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ECONOMIC EVALUATION OF THE LAM NAM OON (LNO) RURAL DEVELOPMENT PROJECT

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Abbreviations

1. AID	=	United States Agency for International Development
2. BAAC	=	Bank for Agriculture and Agricultural Cooperatives
3. B-C Ratio	=	cost-benefit ratio
4. DOA	=	Department of Agriculture
5. Econ.	=	Economic instability index
6. Fin	=	Financial
7. IRR	=	Internal rate of return
8. LNO	=	Lam Nam Oon
9. NESSI	=	Northeast Small Scale Irrigation
10. RID	=	Royal Irrigation Department
11. RTG	=	Royal Thai Government
12. SAT	=	Specific Assignment team
13. OAE	=	Office of Agricultural Economics
n.a	=	not available

ECONOMIC EVALUATION OF THE LAN NAM OON (LNO) RURAL DEVELOPMENT PROJECT

PROJECT BACKGROUND

The LNO Integrated Rural Development Project was designed to meet a number of objectives beyond the provision of on-farm irrigation and increased agricultural production. In addition to research, extension, inputs and marketing activities designed to support the agricultural production objectives, the project includes community services designed to meet social objectives. In terms of the rural development aspect, numerous outputs existed in terms of numbers of families or villages involved in various activities and organizational arrangements. These were largely aimed at agricultural production, but also included health and family planning, a variety of training programs, and increased fish production.

The overall project objectives were set in broad terms referring to the improvement of quality of life of the families residing in the project area. The LNO Irrigation project seeks to raise the income of the LNO population, thereby decreasing dependence on aid from the government. In regards to the on-farm agriculture in the LNO project, 4 agricultural activities were examined for their current status: water management (on-farm systems), soil improvement practices and agricultural communications. Originally (1977) the LNO project began specifically as an irrigation project, but was broadened into an integrated rural development project. A special feature of the project is the on-site management arrangement under which representatives of numerous Royal Thai Government (RTG) departments involved developed joint or closely coordinated activities contributing toward common objectives. This is an important feature because the present administration of the LNO project faces a number of managerial problems that have hindered them from working efficiently and accomplishing the project objectives and targets.

This evaluation of the LNO project essentially examines impact issues from the perspectives of the direct beneficiaries and of the benefits to the economy as a whole. The principal benefits analyzed are those anticipated from the second cropping during the dry season when field cropping is only possible with irrigation.

In order to achieve the objective of increasing agricultural outputs and improving the benefit distribution, the promotion of dry season crops was suggested as the primary channel for implementation. In order to increase the agricultural outputs, the promotion program of dry season crops emphasized three main factors: (1) efficient water distribution, (2) transfer of technology, (3) marketing of farmers' produce. The effectiveness of the program depended on its ability to perform the main activities successfully. To measure the effectiveness in general, variables such as those listed below, were considered for evaluation:

1. The marketing network and merchant relationship of dry season crop production;
2. Net return to farmers for various crops;
3. Problems concerning yields, lack of credit, other inputs, water delivery and the size of the market, etc.;
4. Area to be expected for the planting of each crop.

1. EVALUATION OF PROJECT BENEFIT

1.1 COST-BENEFIT ANALYSIS

1.1.1 Cost benefit analyses made for the LNO in the past vary according to assumptions made and the calculations used. For example, the 1967 Project Paper ignored the capital investment in the dam and irrigation system and showed a benefit-cost ratio of 2.95 and an internal rate of return of 25.8%. In the 1977 Project Paper, the internal rate of return was estimated at 10.2% and the benefit-cost ratio at 1.29. The authors of this Paper admitted that these levels were not very attractive. However, a later evaluation of LNO in 1981 used more realistic assumption and showed the 1977 Paper's estimates of IRR and B-C ratio to be unrealisticly high.

1.1.2 The 1981 Evaluation pointed out that the 1977 Paper did not take into consideration production foregone by farms drowned by the reservoir. Furthermore, the 1977 Paper optimistically assumed dry season irrigation would expand to 68,000 rai by 1981. In fact, the area only expanded to 20,000 rai by that year. An 8% discount rate and 50 year project life were used in the 1977 calculations. If a higher discount rate and 30 year project life had been used, the economic return of the LNO project would have appeared unacceptable. The 1981 Evaluation also noted that, if the actual irrigable area turns out to be much lower than the design area, the economic benefits of the project would become extremely poor in relation to the capital already invested.

1.1.2 Unlike the 1981 Evaluation, capital investment costs are not included in the cost-benefit analysis presented below. This analysis only takes into consideration the on-farm development component. It is considered that the physical and social infrastructure that was introduced in LNO served the purpose of politically stabilizing the areas surrounding the project site. Seen in this light, LNO's capital investment has saved the government the expense of using military means to achieve the same goal and the loss

of life this would involve. By not taking into account capital investment, this analysis hopes to measure the on-farm development component which is considered as the extension of an already constructed irrigation project.

