9.88	0.53	6.41
25 2009	0.0	8.02	8.02	97.30	89.28	1.17	14.21	0.74	8.98	0.47	5.72
26 2010	0.0	8.02	8.02	97.30	89.28	1.08	13.16	0.67	8.16	0.42	5.11
27 2011	0.0	8.02	8.02	97.30	89.28	1.00	12.18	0.61	7.42	0.38	4.56
28 2012	10.79	8.02	18.81	97.30	78.49	2.18	11.28	1.30	6.75	0.79	4.07
29 2013	0.0	8.02	8.02	97.30	89.28	0.86	10.44	0.51	6.13	0.30	3.64
30 2014	0.0	8.02	8.02	97.30	89.28	0.80	9.67	0.46	5.58	0.27	3.25
31 2015	0.0	8.02	8.02	97.30	89.28	0.74	8.95	0.42	5.07	0.24	2.90
32 2016	0.0	8.02	8.02	97.30	89.28	0.68	8.29	0.38	4.61	0.21	2.59
33 2017	0.0	8.02	8.02	97.30	89.28	0.63	7.68	0.35	4.19	0.19	2.31
34 2018	10.79	8.02	18.81	97.30	78.49	1.37	7.11	0.74	3.81	0.40	2.06
35 2019	0.0	8.02	8.02	97.30	89.28	0.54	6.58	0.29	3.46	0.15	1.84
36 2020	0.0	8.02	8.02	97.30	89.28	0.50	6.09	0.26	3.15	0.14	1.65
37 2021	0.0	8.02	8.02	97.30	89.28	0.47	5.64	0.24	2.86	0.12	1.47
38 2022	0.0	8.02	8.02	97.30	89.28	0.43	5.22	0.21	2.60	0.11	1.31
39 2023	0.0	8.02	8.02	97.30	89.28	0.40	4.84	0.19	2.36	0.10	1.17
40 2024	10.79	8.02	18.81	97.30	78.49	0.87	4.48	0.42	2.15	0.20	1.05
41 2025	0.0	8.02	8.02	97.30	89.28	0.34	4.15	0.16	1.95	0.08	0.93
42 2026	0.0	8.02	8.02	97.30	89.28	0.32	3.84	0.15	1.78	0.07	0.83
43 2027	0.0	8.02	8.02	97.30	89.28	0.29	3.56	0.13	1.62	0.06	0.74
44 2028	0.0	8.02	8.02	97.30	89.28	0.27	3.29	0.12	1.47	0.05	0.66
45 2029	0.0	8.02	8.02	97.30	89.28	0.25	3.05	0.11	1.33	0.05	0.59
46 2030	10.79	8.02	18.81	97.30	78.49	0.55	2.82	0.23	1.21	0.10	0.53
47 2031	0.0	8.02	8.02	97.30	89.28	0.22	2.61	0.09	1.10	0.04	0.47
48 2032	0.0	8.02	8.02	97.30	89.28	0.20	2.42	0.08	1.00	0.03	0.42
49 2033	0.0	8.02	8.02	97.30	89.28	0.18	2.24	0.08	0.91	0.03	0.38
50 2034	0.0	8.02	8.02	97.30	89.28	0.17	2.07	0.07	0.83	0.03	0.34
TOTAL	671.81	357.69	1029.50	4207.25	3177.75	503.52	700.79	451.05	506.61	408.48	378.19

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.39 (8%), 1.12 (10%), 0.93 (12%)
INTERNAL RATE OF RETURN (IRR) = 11.2 %

Table 1-4-3 Project Cost and Benefits, Nong Lum Puk Sub-project

(UNIT : MILLION BAHT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE -DISCOUNT RATE 8 %-		-DISCOUNT RATE 10 %-		-DISCOUNT RATE 12 %-	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1985	1.37	0.0	1.37	0.0	-1.37	1.37	0.0	1.37	0.0	1.37	0.0
2 1986	6.40	0.0	6.40	-0.35	-6.75	5.49	-0.30	5.29	-0.29	5.10	-0.28
3 1987	22.06	0.0	22.06	-0.35	-22.41	17.51	-0.28	16.57	-0.26	15.70	-0.25
4 1988	3.15	0.37	3.52	1.83	-1.69	2.59	1.35	2.40	1.25	2.24	1.16
5 1989	0.03	0.37	0.40	2.72	2.32	0.27	1.85	0.25	1.69	0.23	1.54
6 1990	0.03	0.37	0.40	3.28	2.88	0.25	2.07	0.23	1.85	0.20	1.66
7 1991	0.03	0.37	0.40	3.51	3.11	0.23	2.05	0.21	1.80	0.18	1.59
8 1992	0.03	0.37	0.40	3.68	3.28	0.22	1.99	0.19	1.72	0.16	1.49
9 1993	0.03	0.37	0.40	3.72	3.32	0.20	1.86	0.17	1.58	0.14	1.34
10 1994	0.38	0.37	0.75	3.74	2.99	0.35	1.73	0.29	1.44	0.24	1.20
11 1995	0.03	0.37	0.40	3.76	3.36	0.17	1.61	0.14	1.32	0.11	1.08
12 1996	0.03	0.37	0.40	3.77	3.37	0.16	1.50	0.13	1.20	0.10	0.97
13 1997	0.03	0.37	0.40	3.78	3.38	0.15	1.39	0.12	1.09	0.09	0.87
14 1998	0.03	0.37	0.40	3.78	3.38	0.14	1.29	0.11	1.00	0.08	0.77
15 1999	0.03	0.37	0.40	3.78	3.38	0.13	1.19	0.10	0.90	0.07	0.69
16 2000	0.38	0.37	0.75	3.78	3.03	0.22	1.10	0.16	0.82	0.12	0.62
17 2001	0.03	0.37	0.40	3.78	3.38	0.11	1.02	0.08	0.75	0.06	0.55
18 2002	0.03	0.37	0.40	3.78	3.38	0.10	0.95	0.07	0.68	0.05	0.49
19 2003	0.03	0.37	0.40	3.78	3.38	0.09	0.88	0.07	0.62	0.05	0.44
20 2004	0.03	0.37	0.40	3.78	3.38	0.09	0.81	0.06	0.56	0.04	0.39
21 2005	0.03	0.37	0.40	3.78	3.38	0.08	0.75	0.05	0.51	0.04	0.35
22 2006	0.38	0.37	0.75	3.78	3.03	0.14	0.70	0.09	0.46	0.06	0.31
23 2007	0.03	0.37	0.40	3.78	3.38	0.07	0.64	0.04	0.42	0.03	0.28
24 2008	0.03	0.37	0.40	3.78	3.38	0.06	0.60	0.04	0.38	0.03	0.25
25 2009	0.03	0.37	0.40	3.78	3.38	0.06	0.55	0.04	0.35	0.02	0.22
26 2010	0.03	0.37	0.40	3.78	3.38	0.05	0.51	0.03	0.32	0.02	0.20
27 2011	0.03	0.37	0.40	3.78	3.38	0.05	0.47	0.03	0.29	0.02	0.18
28 2012	0.38	0.37	0.75	3.78	3.03	0.09	0.44	0.05	0.26	0.03	0.16
29 2013	0.03	0.37	0.40	3.78	3.38	0.04	0.41	0.03	0.24	0.01	0.14
30 2014	0.03	0.37	0.40	3.78	3.38	0.04	0.38	0.02	0.22	0.01	0.13
31 2015	0.03	0.37	0.40	3.78	3.38	0.04	0.35	0.02	0.20	0.01	0.11
32 2016	0.03	0.37	0.40	3.78	3.38	0.03	0.32	0.02	0.18	0.01	0.10
33 2017	0.03	0.37	0.40	3.78	3.38	0.03	0.30	0.02	0.16	0.01	0.09
34 2018	0.38	0.37	0.75	3.78	3.03	0.05	0.28	0.03	0.15	0.02	0.08
35 2019	0.03	0.37	0.40	3.78	3.38	0.03	0.26	0.01	0.13	0.01	0.07
36 2020	0.03	0.37	0.40	3.78	3.38	0.03	0.24	0.01	0.12	0.01	0.06
37 2021	0.03	0.37	0.40	3.78	3.38	0.02	0.22	0.01	0.11	0.01	0.06
38 2022	0.03	0.37	0.40	3.78	3.38	0.02	0.20	0.01	0.10	0.01	0.05
39 2023	0.03	0.37	0.40	3.78	3.38	0.02	0.19	0.01	0.09	0.00	0.05
40 2024	0.38	0.37	0.75	3.78	3.03	0.03	0.17	0.02	0.08	0.01	0.04
41 2025	0.03	0.37	0.40	3.78	3.38	0.02	0.16	0.01	0.08	0.00	0.04
42 2026	0.03	0.37	0.40	3.78	3.38	0.02	0.15	0.01	0.07	0.00	0.03
43 2027	0.03	0.37	0.40	3.78	3.38	0.01	0.14	0.01	0.06	0.00	0.03
44 2028	0.03	0.37	0.40	3.78	3.38	0.01	0.13	0.01	0.06	0.00	0.03
45 2029	0.03	0.37	0.40	3.78	3.38	0.01	0.12	0.01	0.05	0.00	0.02
46 2030	0.38	0.37	0.75	3.78	3.03	0.02	0.11	0.01	0.05	0.00	0.02
47 2031	0.03	0.37	0.40	3.78	3.38	0.01	0.10	0.00	0.04	0.00	0.02
48 2032	0.03	0.37	0.40	3.78	3.38	0.01	0.09	0.00	0.04	0.00	0.02
49 2033	0.03	0.37	0.40	3.78	3.38	0.01	0.09	0.00	0.04	0.00	0.01
50 2034	0.03	0.37	0.40	3.78	3.38	0.01	0.08	0.00	0.03	0.00	0.01
TOTAL	36.81	17.39	54.20	172.95	118.75	30.95	33.18	28.64	25.02	26.74	19.48