1.2 BENEFITS

1.2.1 Calculation of the benefits of the project required a determination of the cropping patterns. These were determined by interviews with the Department of Agriculture, LNO staff and the farmers. It was found that cropping pattern was decided by considering the availability of labor, efficiency of water distribution, and past returns.

1.2.2 Although non-glutinous rice gives high economic return (See Table 1) its price is quite unstable. Hence it is excluded in the calculation of benefits. See Table 2 for instability of crop prices.

1.2.3 OAE found that, on average, 7% of irrigable land was uncultivated in the 1984/1985 season. For purposes of calculation, 10% was assumed.

1.2.4 Other data from the OAE evaluation team was taken and adjusted to relect the economic price of the crop:

1) Assuming a shadow wage rate of 83%, the daily wage rate was determined as 25 baht per day.

2) All other inputs (seeds, fertilizer, pesticide, insecticide) excluded 10% indirect tax.

3) Rent and depreciations are ~~excluded~~ also excluded.

1.2.4 Table 2 gives the Financial and Economic returns of crops. Table 3 shows the cropping intensity assumed in the cost-benefit analysis. The total incremental benefits of the project are given on Table 4.

Table 1 Net Financial and Economic Returns of Crops (Baht per rai)

	Total Cost		Yield per rai	Farm-Gate Price	Net Revenue	
	Fin.	Econ.	(Kg/rai)	(฿/kg)	Fin.	Econ.
1. Non-glutinous rice	576.10	506.61	500.00	1,550	973.90	1,043.90
2. Peanuts	1,383.60	1,161.60	250.00	9.59	1,013.89	1,235.90
3. Water melon	917.16	766.48	1,565.93	1.16	899.32	1,050.00
4. Pumpkin	880.66	739.71	1,005.91	1.58	125.25	849.63
5. Sweetcorn	1,168.27	981.63	2,583.50 1/	0.67	562.67	749.31
6. Baby Corn	1,386.77	1,165.47	826.51	1.97	241.69	462.99
7. Tomatoes	2,569.30	2,159.98	2,771.22	1.44	1,421.26	1,830.58
8. Chillies	2,279.46	1,907.63	349.29	11.07	1,587.21	1,959.04
9. Vegetables	1,734.50	1,492.49	474.50	5.50	875.25	1,117.26

Note : 1/ Ears Yield/rai

Table 2 Instability Indices of Market Prices

	Instability Indices
1. Paddy grade 2 . 100%	8.02888
2. Paddy 5%	8.00966
3. Paddy grade 3 100%	7.99442
4. Ginger	6.32431
5. Silk grade 1	6.17740
6. Gherknins	4.89947
7. Non-glutinour rice 10%	4.86706
8. Black Mung bean	3.64000
9. Snakehead fish	3.39560
10. Ducks	3.32217
11. Cattle	3.31470
12. Black Pepper	3.25351
13. Black little tunny	3.17570
14. Catfish	3.14856
15. Cotton	3.11887
16. Water Melon	2.97041
17. Broilers	2.94070
18. Groundnuts (Shelled)	2.90713
19. Buffaloes	2.81760
20. Garlic	2.35619
21. Onions	2.23796
22. White little tunny	2.34920
23. Tomatoes	2.20430
24. Soybean (Swan)	2.08307
25. String bean	2.05188
26. Challots	1.85741
27. Redbean	1.85694
28. Long glutinous rice	1.74225
29. Short glutinous rice	1.71147
30. Non-glutinous rice 5%	1.56769
31. Tamarind	1.43960
32. Pumpkin	1.17158
33. Mara	1.10856
34. Corn	1.06491

Note : (1) The instability index is defined as

$$I = \sqrt{\frac{1}{(n-1)} \sum \left[\frac{\ln P_{t+1} - \ln P_t - \sum (\ln P_{t+1} - \ln P_t)}{n} \right]^2}$$

where I = instability index

P = price , N = total number of periods, T = time

Table 3: Cropping Intensity

	Irrigable Area (rai)	Cropped Area Total (rai)	Cropped Area Wet Season (rai)	Cropped Area Dry Season (rai)	Cropping Intensity
1976	185,800	167,400	167,220	200	0.901
1977	185,800	168,020	167,220	800	0.904
1978	185,800	178,533	167,220	11,313	0.961
1979	185,800	192,060	167,220	24,840	1.034
1980	185,800	187,277	167,220	20,057	1.008
1981	185,800	194,070	167,220	26,850	1.045
1982	185,800	173,990	167,220	6,770	0.936
1983	185,800	173,441	167,220	6,221	0.933
1984	185,800	176,902	167,220	9,682	0.952
1985	185,800	170,148	167,220	2,928	0.916
1986	185,800	182,220	167,220	15,000	0.981
1987	185,800	187,220	167,220	20,000	1.008
1988	185,800	192,220	167,220	25,000	1.305
1989	185,800	197,220	167,220	30,000	1.061
1990 and thereafter	185,800	197,220	167,220	30,000	1.061

Table 4: Incremental Benefit (Million B , 1985 prices)

	1976	1977	1978	1979	1980	1981	1982	1983
1. Dry Season crops								
1.1 Peanuts	-	0.06179	0.5079	0.6179	4.2663	11.7411	2.1752	2.9575
1.2 Watermelon	-	-	-	-	-	-	1.5825	0.555
1.3 Pumpkin	-	-	-	-	-	-	1.7384	0.8666
1.4 Sweetcorn	-	-	-	-	-	-	0.3619	-
1.5 Babycorn	-	-	-	-	-	-	-	-
1.6 Tomatoes	-	-	-	-	-	-	-	-
1.7 Chillies	-	-	-	-	-	-	-	-
1.8 Vegetables	-	-	-	-	-	2.0111	0.5251	-
1.9 Others	-	0.0321	0.8462	0.8200	1.1047	1.4445	0.0492	0.4344
2. Fishery	-	-	0.0257	0.0514	0.0922	0.1273	0.1496	0.1753
Total	-	0.09389	1.3798	1.4893	5.4632	15.324	6.5819	4.9888

Table 4: Incremental Benefit (Million B , 1985 prices)

	1984	1985	1986	1987	1988	1989	1990 AND after	1991
1. Dry Season crops								
1.1 Peanuts	9.1926	1.6512	6.1795	7.4154	10.5052	12.359	12.359	
1.2 Watermelon	1.2556	0.8355	1.5	1.875	2.25	2.625	3.000	
1.3 Pumpkin	0.3228	0.3042	1.2744	1.4867	1.6993	2.1241	2.5489	
1.4 Sweetcorn	0.2458	0.1544	0.3747	0.4496	0.5245	0.5994	0.6744	
1.5 Babycorn	0.2963	0.4630	0.0579	0.0694	0.0810	0.0926	0.0926	
1.6 Tomatoes	0.0421	0.0751	0.1831	1.8306	3.6612	5.4917	7.3223	
1.7 Chillies	0.0979	0.0607	0.0975	0.1469	0.1959	0.2939	0.3918	
1.8 Vegetables	0.2827	0.2100	1.11726	1.3966	1.6759	1.9552	9.1749	
1.9 Others	0.0214	0.02825	1.0165	1.5943	1.0807	1.3643	1.6478	
2. Fishery	0.1795	0.1838	0.1881	0.1924	0.1967	0.2009	0.2009	
Total	11.7751	3.9662	11.9890	16.4569	21.8704	27.1061	26.7014	

1.3 COSTS

1.3.1 On-farm development costs come from the 1981 AID Evaluation. However on-farm development costs for the Ditch and Dyke and Modified Ditch and Dyke (LNO) models were given by the LNO project office.

1.3.2 Operation and maintenance costs for the total system for the years 1977 to 1981 come from the 1981 AID Evaluation. Post 1981 data comes form the LNO project office reports. Included is all technical assistance, research, extension, community development, market studies, development of industrial agricultural as well as costs for the Specific Assignment Teams (SAT).

1.3.3 Other assumptions in the calculations of costs:

1) 5% annual inflation adjustment up to 1985

2) Exchange rate of $1 equals 27 baht.

1.3.4 Project costs are presented in Table 5.

1.4 ANALYSIS

1.4.1 Assuming a project life of 30 years (1976 - 2005) and a discount rate of 12% per year showed a cost-benefit ratio of 1.1258 and an internal rate of return of 14.8. These levels are not considered very high. But they do pass all the conventional requirements for water resource projects, as imposed by the World Bank or Asian Development Bank. If a discount rate of 15% is assumed, the cost-benefit ratio is less than one: 0.9692.

1.4.2 It must be mentioned that these estimates are very conservative. 20,000 rai of wet season cultivation and 1,000 rai of dry were not included in the benefits. Furthermore, the authors of this report believe that the benefits of LNO can easily increase. The following pages list many of the problems that need to be solved in order to increase the benefits of LNO as well as some recommendations on how to solve them.