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.07 (8%), 0.87 (10%), 0.73 (12%)
INTERNAL RATE OF RETURN (IRR) = 8.7 %

Table 1-4-4 Project Cost and Benefits, Huai Phlu Sub-project

(UNIT : MILLION BAHT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE -DISCOUNT RATE 8 %-		-DISCOUNT RATE 10 %-		-DISCOUNT RATE 12 %-	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1985	2.51	0.0	2.51	0.0	-2.51	2.51	0.0	2.51	0.0	2.51	0.0
2 1986	9.91	0.0	9.91	-0.51	-10.42	8.50	-0.44	8.19	-0.42	7.90	-0.41
3 1987	26.88	0.0	26.88	-0.51	-27.39	21.34	-0.40	20.20	-0.38	19.13	-0.36
4 1988	19.24	0.0	19.24	-0.51	-19.75	14.14	-0.37	13.14	-0.35	12.23	-0.32
5 1989	4.92	0.66	5.58	3.58	-2.00	3.80	2.44	3.46	2.22	3.17	2.03
6 1990	0.0	0.66	0.66	5.19	4.53	0.42	3.27	0.37	2.93	0.33	2.63
7 1991	0.0	0.66	0.66	6.18	5.52	0.39	3.61	0.34	3.17	0.30	2.80
8 1992	0.0	0.66	0.66	6.59	5.93	0.36	3.56	0.31	3.07	0.27	2.66
9 1993	0.0	0.66	0.66	6.86	6.20	0.33	3.43	0.28	2.91	0.24	2.47
10 1994	0.83	0.66	1.49	6.91	5.42	0.69	3.20	0.57	2.66	0.48	2.22
11 1995	0.0	0.66	0.66	6.93	6.27	0.28	2.97	0.23	2.43	0.19	1.99
12 1996	0.0	0.66	0.66	6.94	6.28	0.26	2.76	0.21	2.21	0.17	1.78
13 1997	0.0	0.66	0.66	6.95	6.29	0.24	2.56	0.19	2.01	0.15	1.59
14 1998	0.0	0.66	0.66	6.96	6.30	0.22	2.37	0.17	1.83	0.14	1.42
15 1999	0.0	0.66	0.66	6.96	6.30	0.21	2.19	0.16	1.67	0.12	1.27
16 2000	0.83	0.66	1.49	6.96	5.47	0.43	2.03	0.32	1.51	0.24	1.14
17 2001	0.0	0.66	0.66	6.96	6.30	0.18	1.88	0.13	1.38	0.10	1.01
18 2002	0.0	0.66	0.66	6.96	6.30	0.17	1.74	0.12	1.25	0.09	0.91
19 2003	0.0	0.66	0.66	6.96	6.30	0.15	1.61	0.11	1.14	0.08	0.81
20 2004	0.0	0.66	0.66	6.96	6.30	0.14	1.49	0.10	1.03	0.07	0.72
21 2005	0.0	0.66	0.66	6.96	6.30	0.13	1.38	0.09	0.94	0.06	0.64
22 2006	0.83	0.66	1.49	6.96	5.47	0.27	1.28	0.18	0.86	0.12	0.58
23 2007	0.0	0.66	0.66	6.96	6.30	0.11	1.19	0.07	0.78	0.05	0.51
24 2008	0.0	0.66	0.66	6.96	6.30	0.10	1.10	0.07	0.71	0.04	0.46
25 2009	0.0	0.66	0.66	6.96	6.30	0.10	1.02	0.06	0.64	0.04	0.41
26 2010	0.0	0.66	0.66	6.96	6.30	0.09	0.94	0.06	0.58	0.03	0.37
27 2011	0.0	0.66	0.66	6.96	6.30	0.08	0.87	0.05	0.53	0.03	0.33
28 2012	0.83	0.66	1.49	6.96	5.47	0.17	0.81	0.10	0.48	0.06	0.29
29 2013	0.0	0.66	0.66	6.96	6.30	0.07	0.75	0.04	0.44	0.02	0.26
30 2014	0.0	0.66	0.66	6.96	6.30	0.07	0.69	0.04	0.40	0.02	0.23
31 2015	0.0	0.66	0.66	6.96	6.30	0.06	0.64	0.03	0.36	0.02	0.21
32 2016	0.0	0.66	0.66	6.96	6.30	0.06	0.59	0.03	0.33	0.02	0.19
33 2017	0.0	0.66	0.66	6.96	6.30	0.05	0.55	0.03	0.30	0.02	0.17
34 2018	0.83	0.66	1.49	6.96	5.47	0.11	0.51	0.06	0.27	0.03	0.15
35 2019	0.0	0.66	0.66	6.96	6.30	0.04	0.47	0.02	0.25	0.01	0.13
36 2020	0.0	0.66	0.66	6.96	6.30	0.04	0.44	0.02	0.23	0.01	0.12
37 2021	0.0	0.66	0.66	6.96	6.30	0.04	0.40	0.02	0.20	0.01	0.11
38 2022	0.0	0.66	0.66	6.96	6.30	0.04	0.37	0.02	0.19	0.01	0.09
39 2023	0.0	0.66	0.66	6.96	6.30	0.03	0.35	0.02	0.17	0.01	0.08
40 2024	0.83	0.66	1.49	6.96	5.47	0.07	0.32	0.03	0.15	0.02	0.07
41 2025	0.0	0.66	0.66	6.96	6.30	0.03	0.30	0.01	0.14	0.01	0.07
42 2026	0.0	0.66	0.66	6.96	6.30	0.03	0.27	0.01	0.13	0.01	0.06
43 2027	0.0	0.66	0.66	6.96	6.30	0.02	0.25	0.01	0.12	0.01	0.05
44 2028	0.0	0.66	0.66	6.96	6.30	0.02	0.24	0.01	0.11	0.00	0.05
45 2029	0.0	0.66	0.66	6.96	6.30	0.02	0.22	0.01	0.10	0.00	0.04
46 2030	0.83	0.66	1.49	6.96	5.47	0.04	0.20	0.02	0.09	0.01	0.04
47 2031	0.0	0.66	0.66	6.96	6.30	0.02	0.19	0.01	0.08	0.00	0.03
48 2032	0.0	0.66	0.66	6.96	6.30	0.02	0.17	0.01	0.07	0.00	0.03
49 2033	0.0	0.66	0.66	6.96	6.30	0.02	0.16	0.01	0.07	0.00	0.03
50 2034	0.0	0.66	0.66	6.96	6.30	0.01	0.15	0.01	0.06	0.00	0.02
TOTAL	69.27	30.36	99.63	312.12	212.49	56.72	56.71	52.26	42.04	48.58	32.18

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.00 (8%), 0.80 (10%), 0.66 (12%)
INTERNAL RATE OF RETURN (IRR) = 8.0 %

Table 1-4-5 Project Cost and Benefits, Package Project (Case 1)

- Lam Plai Mat, Nong Lum Puk and Huai Phlu Sub-Project -

(UNIT : MILLION BAHT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE -DISCOUNT RATE 8 %- (COST)	(BENEFITS)	-DISCOUNT RATE 10 %- (COST)	(BENEFITS)	-DISCOUNT RATE 12 %- (COST)	(BENEFITS)
	CAPITAL	O & M	TOTAL								
1 1985	16.46	0.0	16.46	0.0	-16.46	16.46	0.0	16.46	0.0	16.46	0.0
2 1986	47.41	0.0	47.41	0.0	-47.41	40.65	0.0	39.18	0.0	37.79	0.0
3 1987	51.99	0.0	51.99	-3.64	-55.63	41.27	-2.89	39.06	-2.73	37.01	-2.59
4 1988	181.55	1.60	183.15	-4.15	-187.30	134.62	-3.05	125.09	-2.83	116.40	-2.64
5 1989	291.24	5.18	296.42	-1.99	-298.41	201.74	-1.35	184.05	-1.24	168.20	-1.13
6 1990	93.57	8.39	101.96	28.82	-73.14	64.25	18.16	57.55	16.27	51.66	14.60
7 1991	10.59	9.05	19.64	62.84	43.20	11.46	36.67	10.08	32.25	8.88	28.43
8 1992	0.03	9.05	9.08	81.07	71.99	4.91	43.80	4.24	37.82	3.67	32.74
9 1993	0.03	9.05	9.08	93.63	84.55	4.54	46.84	3.85	39.71	3.27	33.76
10 1994	12.00	9.05	21.05	100.77	79.72	9.75	46.68	8.12	38.85	6.78	32.45
11 1995	0.03	9.05	9.08	104.76	95.68	3.89	44.93	3.18	36.72	2.61	30.12
12 1996	0.03	9.05	9.08	107.13	98.05	3.61	42.54	2.89	34.14	2.33	27.50
13 1997	0.03	9.05	9.08	107.96	98.88	3.34	39.70	2.63	31.27	2.08	24.74
14 1998	0.03	9.05	9.08	108.01	98.93	3.09	36.77	2.39	28.44	1.86	22.10
15 1999	0.03	9.05	9.08	108.02	98.94	2.86	34.05	2.17	25.86	1.66	19.73
16 2000	12.00	9.05	21.05	108.03	86.98	6.14	31.53	4.58	23.51	3.43	17.62
17 2001	0.03	9.05	9.08	108.03	98.95	2.45	29.20	1.80	21.37	1.32	15.73
18 2002	0.03	9.05	9.08	108.03	98.95	2.27	27.03	1.63	19.43	1.18	14.05
19 2003	0.03	9.05	9.08	108.03	98.95	2.10	25.03	1.48	17.66	1.05	12.54
20 2004	0.03	9.05	9.08	108.03	98.95	1.95	23.18	1.35	16.06	0.94	11.20
21 2005	0.03	9.05	9.08	108.03	98.95	1.80	21.46	1.23	14.60	0.84	10.00
22 2006	12.00	9.05	21.05	108.03	86.98	3.87	19.87	2.59	13.27	1.74	8.93
23 2007	0.03	9.05	9.08	108.03	98.95	1.55	18.40	1.01	12.06	0.67	7.97
24 2008	0.03	9.05	9.08	108.03	98.95	1.43	17.04	0.92	10.97	0.60	7.12
25 2009	0.03	9.05	9.08	108.03	98.95	1.33	15.77	0.84	9.97	0.53	6.35
26 2010	0.03	9.05	9.08	108.03	98.95	1.23	14.61	0.76	9.06	0.48	5.67
27 2011	0.03	9.05	9.08	108.03	98.95	1.14	13.52	0.69	8.24	0.43	5.07
28 2012	12.00	9.05	21.05	108.03	86.98	2.44	12.52	1.46	7.49	0.88	4.52
29 2013	0.03	9.05	9.08	108.03	98.95	0.97	11.59	0.57	6.81	0.34	4.04
30 2014	0.03	9.05	9.08	108.03	98.95	0.90	10.74	0.52	6.19	0.30	3.61
31 2015	0.03	9.05	9.08	108.03	98.95	0.84	9.94	0.47	5.63	0.27	3.22
32 2016	0.03	9.05	9.08	108.03	98.95	0.77	9.20	0.43	5.12	0.24	2.87
33 2017	0.03	9.05	9.08	108.03	98.95	0.72	8.52	0.39	4.65	0.22	2.57
34 2018	12.00	9.05	21.05	108.03	86.98	1.54	7.89	0.82	4.23	0.45	2.29
35 2019	0.03	9.05	9.08	108.03	98.95	0.61	7.31	0.32	3.84	0.17	2.05
36 2020	0.03	9.05	9.08	108.03	98.95	0.57	6.77	0.29	3.49	0.15	1.83
37 2021	0.03	9.05	9.08	108.03	98.95	0.53	6.26	0.27	3.18	0.14	1.63
38 2022	0.03	9.05	9.08	108.03	98.95	0.49	5.80	0.24	2.89	0.12	1.46
39 2023	0.03	9.05	9.08	108.03	98.95	0.45	5.37	0.22	2.63	0.11	1.30
40 2024	12.00	9.05	21.05	108.03	86.98	0.97	4.97	0.47	2.39	0.23	1.16
41 2025	0.03	9.05	9.08	108.03	98.95	0.39	4.60	0.18	2.17	0.09	1.04
42 2026	0.03	9.05	9.08	108.03	98.95	0.36	4.26	0.17	1.97	0.08	0.93
43 2027	0.03	9.05	9.08	108.03	98.95	0.33	3.95	0.15	1.79	0.07	0.83
44 2028	0.03	9.05	9.08	108.03	98.95	0.31	3.66	0.14	1.63	0.06	0.74
45 2029	0.03	9.05	9.08	108.03	98.95	0.28	3.38	0.12	1.48	0.06	0.66
46 2030	12.00	9.05	21.05	108.03	86.98	0.61	3.13	0.26	1.35	0.11	0.59
47 2031	0.03	9.05	9.08	108.03	98.95	0.24	2.90	0.10	1.22	0.04	0.53
48 2032	0.03	9.05	9.08	108.03	98.95	0.23	2.69	0.09	1.11	0.04	0.47
49 2033	0.03	9.05	9.08	108.03	98.95	0.21	2.49	0.09	1.01	0.04	0.42
50 2034	0.03	9.05	9.08	108.03	98.95	0.19	2.30	0.08	0.92	0.03	0.37
TOTAL	777.89	413.37	1191.26	4674.28	3483.02	588.66	779.75	527.71	563.94	478.10	421.17

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.32 (8%), 1.07 (10%), 0.88 (12%)

INTERNAL RATE OF RETURN (IRR) = 10.7 %

Table 1-4-6 Project Cost and Benefits, Package Project (Case 2)