Table 5: Project Costs (million Baht, 1985 prices)

	1976	1977	1978	1979	1980	1981	1982	1983
1. Area of On-farm Development (rai)								
1.1 Intensive model (rai)	1,000	-	-	1,169	985	2,650	2,710	-
1.2 Extensive model (rai)	-	-	-	-	-	2,460	13,218	49,004
1.3 LNO model (rai)	-	-	-	-	-	-	2,000	-
2. Construction costs	-	-	-	10.77087	9.0755	24.4164	35.0092	-
2.1 Intensive model		-	-	10.77087	9.0755	24.4164	24.9692	-
2.2 Extensive model	-	-	-	-	-	-	5.04	-
2.3 LNO model	-	-	-	-	-	-	5.00	-
3. O&M costs for the system	-	3.3	5.3	5.5	7.6	10.0	12.8	12.8
4. On-farm extension by the specific assignment team	-	-	-	-	-	1.0	1.0	-
5. Promotion of industrial agriculture	-	-	-	-	-	-	-	-
6. Original allocation for technical assistance, research, extension, community development project administration, and market study	-	-	27.9	15.6	9.5	7.5	5.6	18.1
7. Total costs	9.21375	3.3	33.2	31.87083	26.17554	42.9164	53.4092	134.9084

Table 5: Project Costs (million Baht, 1985 prices)

	1983	1984	1985	1986	1987	1988	1989	1990	1991
Area of									
1. On-farm Development (rai)									
1.1 Intensive model (rai)	-	-	-	-	-	-	-	-	-
1.2 Extensive model (rai)	49,004	76,478	13,710	-	-	-	-	-	-
1.3 LNO model (rai)	-	-	-	-	-	-	-	-	-
2. Construction costs	102.9084	16	160.6038	-	-	-	-	-	-
2 .1 Intensive model									
2.2 Extensive model	102.984	16	160.6030	-	-	-	-	-	-
2.3 LNO model	-	-	-	-	-	-	-	-	-
3. O&M costs for the system	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	
4. On-farm extension by the specific assignment team	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	
5. Promotion of industrial agriculture	-	-	-	-	2.5	11.0	7.5	6.0	
6. Original allocation for technical assistance, research, extension, community development project administration, and market study	18.1	18.1	18.1	-	-	-	-	-	
7. Total Costs	134,904	48.0	192.7038	16.5	25	21.5	20	19	16.8

* same amount through the year 2005

1.5 SENSITIVITY TESTS

1.5.1 Since the benefits of non-glutinous rice were not considered in the base cost-benefit anslysis, sensitivity analyses were conducted to test for this and other variations. The results of the sensitivity tests were encouraging (See Table 6).

1.5.2 Case I assumed non-glutinous rice to be included in the benefit stream. A very high discount rate of 25% per year was assumed. The cost-benefit ratio was still positive at 1.4393 and the IRR was quite high at 65.

1.5.3 Case II assumed cost to be even 5% higher than in the conservative Base Case. A 12% discount rate, the rate conventionally applied to water resource projects, was assumed. In this Case, the B-C ratio was 1.0722 and the IRR 14.4.

1.5.4 If a project shows an IRR above 12%, it is considered a viable project. Given this criteria, Cases III through VI tested for variations of cost and benefit. Increase in cost and decrease in benefits as high as 10% were tested. In each case, the IRR was 12 or above.

2. KIND OF BENEFITS AND FACTORS CONTRIBUTING TO BENEFIT VARIATION IN THE PROJECT SUB-AREAS

2.1 KIND OF BENEFITS

2.1.1 The general overall benefits of the project are as follows:

1. Water is available when needed for irrigation.
2. Water is available for fish ponds.
3. Flooding near the natural river bed is relieved.
4. Water is available for household use.
5. Because the water table in the area has risen, drinking water is more accessible through wells.

Table 6: Sensitivity Tests

	Discount Rate	B/C Ratio	IRR
Base Case	12	1.1258	14.8
	15	0.9692	
Case I: Non-glutinous rice	25	1.4393	65.0
is included in the	60	1.08117	
benefit stream			
Case II: Costs increase	12	1.0722	14.4
by 5%	15	0.9513	
Case III: Costs increase	12	1.0234	12.9
by 10%	15	0.9316	
Case IV: Benefits increase	12	1.1821	15.4
by 5%	15	1.0176	
Case V: Benefits increase	12	1.2383	15.6
by 10%	15	1.0066	
Case VI: Benefits decrease	12	1.0132	12.4
by 10%	15	0.873	

2.2 FACTORS CONTRIBUTING TO VARIATION OF BENEFITS

2.2.1 Distribution of water varies depending on the topography of the land. Farms located on hilly ground may have trouble receiving water. This is especially true if the farm is far from the supplying canal.