- Lam Plai Mat and Huai Phlu Sub-Project -

(UNIT : MILLION BAHT)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE -DISCOUNT RATE 8 %-		-DISCOUNT RATE 10 %-		-DISCOUNT RATE 12 %-	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1985	16.29	0.0	16.29	0.0	-16.29	16.29	0.0	16.29	0.0	16.29	0.0
2 1986	45.47	0.0	45.47	0.0	-45.47	38.98	0.0	37.58	0.0	36.25	0.0
3 1987	48.64	0.0	48.64	-3.29	-51.93	38.61	-2.61	36.54	-2.47	34.62	-2.34
4 1988	154.43	0.0	154.43	-3.80	-158.23	113.51	-2.79	105.48	-2.60	98.14	-2.41
5 1989	290.79	0.0	290.79	-3.80	-294.59	197.91	-2.59	180.56	-2.36	165.00	-2.16
6 1990	93.54	4.81	98.35	26.11	-72.24	61.98	16.45	55.52	14.74	49.83	13.23
7 1991	10.59	8.68	19.27	59.57	40.30	11.24	34.76	9.89	30.57	8.72	26.95
8 1992	0.0	8.68	8.68	77.56	68.88	4.69	41.90	4.05	36.18	3.51	31.33
9 1993	0.0	8.68	8.68	89.94	81.26	4.34	44.99	3.68	38.14	3.13	32.43
10 1994	11.62	8.68	20.30	97.05	76.75	9.40	44.95	7.83	37.42	6.54	31.25
11 1995	0.0	8.68	8.68	101.01	92.33	3.72	43.32	3.04	35.40	2.50	29.04
12 1996	0.0	8.68	8.68	103.37	94.69	3.45	41.05	2.77	32.94	2.23	26.53
13 1997	0.0	8.68	8.68	104.18	95.50	3.19	38.31	2.51	30.18	1.99	23.88
14 1998	0.0	8.68	8.68	104.22	95.54	2.96	35.48	2.29	27.44	1.78	21.33
15 1999	0.0	8.68	8.68	104.25	95.57	2.74	32.86	2.08	24.96	1.59	19.05
16 2000	11.62	8.68	20.30	104.26	83.96	5.93	30.43	4.42	22.69	3.31	17.01
17 2001	0.0	8.68	8.68	104.26	95.58	2.35	28.18	1.72	20.63	1.26	15.18
18 2002	0.0	8.68	8.68	104.26	95.58	2.17	26.09	1.56	18.75	1.13	13.56
19 2003	0.0	8.68	8.68	104.26	95.58	2.01	24.16	1.42	17.05	1.01	12.11
20 2004	0.0	8.68	8.68	104.26	95.58	1.86	22.37	1.29	15.50	0.90	10.81
21 2005	0.0	8.68	8.68	104.26	95.58	1.72	20.71	1.17	14.09	0.80	9.65
22 2006	11.62	8.68	20.30	104.26	83.96	3.73	19.18	2.49	12.81	1.68	8.62
23 2007	0.0	8.68	8.68	104.26	95.58	1.48	17.76	0.97	11.64	0.64	7.69
24 2008	0.0	8.68	8.68	104.26	95.58	1.37	16.44	0.88	10.59	0.57	6.87
25 2009	0.0	8.68	8.68	104.26	95.58	1.27	15.22	0.80	9.62	0.51	6.13
26 2010	0.0	8.68	8.68	104.26	95.58	1.17	14.10	0.73	8.75	0.46	5.48
27 2011	0.0	8.68	8.68	104.26	95.58	1.09	13.05	0.66	7.95	0.41	4.89
28 2012	11.62	8.68	20.30	104.26	83.96	2.35	12.09	1.41	7.23	0.85	4.37
29 2013	0.0	8.68	8.68	104.26	95.58	0.93	11.19	0.55	6.57	0.32	3.90
30 2014	0.0	8.68	8.68	104.26	95.58	0.86	10.36	0.50	5.98	0.29	3.48
31 2015	0.0	8.68	8.68	104.26	95.58	0.80	9.59	0.45	5.43	0.26	3.11
32 2016	0.0	8.68	8.68	104.26	95.58	0.74	8.88	0.41	4.94	0.23	2.77
33 2017	0.0	8.68	8.68	104.26	95.58	0.68	8.23	0.37	4.49	0.21	2.48
34 2018	11.62	8.68	20.30	104.26	83.96	1.48	7.62	0.79	4.08	0.43	2.21
35 2019	0.0	8.68	8.68	104.26	95.58	0.59	7.05	0.31	3.71	0.16	1.97
36 2020	0.0	8.68	8.68	104.26	95.58	0.54	6.53	0.28	3.37	0.15	1.76
37 2021	0.0	8.68	8.68	104.26	95.58	0.50	6.05	0.26	3.07	0.13	1.57
38 2022	0.0	8.68	8.68	104.26	95.58	0.47	5.60	0.23	2.79	0.12	1.41
39 2023	0.0	8.68	8.68	104.26	95.58	0.43	5.18	0.21	2.53	0.10	1.25
40 2024	11.62	8.68	20.30	104.26	83.96	0.93	4.80	0.45	2.30	0.22	1.12
41 2025	0.0	8.68	8.68	104.26	95.58	0.37	4.44	0.17	2.09	0.08	1.00
42 2026	0.0	8.68	8.68	104.26	95.58	0.34	4.11	0.16	1.90	0.07	0.89
43 2027	0.0	8.68	8.68	104.26	95.58	0.32	3.81	0.14	1.73	0.07	0.80
44 2028	0.0	8.68	8.68	104.26	95.58	0.29	3.53	0.13	1.57	0.06	0.71
45 2029	0.0	8.68	8.68	104.26	95.58	0.27	3.27	0.12	1.43	0.05	0.64
46 2030	11.62	8.68	20.30	104.26	83.96	0.59	3.02	0.25	1.30	0.11	0.57
47 2031	0.0	8.68	8.68	104.26	95.58	0.23	2.80	0.10	1.18	0.04	0.51
48 2032	0.0	8.68	8.68	104.26	95.58	0.22	2.59	0.09	1.07	0.04	0.45
49 2033	0.0	8.68	8.68	104.26	95.58	0.20	2.40	0.08	0.98	0.03	0.40
50 2034	0.0	8.68	8.68	104.26	95.58	0.19	2.22	0.07	0.89	0.03	0.36
TOTAL	741.09	386.73	1127.82	4505.47	3377.65	553.50	749.15	495.76	541.26	448.84	403.81

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.35 (8%), 1.09 (10%), 0.90 (12%)

INTERNAL RATE OF RETURN (IRR) = 10.9 %

ANNEX J RURAL SOCIOLOGY

ANNEX J. RURAL SOCIOLOGY

Page

ANNEX J. RURAL SOCIOLOGY

J.1. *Social Dynamics in the Villages*

A particular emphasis had been placed upon the subject during the field operations, with a hope that something may emerge through intensive discussions and deliberations of the following items for proper formulation of the development strategies especially for on-farm work of the terminal irrigation services and for communal facilities for villagers' basic human needs to be involved in the proposed Lower Northeast Medium Scale Irrigation Project.

1. General
2. Family Composition of the Households
3. Cooperative Patterns in the Village Daily Life
4. Decision Making at Farmers' Level
5. Village Leadership
6. Labor Custom in the Village
7. Migration Pattern
8. Buddhism
9. System of Decision Making at Administrative Level
10. Vegetable Gardening in Ban Don Daeng, Chanwat Khon Kaen
11. District Characteristics between the Least Poor and the Poorest
12. Water Resource Development: Type and Design

Note: The original of this note was reviewed by Dr. Amara Pongsapich, Social Research Institute of Chulalongkorn University in December 1983. Her comment has been fully incorporated.

1. General

It would not be possible during the short period to describe, not to say to analyze the overall institutional framework that comprises of the Northeast rural society in general and of its Lower Northeastern components in particular to its full extent. Since it should be assumed that whatever action would usually generate reaction, it could be concluded that farming communities are rather dynamic than static. There is a tradition which in itself is a process of acceptance, rejection, selection, omission and modification that have been going on a way best described as two overlapping curves along one, and the same axis thus forming equal amplitudes due to its bringing alternate generation gaps; therefore, changes have been a common feature of the farmers' societies. In the case of farmers in the Lower Northeast, however, the regulative mechanism described as "oscillation" has allowed for impacts towards the kind of drastic change which would be caused by crisis in due course of modernization and development, and is called "social change".

Dr. Koichi Mizuno, Professor of the Center for Southeast Asian Studies, Kyoto University, Japan carried out the village study from 1964 to 1966 in Muban Dong Daeng, Tambon Dong Hang, Amphoe Muang, Changwat Khon Kaen, after which he pointed out the following salient features:

- Cultivation of paddy and other crops which is managed by reciprocal cooperation among the family members and close kinsmen is primarily for subsistence. Since no other major income sources exist, no great disparity in income level is identified among the village peoples.

° Reciprocal cooperation between close kinsmen in farming, animal breeding and other economic activities would be a key to understand the core social structure in the village that coordinates all these structural aspects of the village life in order to get some diachronic perspectives on the future change of the village life.

° The core social structure is also related to the kinship sytem, which has bilateral features with uxori-matrilineal quantities. These characteristics could be recognized in the rule of residence after marriage, the mutual aid system, and the rule of inheritance.

° The village vertical structure cannot be grasped without an insight into the structural processes of the developmental cycle of the family and the structural relationship of parent-daughter households. The lower strata of the village society consist mainly of the younger dependent households; while the upper strata mainly of the parental independent household. Village leaders come from the latter households.

The following observations have been made after the rural-sociological study in the Lower Northeast region:

- Factors affecting a change in rural area are numerous and diverse. Interplay between them is so complicated that it is very difficult to predict the direction and the rate of changes.

- Changes which have actually taken place have their own rationale. The government's help is not necessarily a preconditions for change to take place.

2. Family Composition of the Households

1. Single : widow
2. Conjugal : husband and spouse
3. Nuclear : parent(s) + unmarried children
4. Extended:
   - I ------ single + odd relatives
   - II ----- conjugal + odd relatives
   - III ----- nuclear + odd relatives
5. Others:
   - I ------ single + odd relatives
   - II ------ conjugal + odd relatives
   - III ------ nuclear + odd relatives

Majority of the rural households would belong to the above 3 and 4.

Notes: Working age ------ 15 to 65 years
Dependents-------- Pre-school children, aged under 7 years
School children, aged 7-4 yrs.
Elder, aged 65 yrs. or more

3. Cooperative Patterns in the Village Daily Life

Like other rural areas in the Northeast, the villagers usually live together in villages surrounded by paddy field and other agricultural lands. Some villagers, however, have to travel quite a distance to their farm lands. Most of the families have settled in the villagers for long years and have developed strong ties and relations among themselves.

It is said that the farmers mostly have their own land with few percentage of the tenant farmers. A fairly high rate of the renting farmland is remarkable due to the traditional mutual aid system amogn close kinsmen. This may be found clearly in the landlord-tenant relationship. A change, however, could also be observed in the

pattern of landlord-tenant relationships, reflecting the changes of socio-economic conditions in the village and its environs.

The farm land is mainly rented between parent and daughter, between sisters and between close kinsmen. This is particularly in the case of paddy land. This seems to be closely related to the traditional female-focused close kin cooperative system. In the case of upland fields and garden land, the same tendency is also observed, but with a slightly different shading in close kin renting relations. A fairly high rate of landlord-tenant relationships between non-kin people is noticed, and the parent-son renting is frequent between kin.

The rental pattern between parent and child in the case of paddy land is free-renting, reflecting the factor that their relationship is not the so-called landlord-tenant relationship but that of the close kin mutual aid system. This free-renting is also sometimes observed between siblings together with share-cropping, which is predominant between other kin and between non-kin. In the case of upland field and garden land, free-renting is also outstanding in the relationship between parent and child and between kinsmen; however, fixed rental is found in the landlord-tenant relation between non-kin farmers with the rent of about ฿100 per rai.

"Work together, eat together and use together" is considered as the ideal norm within the close kin grouping called "chum". It is not merely a social category without any sense of grouping. A fairly clear sense of social boundary that distinguishes insiders and outsiders could be noticed in the daily use of the term. The mode of cooperative among close kinsmen is various including (1) cooperation in farming works, (2) sharing the products of farm land, (3) entrusting the farm management to close kin, (4) free-renting of farm land, (5) free-renting or sharing of house land, (6) working together for animal husbandry, and (7) various exchanges for mutual help.

Some changes in social life can also be noticed as a result of changes in economic life. It was formerly considered ideal for close kinsmen to live close to each other so that they could help each other in their daily life. Since the income level of households is diversified, some of the village people think that it is not good for kinsmen to live close to each other when their income levels are different, because the children of the lower income family would notice the things bought for those of the higher income family and pester their parents, and this would be the cause of quarrels between the close kinsmen. It should be imperative to identify the corresponding changes in kin and non-kin exchange systems among the villagers through which various aspects of their daily life are coordinated.

The basic cooperative patterns in the village daily life and these diachronic and synchronic features should be properly evaluated so that some developmental perspectives of a village in the Northeast Thai could be delineated and a plan of the water-based integrated rural development under the proposed irrigation project would be worked out.

4. Decision Making at Farmers' Level

The Northeastern farmers are not simply rice growers engaging in a single economic activity, and they appear to be managing a quite complex farm level resource system in which their interaction with any single component is likely to affect their relations with other components. For example, when an off-farm labor employment opportunity may expect high returns, no crop may be grown even if the dry season water can be provided in a reliable manner.

The villagers appear to highly value independence and freedom. The growing of sufficient rice to feed their family each year is a major goal, and also they try to grow vegetables, fruit and poultry for their own subsistence needs and also cash income. In addition, they value religious merit and need cash to make as gifts to the monks, as contribution to the upkeep of the wat and for ordination of the young men. They also require cash for education and health. Finally, they need to be in better standing with their neighbours and relatives, able to pay off debts, give cash and goods to those who need them, and provide for feasts and ceremonies as the occasion arises.

Over and above the basic needs, the farmers seek to generally increase their income, and with a rapid growth in recent years of on-farm and off-farm employment, they are quick to take advantage of the real opportunities. Given these goals and their relative priorities, the villagers would take one of the relatively small number of strategy which depend upon (1) amount and type of land available, (2) amount and skills of labor available, and (3) off-farm employment opportunities (agri and non-agri.).

The strategies may be roughly classified as follows:

Conditions	Strategies
1. Subsistence cropping not a goal (rare)	COMMERCIAL (grow cash crops, buy rice)
2. Less than or just sufficient paddy land or labour for subsistence	SUBSISTENCE DOMINATED
a) village or farm labour opportunities	a) PLUS FARM OR VILLAGE LABOR
b) off-village labor opportunities	b) PLUS OFF-VILLAGE LABOR
c) craft skills	c) PLUS FARM CRAFTS
3. More than sufficient paddy land for subsistence	CASH DOMINATED
a) uplands & labor available	a) UPLAND CROPPING
b) water in dry season	b) DRY SEASON CASH CROPPING
c) pasture land and labor	c) LIVESTOCK FOR CASH
d) craft skills	d) FARM CRAFTS
e) off village labor opportunities	e) OFF VILLAGE LABOR

Within these broad strategies, the villagers would adopt variable tactics from year to year, season to season and every week, based upon the available labor and their control of it, employment opportunities, the relative anticipated prices of the major cash crops, and water conditions.

- The attitudes, values and goals of the farmers in relation to the basic cooperative pattern in the village daily life.

- How to determine the choices of subsistence and cash strategies/*.

- The best mixes of crops, livestock, farm crafts and off-farm employment to promote productivity, stability and durability of the farm income.

- Impact of population pressure in future.

- Significance of the internal and external factors affecting the dynamic aspect of the village community.

/* --- co-existence of subsistence and market economies and its meaning to rural development.

5. Village Leadership

Compared with villages in the Central Thai, the Northeast village would have a fairly well-organized autonomous village organization lead by muban head and some assistant heads. It has a Village Community Development Committee which functions as a village council, an advisory group to the village leaders, a temple committee, a financial committee, the educational committee of the school, a youth association and others.

Leaders in the village would be qualified with the following characteristics:

(1) The consensus of the villagers on the village leaders is very high.

(2) Some are the knowledgeable village elders.

(3) They are economically well off and socially stable in that they have many important relatives around them in the village.

(4) They are very interested in both commercial and religious activities.

(5) They are also the coordinators of village opinion.

Sociologically, this fact may partly be due to the clustered settlement pattern and partly to the fact that village structure is closely related to the nature of kin relationship.

6. Labor Custom in the Village

An important traditional custom in the Northeast villages had been that of labor exchange (long khak), principally used during the times of transplanting and harvesting rice. Farmers were helped by relatives and neighbors on these tasks, and in turn they provided a meal during the workday and incurred an obligation to reciprocate with their own labor for the same type of work. Usually, a village had several of these groups, within which labor was exchanged.

There is a recent tendency that the labor exchange has been much less common, partly because of upland cropping which requires a much tighter scheduling of labor and partly because money is the accepted medium of exchange. Labor exchange, however, is still important for house construction. Another common traditional practice is to hire a young man for the rice season who would live with the landowner's family with a payment of 100 tang of rice at harvest. Hired casual labor by the day or season has become increasingly common with the spread of a monetized economy.

Voluntary community labor was important for centuries. Farmers worked during the dry season for the villages in the construction and maintenance of roads, ditches, wells, bridges, schools and so forth. But, this practice is also declining particularly under the influence of the Government's job creation program whereby farmers, their spouses and dependents are hired for wages to carry out this work. There would be danger that the job creation program will destroy the willingness to undertake communal work.

With respect to a particular relevance to the Northeast poverty problem, the Government has launched a special rural work program so-called "Job Creation Project" to provide employment for the villagers in the dry season and alleviate the heavy seasonal migration. This policy has beneficial effects in the short run, but there likely would be problems in the long term. First, the wage paid is tied to the minimum industrial rate that is considerably higher than the income from alternative rural employment that could be derived from farm activity such as cropping in the dry season, livestock raising, silk manufacture, etc. Second, many of the projects are those which might be otherwise carried out as voluntary communal activity that has been traditional to the area in the past.

7. Migration Pattern

The prevailing tendency in Thai-Lao (Isan) culture is for daughters to inherit the house, rice and other land of their parents. Young men have traditionally left home to seek a wife and land or a job in another province. The consequence of this pattern of marriage and land inheritance is an expansionist system, consisting of a fairly rapidly shifting movements by individuals between households and villages, and by families between villages, sometimes at great distance. The Northeast Thai-Lao pattern of internal and external migration thus has deep origins. Nowadays, young girls are also going or are sent away to work, sometimes to improve the household's access to external resources, at other times seemingly for adventure.