2.2.2 In the 23 units receiving water for crops, land holding varies from household to household and, in general, those with the larger holdings get better yields. There are also differences in soil quality which affect yield. The soil in some areas have salinity problems while the areas with Phi Mai soil are much more fertile. With proper fertilizer use, the difference would not be so great.

2.2.3 The farmer's ability to predict the market and choose a profitable crop to cultivate also contributes to the variation of benefits. For example, farmers who chose to cultivate glutinous rice last year did better than those who grew regular rice because of a rise in the price of glutinous rice. Obviously, the varying abilities of the farmers in each unit as farmers determines how much benefit he can take.

2.3 INCREMENTAL BENEFIT GENERATED BY THE PROJECT SUB-AREAS

2.3.1 A measure of the added economic benefit for each sub-area is presented in Table 7. Figures for the actual incremental benefit for the crop year 1984/85 were used in the present analysis. The benefit was divided by the land holding per household to give the benefit per household in each sub-area. Obviously, the size of land holding is the major factor in how much benefit a sub-area or household receives.

2.3.2 The calculation did not take into account benefits generated for sales of glutinous rice and livestock (chicken, buffalo, etc). The figures only measure economic benefit added by LNO irrigation. Benefit from fish pond production were included as it is water related.

TABLE 7 INCREMENTAL BENEFIT GENERATED BY THE PROJECT SUB-AREAS

Unit	Rai in Unit	Families in Unit	Incremental Benefit ($/yr)
1	5775	393	342.5
2	6401	450	331.56
3	7429	401	431.84
4	15910	772	480.37
5	3558	n.a.	n.a.
6	8805	74	n.a.
7	3922	372	245.76
8	7404	n.a.	n.a.
9	8649	812	248.27
10	13400	711	439.30
11	3038	316	224.08
12	2154	232	216.41
13	7742	321	562.19
14	9065	550	384.17
15	6955	383	423.29
16	8073	874	215.29
17	3382	363	217.16
18	5243	291	489.25
19	7485	n.a.	n.a.
20	4724	196	561.82
21	6865	n.a.	n.a.
22	15,501	n.a.	n.a.
23	1577	n.a.	n.a.

Note: Data on land area and families in sub-area obtained from LNO project office. Data on incremental benefit from calculations shown on Table 4.

3. COMPARISON OF ON-FARM IRRIGATION MODELS

3.1 A comparison of the cost/benefit between three irrigations models: (1) Land Consolidation (Intensive) Model; (2) Lan Nam Oon (Modified Ditch and Dyke) Model; (3) Ditch and Dyke (Extensive) Model was made to determine which model yields the most economic benefit.

3.2 In comparing the three models, it was assumed that they were all equal in terms of the following non-water variables:

- Extension effort
- Cropping pattern
- Soil type
- Topography
- Farmers entrepreneurship, management ability, access to the market and factor inputs

3.3 By discounting non-water variables, the relative cost/benefits of the three models was made to reflect their relative efficiency of water distribution. The comparison shows (1) the Land Consolidation Model to be the most efficient, followed by (2) the Lan Nam Oon Model and then the (3) Ditch and Dyke Model, in terms of water distribution.

3.4 However, when the relative construction costs of the different models are taken into consideration, they rank in the opposite order in terms of economic benefit. Construction costs of the (3) Ditch and Dyke is set at 2,100 baht per rai, the (2) Lan Nam Oon Model at 2,500 baht/rai and the (1) Land Consolidation at 9,214 baht/rai. Expressed in ratios, the relative constructions costs (of (3) to (2) to (1)) are 1 : 1.19 : 4.4. In other words, the Land Consolidation Model costs over four times the amount to build either of the other two. Even if the Land Consolidation model is a more efficient water distribution system, it would have to be more than four times more efficient to yield the same economic benefit as the other two. This is impossible as the difference in water distribution efficiency between irrigation models does not vary to this degree.

3.5 Comparing the LNO model and the Ditch and Dyke, it is found that the different in crop yields between the two is not significant. Hence it is difficult to determine which model will generate a better cost-benefit ratio.

4 : WATER DISTRIBUTION

4.1 EFFICIENCY OF DISTRIBUTION

4.1.1 In the wet season, there is no shortage of water and the 185,000 rai in LNO are easily irrigated. In the dry season, however, only 60,000 rai of the area can be provided with water. This 60,000 rai can be anywhere in the project command area.

4.1.2 But because many farmers choose not to cultivate during the dry season, the system has not been tested to its full capacity. In the past, only about 20,000 rai had been actually utilized. In recent years, the irrigated rai had dropped drastically to about 8,000 rai due to the problem of commodity prices. There has been no problem in providing the water for this area.

4.1.3 It was found that water distribution was sometime not equitable if the farmers nearest the canal turnouts misused water or used it with out authorization. This practice would limit the volume of water available to farmers further away from the canal turnouts. This problem was mentioned in the previous evaluation report, but now the problem is not serious.