The seasonal out-migration is quite common in the area, especially after the rice harvesting when the farm work load becomes low.

- Some of the people become temporary vendors of the household necessities such as clothes, mats and others in other tambons or amphoes.

- Quite a number of working-age residents seek off-farm employment in major urban cities.

- These temporary emigrants would return home early in the rainy season to participate in the farm activities.

- Semi-permanent emigrants work in the Middle East particularly in Saudi Arabia where their earnings are very high.

Whether or not emigration of the labor force would affect the proposed Project which will require more labor input than at present.

It is said that even if sufficient water could be provided for dry season crop, no crop may be grown since off-farm labor employment may yield higher returns, thus drawing off available rural labor supply.

8. Buddhism

The vast majority of population are Buddhists who are pursuing the Buddhist way of life, that is more stringent than that of the urban people. In the annual village calendar, the main communal events have religious overstones or are imbued with religious significance, which include the annual cycle of the twelve religious festivals plus occasions such as the ordination of young men as monks. Some of those festivals focus on the household, some on the village, and some on a ceremonial community that includes a number of surrounding villages. These festivals may include the presentation of gifts and copious food to the monks, which are later shared among villagers. Thus, religion may be seen as facilitating a range of social relationships throughout the Northeast.

9. System of Decision Making at Administrative Level

The principal systems of Government's decision making in the Northeast region exhibit two major characteristics, viz. first, there is considerable overlap of responsibility, and second, the key decisions in many instances are made at national level rather than regional.

The appointment, promotion, demotion or transfer of the changwat governor and the amphoe head is under the authority of MOI. In addition, there are also officials from other ministries stationed in every changwat and amphoe administration who are directly under the control of the central government.

The leaders at the lower level, tambon and muban are popularly elected. The muban head (puyai ban) is directly elected by the muban people, while the muban heads in a tambon then can be the candidates for the tambon head (kamnan) who is also popularly elected. Both leaders are not civil servants, but are entitled to wear uniforms and paid a small honorarium for their services. Both the heads may be, depending upon personal characteristics, influential to the people in the daily life. With respect to the source of information and news as well as of knowledge of the local people, both leaders are also important, viz. they usually have frequent contacts with the amphoe and changwat offices to obtain official news for their villagers. On the other hand, the village people contact the amphoe and changwat officials to ask for the needed assistance.

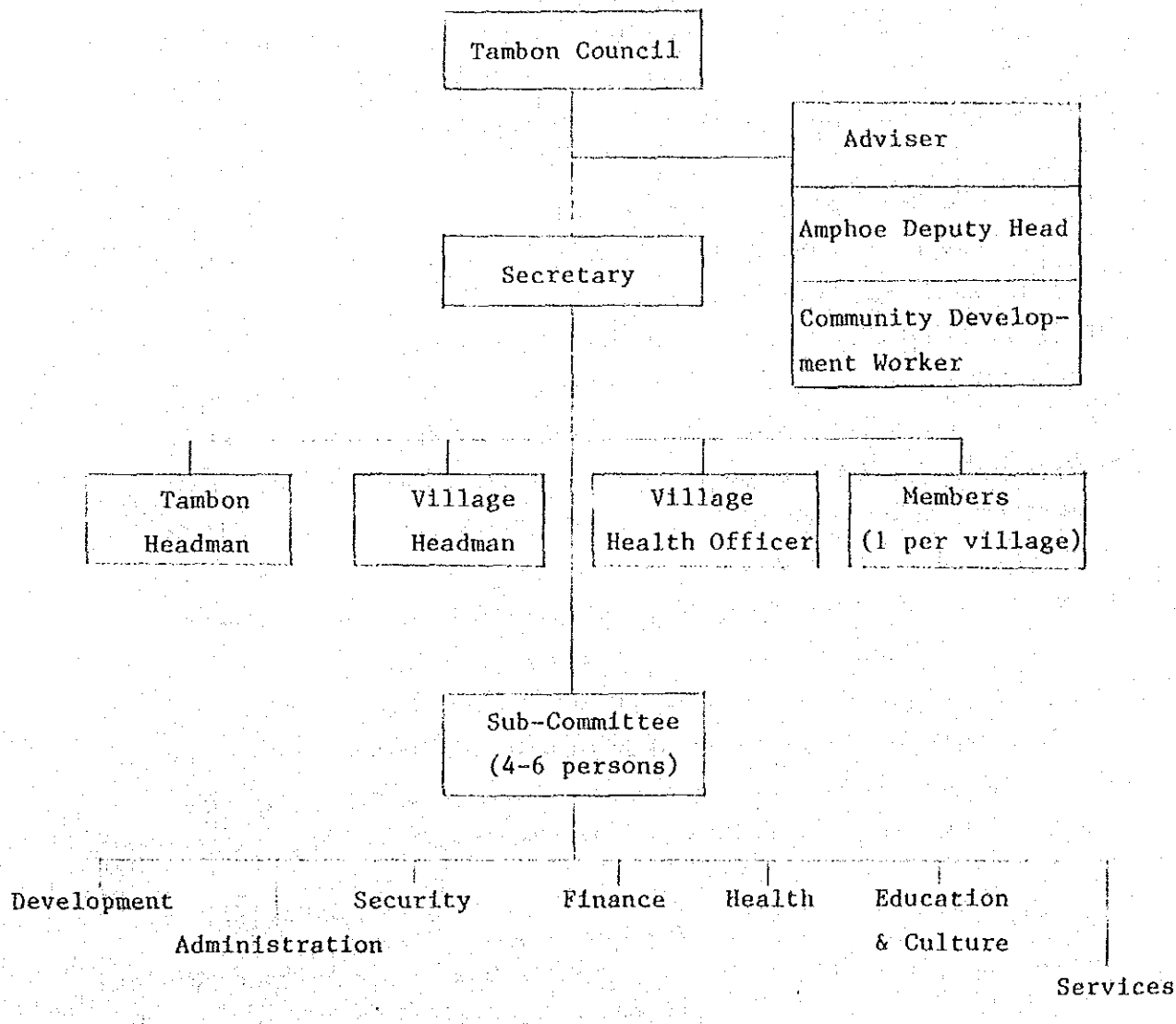
The tambon head and muban head can be considered quasi-agents of the central government and are responsible for transmitting to the people the directions of the Government as handed down through the chain of command, and responding upwards with specific information and answers to questions. Their function includes the supervision of law and order in the tambon or muban, the supervision of agricultural projects, participation in ceremonial duties, recording vital statistics, tax collection, and ex-oficio membership on the tambon council. They should try to maintain the peace and happiness of their tambon or muban by settling disputes, promoting village projects, and communicating with the amphoe officials.

Probably the most important decisions at the muban level are those concerning the management of communal resources/* such as grazing land, water, fishpond, forest and so forth. For each farm

/* --- (1) Nature and extent of communally managed resources.
(2) Policy to manage the communal resources; viz. individual access to them alloted? and conflicts involved?
(3) The loss of communal linkages would seriously threaten the durability of the village in the face of crop instability. Which linkages should be preserved or strengthened?

household, access to village level resources and the need to meet demands of the village level social system may critically constrain the farmer decision making. For instance, access to the communal grazing lands may be a key factor in determining the size of livestock herd raised by individual families. The village norm about communal sharing of available water during the dry season may limit individual opportunity for irrigation activity.

Tambon Council



The current policy of the Government is to encourage local participation in rural development. To achieve this objective, a Tambon Council Program has been introduced. The main function of the Tambon Council is to plan and carry out the tambon development program under the governmental supervision.

10. Vegetable Gardening in Ban Don Daeng

Ban Don Daeng is sociologically situated in the domain of Khon Kaen city, lying 10 km due northwest of the villages, and is physically located at the boundary of floodplain along the Mae Nam Chi and the so-called "Middle Terrace".

Although the paddy growing is very unstable in this village because of the natural conditions, it is still important for villagers' subsistence. Farmers traditionally plant glutinous rice for home consumption and store up to three years' supply in their rice barns. They will not normally sell any of this rice until they are assured of a good yield in the coming harvest. The villagers expect a bad harvest once in three years due to drought or flood.

The recent improvement of communication and traffic conditions, howerver, have given the villagers access to urban market and greatly increased the economic value of the upland crop (cassava) and garden crops (chili and other vegetables). This trend has motivated the villagers to make more effort to increase their production of cash crops by using chemical fertilizers, insecticides and water pumps for garden crops during the dry season.