4.1.4 Other problems limiting the efficiency of water distribution include:

- Distribution canals which are designed too long so that amount of water reaching the end of the distribution network is inadequate.
- Sandy soils which cause sedimentation to fill up the canals and contribute to their deterioration.

- Water distribution which is not appropriately matched with production due to the farmers uncertainty of marketing the crops.

- Over irrigation when traditional wet season irrigation methods are applied to dry season crops. This damages crops are and yields reduced.

4.2 MAINTENANCE EFFICIENCY

4.2.1 Interviews with water user's groups reveiled that maintenance of the on-farm distribution facilities is carried out in the dry season only if dry season crops, such as peanut, watermelon, cucumbers or pumpkin, are being cultivated. The facilities were found to be in good condition and little maintenance is required. Cleaning the canals of silt and weeds is the major task. For most units, this can be completed in one day.

4.2.2 Since growing dry season crops is recent, the maintenance of on-farm distribution facilities has not been fully implemented. Maintenance funds only cover the operations cost, but not the additional equipment needed. The RID O&M Division at LNO is still badly in need of the equipment required to maintain the canal system.

4.2.3 The operation and maintenance budget should be increased to finance the routine maintenance required to prevent deterioration of the canal system.

4.3 DISTRIBUTION OF PROJECT BENEFITS

4.3.1 Since the benefits of the project come from the water, uniform distribution of benefits requires uniform distribution of water. It was found that the watermaster and zonemen were doing a good job in providing service to all the water user groups. Zonemen visit the unit once a day to check maintenance and are always accessible to farmers. The benefits are uniformly available to all the farmers but

some farmers choose not to cultivate in the dry season and so don't receive benefits.

4.3.2 With-in a unit, there is the possibility that those farms located at the end of the canal, that is furthest from the suppling canal, may not get enough water if the farmers closer to the suppling canal misuse the water. To avoid this problem, farmers need training in the proper amount of water to be used for different crops.

4.4 RECOMMENDATIONS FOR WATER DISTRIBUTION

4.4.1 Below are recommendations for improving water distribution:

1. Increase staff with appropriately qualified people to deal effectively with water distribution management.

2. Irrigation project planning and analysis must consider on-farm development.

4. Risk-reducing innovations, such as better pest and weather resistant crops and advice on simple improvements in crop husbandry should be made to water users.

5. Of the total project area of 185,000 rai, the system was originally designed to irrigate about 106,000 rai in the dry season. Even though only 60,000 rai of dry season irrigation is now considered possible, farm-level water management is required. It is extremely important for the RID to develop the capability to manage the system in a way that avoids serious maldistribution of benefits among the project population.

6. On-farm drainage is needed to permit timely, orderly removal of excess rainfall or irrigation water. This is essential for optimum agriculture production and water management.

5. NON-WATER FACTORS

5.1 Various non-water factors were also considered in the evaluation of LNO.

5.1.1 Seeds. The distribution of paddy seeds by the DOA is not sufficient. Consequently, farmers use seeds from the last year's crop and this practice decreases yields. Considering the considerable investment already made in LNO, every effort should be made to ensure that the best seeds are used in cultivation. Fast growing non-photo period sensitive rice varieties should be used to allow another crop cycle of tomatoe or peanut. The Tanan-9 type peanut seed is currently used. This variety is not for protein use but for oil use. As the market for peanut oil is limited, a better variety must be found. Further research is also required to find the proper variety of tomatoe seed. In general, seeds must be made available in sufficient quantity, the varieties with good market potential must be used and research must be done to determine the proper types.

5.1.2 Capital. The BAAC claims that there is sufficient capital available to the farmers. Capital increases 10-15% annually. However, a farmer's ability to get capital depends on his own credit worthiness. Training on how to secure and pay back loans should be provided to water user groups. The farmers in LNO will eventually acquire title deeds to their land, so farmers will have good security in getting loans.

5.1.3 Labor. There are some shortages during harvest and planting but this is not serious. Labor is available in nearby provinces. People returning from working in Bangkok or the Middle East are also available. Farmers reported that labor can be hired at a daily wage of 20 to 30 baht. This is much lower than the wage paid to unskilled labor by RID in LNO, which is 60 baht per day.

5.1.4 Fertilizer. The use of chemical fertilizers and manure is still low among the farmers in the project area. The majority of

the farming population should be encouraged to use more fertilizers in order to increase crop yield. The farmers also need to be trained in the application of fertilizer and the proper amount and types for different crops.

5.1.5 Ethnolinguistic Differences. There are several ethnic groups represented in the area. But because the water user groups are small and well organized, this has not posed any problems.