Although the area and number of growers for the paddy land and upland field are limited, it is in the ownership and operation of vegetable gardening that a remarkable change has occurred recently. Vegetable-growing is an important source of cash income for the majority of households, and also vegetable cultivation is very significant in terms of working hours. Therefore, in order to understand the muban structure and important activities of the villagers, a study of vegetable gardening is indispensable.

At present, the average area of paddy land and upland field owned and operated per household is 17 rai and 6 rai respectively. The total area of garden land owned and operated has increased greatly from 73 to 142 rai and from 73 to 130 rai respectively during the past two decades. The numbers of owners and operators have also increased greatly from 57 to 104 and from 57 to 125. The average of garden land owned and operated per household has increased from 1.27 to 1.36 rai in the case of ownership and decreased from 1.27 to 1.30 rai in the case of operation.

Farm Households by the Area of Garden Land

(D.D. 1981)

Owned			Cultivated		
Area (rai)	No.	%	Area (rai)	No.	%
0	72	(41)	0	51	(29)
0 - 1	61	(35)	0 - 1	78	(44)
1 - 2	23	(13)	1 - 2	29	(17)
2 - 3	11	(6)	2 - 3	9	(5)
3 - 4	4 104	(2)	3 - 4	2 125	(1)
4 - 5	0		4 - 5	0	
5 - 6	0		5 - 6	2	
6	5	(3)	6	5	(3)
	176	(100		176	(100

Note: By main occupation of household:

Farmer: 111 (63%)

a. Paddy 108

b. Vegetable 2

c. Sugarcane 1

Neither hired labor nor labor exchange is used for vegetable growing. Normally, garden land is operated by wives, sometimes helped by unmarried and/or married daughters. Two decades ago, it was the men who took vegetables to the nearby urban markets for sale, but now it is the women's work. Whether such co-working groupings for vegetable-growing are the same as the groups for other farming operations is not clear.

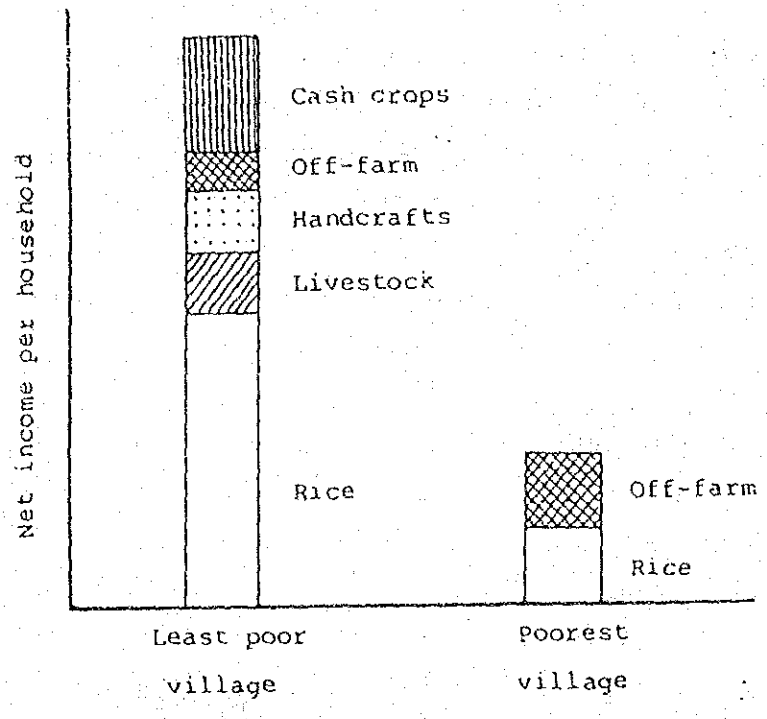
Various vegetables are planted, but the main crop is chili which can be exchanged for rice when the paddy yield is bad due to unfavorable weather. The vegetable-growing farms vary greatly in production, cash sale and bartering of vegetables. These variations could be explained by availability of family labor than by land availability, because a substantial area suitable for vegetables is left uncultivated. The variations may be more closely related to the availability of female labor than that of the total family labor.

Since intensive labor is required for the operation of garden land, particularly the constant watering during the dry season, the area operated is greatly smaller than that of the paddy land. Many farmers think that the desirable area of paddy for subsistence is around 10 to 30 rai, but none of them have a strong desire to enlarge their holding further because of the unstable productivity. They also have no keen desire to enlarge the operated area of garden land due to the intensive labor required for its operations. In the case of upland field, however, they think it desirable to have a larger area for cultivation, and this fact may reflect their idea that the upland crop cultivation is a good means of increasing income.

The annual gross income from vegetable growing was reported at more than ฿50,000 in 2 cases, ฿30,000 to 10,000 in 5 cases and less than ฿10,000 in 5 cases. While numerous crops are grown for home consumption to a lesser extent, the gross income from vegetables would differ greatly among the growers and appear to be related more to management than the size of the garden. Perishability of produce,

demand by neighboring villages and marketing conditions appear to have resulted in the variation in the selling/bartering ratio with the kind of crop. This ratio also appears to depend upon such factors as the availability of female family members who can go to the market place and the relative importance of vegetable faring vs. paddy farming in the household economy.

11. Distinct Characteristics between the Least Poor and the Poorest



Generalized patterns of income characteristics of least poor and poorest village in Northeast Thailand.

The recent finding indicates that the least poor and the poorest are distinguished by a distinctive cluster of characteristics as shown above. In general terms, the poorest villages would have alow rice income obtaining half to two thirds of their per capita rice requirement, and they survive on the basis of off-farm income, while the least poor villages have sufficient rice per capita with a surplus in some years, and also have large, highly varied and balanced sources of other income.

These differences, of course, reflect those in resources. The important variables would be farm size, land form in terms of proportion of lower/upper paddy and upland, availability of the wet season water, transportation and markets, and the degree and regularity of occurrence of drought and flooding.

How can the poorest village achieve the characteristics typical of the least poor villages? It seems probable that one or more major thresholds exist between the poorest and the least poor. The interaction of variables in the poorest is likely to produce negative feedback loops that keep the village poor. On the other hand, the feedbacks are likely to be positive in the least poor, and they would become progressively better off.

It is evident that many of the variables determining village household income are environmentally given. An interesting question concerns those villages which are better off or worse off than they should be on purely environmental criteria. It is believed that careful examination of those villages may reveal clues to development strategies which can be adopted in others.

It is very evident that there is a considerable discrepancy betwen (1) how the farmers use the land and (2) the recommendations for land use in the land suitability maps prepared on the basis of soil and topographic survey. Throughout the Northeast, farmers grow paddy on the land which is designated as only suitable for upland crops. Such is seen in the upper paddy crop production on the critical land forms where a great many farmers provide only possible opportunity of meeting their subsistence rice requirement, once in some years.

To what extent should farmers be encouraged or persuaded to change their land use practices to confirm to the above recommendations?

12. Water Resources Development: Type and Design

The provision of water as well as the transfer of technology are commonly considered at administrative level to be crucial to the agricultural development in the Northeast Thai. These two factors also are often looked upon as interrelated, thus there is a strong bias towards irrigated agricultural development.

The problems which have arisen on irrigation schemes in the Northeast also highlight the problems of technology transfer if the conditions are not right. The attempts to introduce irrigated agriculture into the schemes have generally proved disappointing.

With few exceptions, it is said that farmers do not take up the new opportunities which the improved water supply is supposed to provide. Closer examination suggests that it is not the lack of technology per se which is the problem, but it is the farmers's lack of certainty and confidence brought about by the newly changing situations to be created by the water resources development.

In the case where farmers have a high degree of control over water/1 and the production of irrigated crops does not interfere with other activities/2, and the farmers as innovative as those elsewhere are expected to yield markedly better return, they would quickly take up the new opportunities.

/1 --- It would be otherwise more important to concentrate extension effort on providing appropriate technology for existing rainfed irrigated agriculture.

/2 --- Proportion of irrigated land currently double-cropped is still small presumably due to the limitations of labor and cash in many of the schemes.

For this reason, extension or the technology transfer alone, when other conditions have not been met, is insufficient for agricultural development to take place.

Under the proposed program that would be devised to meet the basic water requirements of the poor farmers, greater emphasis is to be put on local villagers' participation in initiating the project, in contributing labor for construction, in cost sharing and in operation and maintenance of the system. This objective is to ensure that the local people feel the sytem belongs to them.