5.2 HOUSEHOLD INCOME AND EXPENSES

5.2.1 The average household owns 17.9 rai and has an annual income is 10,799 baht. The total expense for fertilizers, seeds, manure, etc. amount to 1,233 baht per year. Labor and rent expenses amount to 4,950 baht per year. Therefore, the total net income per household is 4,616 baht. But considering expenses for household consumption (i.e food, clothes and basic needs), it is estimated that the average household finds itself approximately 2,268 in debt each year.

6. CROPPING PATTERN

6.1 The LNO encourages farmers to take advantage of the irrigation system for dry season cultivation. It is believed that new crops should not replace rice but should be grown as second crops during the dry season. Commercial crops such as tomatoes for processing into tomatoe paste and vegetable seeds are especially encouraged.

6.2 For the most part, the villagers are not prepared to shift from glutinous rice to alternative cash crops for dry season cultivation. Farmers' reluctance to engage in dry season irrigated agriculture is due to a number of reasons, e.g. lack of reliable water supply; high costs of inputs with respect to product price; lack of technological competence required in irrigated agriculture, coupled with inadequate extension services to provide the needed training.

6.3 Cropping requires investment up front in fertilizers and pesticides, absorbs labor time and produces at the end of the process a net return that is uncertain at the start of the process, depending on production results and market conditions. On the other had, an assured high economic return on investment might induce the farmers to grow new crops.

6.4 The introduction of certain crops have experienced the following obstacles:

- saline soil which effects the growth of bean varieties; and general low fertility of soil.

- insect and pests attack in certain planting seasons.

- damage done to crops by livestock raised by the farmers.

- market demand for dry season crops which varies from year to year.

- new technology which is unfamiliar to most farmers.

- farmers that are skeptical or uncertain about the system's reliability for delivering water when needed.

- there is not enough data available to effectively determine the cost and income of crops, especially during the dry season.

6.5 RECOMMENDATIONS FOR CROPPING

1. Research on dry and wet season crops suitable for LNO soils should be expanded. Non-glutinous rice, glutinous rice, and alternative dry season crops should be tested more intensively for their response to fertilizers, soil amendments, and green manure. Agronomic practices which encourage both diversified cropping patterns and soil conservation need to be further developed and disseminated to the farmers. Such research should include on-farm water management and use, and market considerations.

2. To ensure that farmers are faced with an attractive alternative to their present dry season income opportunities, the private sector should continue the guarantee program (as in the case of tomatoes) until the scale of the production and marketing systems reaches a point where the momentum will carry the whole system up to a dry season potential.

3. The non-glutinous variety to be introduced should be Khao Dok Mali 105. Appropriate varieties of tomatoes, peanuts, baby corn, chillies, cucumbers should also be brought to the attention of the farmers

4. Produce manuals for crop production in irrigated areas.

7. MARKET AND ROLE OF THE PRIVATE SECTOR

7.1 MARKET CONSIDERATIONS

7.1.1 Market Access In the past, two prime needs have been asserted by the farmer at LNO: a reliable supply of water; and a market situation which contains limited or no risk to them. However, at the present, only the market constraints are of concern. Merchants in the Northeast are not aware of the LNO area. Some merchants come from Loei, Udon, Korat and Sakon Nakhon to buy peanuts, but more effort is needed to encouraged more buyers to come. There is an industrial market for vegetable seed and tomatoes but more private sector involvement is needed.

7.1.2 Market Information Farmers get market information from the SATs and via a village broadcasting system set up by the Department of Non-formal Education. At this time, only current market prices are relayed. There is no service providing market analysis to the farmers. A SAT should be trained to make market analyses. The infrastructure already exists that can relay this information to the farmers.

7.1.3 Market Problems

1. Price uncertainties.

2. Some of the marketing problems have emerged due to government intervention, e.g. non-glutinous rice.

3. The Northeastern market is not large enough to absorb the new LNO dry season produce. There is also a lack of competition among merchants.

4. A lack of appropriately scaled agro-processing factories to create demand for agricultural products locally produced.

7.1.4 Recommendations

1. Marketing studies should be conducted especially on crops suitable for the LNO area, such as: tomatoes; vegetables; cucumbers; seeds; etc.

2. In order to promote production, it is necessary to assure farmers of market availability and good price by introducing appropriate private enterprise to purchase their products.

3. Agricultural extension services need to be expanded to all areas and better communication networks between extension officials and the Agriculture Department.

4. Identify the market target bearing in mind the nature of production in the area.

5. Increase collective group bargaining.

6. A new emphasis must be made regarding a program under which the RTG will help bring about the change from the present thin production/ marketing situation, to the relatively large-scale dry season economy envisaged under the LNO project.