- What are the best type and design of the proposed Project for providing stable and durable agricultural production?

- Need of the examination on the post-project evaluation of the SSIP in the proposed service area.

J.2. Special Aspects on Rural Development

01. Provision of the basic water requirements in villages in general and implementation of the integrated rural development in particular cannot be successful if all decision-making and planning are centered in Bangkok, as has been the practise until recently. The government has now established a clear policy of decentralization which aims at strengthening the changwat administration as the local decision-making unit by building up the capability of changwat to plan as well as by channelling funds for rural development programs through the changwat administration.

The changwat appears to be the most appropriate level for planning and coordinating the implementation of programs to meet the basic water requirements of mubans concerned, as well as planning for distributing water supplies from the RID-operated canals. A number of small schemes are premised involving a large number of the line agencies and local administration levels which should be coordinated and compiled into a coherent whole.

02. The need for decentralization of authority has been recognized throughout the developing worlds as one of the foundations of successful rural development strategy. The same is seen for Thailand, which had developed a highly centralized bureaucratic system, gradually weakened local government and made local administration ineffective, therefore, being heavily dependent upon strong directives from Bangkok. This has currently been recognized, and a number of steps have been taken towards effective decentralization. The Department of Local Administration (DOLA) in the Ministry of Interior is placing increased emphasis on changwat planning and the strengthening of planning capabilities at this level.

03. In general, the Thai central government channels its funds for rural development through two different procedures. Normal agency budgets which are received from the Budget Bureau are channelled to the region for on-going project development by the various line agencies. The second channel being similar to the tambon council scheme initiated in 1976 entails a direct flow from the central government to the changwat for special development projects at the tambon and village level.

04. Channelling funds for rural development directly to the changwat would be an important development which needs to be continued as so far emphasized by DOLA. This development, however, would not be successful if the changwat cannot utilize its resources for obtaining the services of professionals. The procedures for transferring changwat development fund to line agency-operated projects have been roughly established, but appear to be cumbersome.

It is recommended that flow of the budget from changwat development programs to the line agencies will need to be streamlined and agreed upon in advance so that technical and equipment support by line agencies could be available upon changwat's request. In this manner, the line agencies may be encouraged to use the funds made available to changwat, in addition to the funds made available to them directly through central budgetary allocation.

05. The changwat appears to be the lowest level at which good professional services with managerial and technical manpower can be concentrated. It is believed that efforts to expand technical expertise at the changwat level will considerably improve the probability of success of decentralization.

A source of the technical personnel would be the ARD Office in each of the changwats of the Northeast Thai. ARD teams, with qualified and experienced engineers and numerous technicians are working closely with the changwat and amphoe officers to plan, design and construct roads, deep/shallow wells and village ponds. It is said that many changwat offices would have technicians currently under employed, because of a shortage of more qualified engineers at the changwat level to give them guidance on a daily basis.

At present, RID has approximately one engineer and one assistant in every changwat of the Northeast, each responsible for about 10 SSIP. RID could use personnel from its Region VI in Korat to assist with small water schemes, and could increase the number of field staff by borrowing from its Bangkok headquarters.

It is reported that many bilateral foreign aid agencies would be interested in providing technical assistance to individual changwat on a grant basis. To be of most value, foreign water resources engineers should be involved simultaneously with planning and implementation, both at changwat level and at demonstration and training sites.

06. It would be unrealistic to expect the local farmers in the Lower Northeast to participate in muban water development activities unless they believe their participation will benefit them, despite a fact that many socio-economic surveys of villages in the Northeast have revealed their top priority is access to water for consumption and irrigation, above such items as road, health and education. It is, therefore, necessary to solicit farmers' views on their water needs, promote the on-farm and muban water programs and assess their willingness to participate in planning and execution of such programs.

07. An assessment of the farmers' willingness can be made by someone who deals with them on a regular basis, such as the Community Development worker or the Agricultural Extension agent, or by an outside promoter who comes in for the specific purpose of introducing the government program. As with many other integrated rural development projects, it is expected that the Community Development worker in each tambon will play the crucial role in mobilizing people's participation and interest. He will be requested to call village meetings in his tambon with the sole purpose of discussing water supply problems of which the villages are very conscious.

08. Before the program is introduced to a muban, a promotion campaign should be initiated by radio, handbills and administrative circulars from the changwat planning office who should coordinate all activities of the line agencies concerned. Promotion may be accompanied by a manual which describes the village water development program with the available alternatives to be chosen by each muban. The CD worker can then refer to this manual, and the villagers will be told they are entitled to choose the alternative from the manual which would explain the cost of each and the contribution expected from the villagers in terms of labor, land and money.

09. At present, each of the line agencies would not possess the necessary manpower to identify the most feasible water-based integrated development scheme on a muban-by-muban basis. The changwat planning office will need to organize survey teams of engineers and experts to be recruited from the line agencies or through utilization of consulting firms who will visit every muban and, working with villagers, will identify the most feasible scheme with preparation of the preliminary engineering design. While the above team identifies those schemes on a tambon-by-tambon basis, the tambon council will assist in preparing project documents and submit, through the amphoe office, to the changwat planning office for approval.

J-3. Definition of the Poverty Line

1. NESDB indicates that the present poverty line in rural area at ฿3,500 per capita per year (1982/83) has been slided by an appropriate Consumers' Price Index from the 1976 one at ฿1,981 per capita per year that is estimated at the World Bank Country Study: Thailand, Income Growth and Poverty Alleviation, 1980.

The 1976-rural poverty line was calculated by (1) a set of recommended minimum nutritional diet requirement by age group and sex based upon actual Thai body sizes and activities as prepared by Ministry of Public Health, (2) unit prices from the 1976 Consumer Prices Indices for the Northern Region, and (3) expenditures on non-food items from the ratio of food to total expenditure for the lowest quintile from the 1975/76 Socio-Economic Survey. Expenditures by category at the poverty line in 1976 per capita per year are shown below:

	Rural			Urban		
	฿	%	%	฿	%	%
Calories requirement per day	(1,978)			(1,978)		
Food Items	1,343	100	68	1,593	100	54
Cereals	375	28	19	349	22	12
Meat & fish	481	36	24	595	37	20
Vegetables	152	11	8	254	16	9
Fish sauce	93	7	5	50	3	2
Fats and oils	203	15	10	243	15	8
Others	59	4	3	102	6	3
Non-food Items	638		32	1,368		46
Total: Poverty Line	1,981		100	2,961		100
1982/83 price	฿3,500					

In order to estimate the incidence of poverty, it is assumed that individuals earning an income just equal to the minimum required expenditure are at the poverty line. Those with incomes below this line are by definition living in absolute poverty.

2. The said World Bank Country Report explains some determinants of the poverty in the rural Northeast from which selected socio-economic characteristics of rural households by income group have been quoted for reference, as shown in the succeeding page.

Selected Socio-Economic Characteristics of Rural Households in the Northeast Region (1975/76)

- by Income Group -

	Poverty	Marginal	Better-Off	Wealthy	Total
(1) Annual Income Range (฿ per capita)	<1,981	1,981-2,640	2,640-3,960	>3,960	
(2) No. of Households (%)	43.3	27.1	22.3	7.3	100.0
(3) Ave. Household Income (฿) (1)	9,876	14,304	21,216	43,932	16,152
Household Size	6.76	6.01	5.38	4.69	6.11
Economically Active (2)	3.5	3.3	3.1	2.6	3.3
Dependency (3)	3.26	2.71	2.28	2.09	2.81
Dependency Ratio (3)/(2)	0.93	0.82	0.75	0.78	0.85
Daily Wage Equivalent of Economically Active ((1) ÷ 12mos. ÷ (2) ÷ 25days/mo.) (฿)	9.0	13.9	22.1	39.2	15.7
Ave. Per Capita Income (฿)	1,460	2,380	3,943	9,367	2,644
(4) Asset Characteristics					
Cultivated Area (rai)	23.4	19.2	21.5	30.1	22.4
Cultivated Area Greater than Subsistence (%)	81.2	80.7	78.3	75.6	80.1
Households with no Draft Animals (%)	24.3	29.4	34.4	54.5	30.2
Households with 1-2 Draft Animals (%)	53.0	47.6	43.3	30.4	47.7
(5) Crop Production Characteristics (฿ per year)					
Total Crop Value	4,639	6,134	7,888	9,632	6,155
Value per rai	198	319	367	320	275
Expenses per rai	37	67	85	191	73
Net Value per rai	101	252	282	29	202