7. A marketing system which will respond favorably and adjust to the requirements of handling produce on a much larger scale is necessary.

8. The government should create a clear agricultural development policy (particularly commercial agriculture) at the local level. Crops introduced should be appropriate to the local conditions.

9. A guaranteed price by the private sector must be provided in order to help the farmers make long-term investments.

10. Decentralization of government services needs to occur and this will reduce the amount of bureaucratic red tape that has caused frustration for the farmers.

7.2 ROLE OF THE PRIVATE SECTOR

7.2.1 As suggested in the 1982 evaluation report, the private sector could contribute more agricultural information regarding agriculture supplies to the farmers. Such information could include crop varieties, fertilizers, and insecticides. The merchants or middle men representing the private sector greatly influence the farmers' decision about which dry season crop to plant. Verbal agreements of purchasing a specific dry season crop for a specific price are made, but farmers are skeptical about the information they receive, especially of the verbal agreements with the merchants. Hence, better information and more fair agreements from the private sector to the farming community could lead to lead to better relations and a strengthened market exchange. Government agencies have the capability to produce quality training films, slides, and curriculum. Private firms should be contracted to produce the necessary relevant training materials. These materials would be useful for all the irrigation projects in the Northeast. This also would imply that the private sector become more aware of the issues and a particular sensitivity is needed by the private sector to better work and integrate itself as a complementary sector with the farming community and irrigation needs of Thailand.

7.2.2 The LNO has great potential for private sector investment. It is attractive because of its easy access and good roads, its well organized farmers' groups and the eagerness of the LNO project staff to cooperate with the private sector. The staff at the Land Consolidation Office are especially eager for more private sector involvement as this Office must collect costs from farmers and they would like to see farmers' income increase to better afford their fees.

7.2.3 Recommendations for Increasing Private Sector Involvement

1. Field Directors should promote the LNO by talking to businessmen and potential investors. A public relations campaign should be launched using radio, television and print media.

2. LNO should pursue the joint government private sector committee (Ko. Ro. O.). At the last Ko. Ro. O. meeting in Khon Kaen in January 1986, the LNO set up an exhibition for potential investors and the response was very good.

3. A three-tier approach involving farmers, private sector/commercial banks and the government should be adopted. The private sector should provide the farmers with technical know how, purchase price guarantees and a guaratee on loans using the farmers' assets as collateral. The government should provide better extension services to the farmers and promotion privileges, such as tax exemptions on imported raw material and soft loans, to the private sector.

4. The LNO should start a One Stop Shop program. In this program, potential investors can come to the project site and, at one time, obtain all the necessary technical and economic data necessary to facilitate an investment decision. Necessary arrangements with the government offices can also be accomplished, thus minimizing red tape. Efforts should be made by the government, the private sector and LNO farmers and staff to initiate and continue such a program.

5. More marketing studies should be carried out to be used as a selling point to potential investors.

6. LNO staff responsible for marketing should be enthusiastic and proficient.

8. EVALUATION OF LNO TRAINING AND MANAGEMENT

8.1 Microcomputer Water Management Only few of the LNO staff (2 persons) know the fundamentals of micro-computer programming and data processing at LNO operation center. More staff, including SAT, should be trained in the use of the computer. Micro-computer data requirement training should be provided for the LNO staff (including watermasters, zonemen and SAT) so that better data can be fed into the computer and predictions of water distribution can be more reliable.

8.2 Training Programs The existing training program is quite relevant to the LNO project, especially concerning water use. The level of effort in orientation and training is adequate for the farm. But the program at Ban Fang Daeng should be upgraded and expanded to include farm management as well as basic financial and economic analysis.

8.2.1 Recommendations for Training.

1. Quality training programs must selecting qualified trainers and use proper training techniques and training materials.

2. Human resource development is needed for both the government officials and the farmers so that these people will be ready to undertake commercial agriculture.

3. The number of people who need to be trained is so large, that the only practical way is to adopt a multiplier approach by training the trainers.

8.3 Problems of Technical Transfer There is a lack of acceptance of new technology from the farmers due to:

- level of education
- social economic
- culture and beliefs
- experience with commercilizing the harvest

8.3.1 Recommendations on Technical Transfer

1. An easily understood training manual should be provided for the farmers.

2. A certain amount of time should be allowed before going into evaluate the success of technical transfer for the farmers who attended the project training.

3. The private sector should be encouraged to participate as much as possible, especially in the stimulation of technical transfer.

4. A constant flow of new field-tested technical knowledge relevant to small holder production is a precondition for success.

8.4 SPECIFIC ASSIGNMENT TEAMS

8.4.1 The SATs were found to be quite effective. They have been successful in helping the water user groups use their water properly. They relay market information about the local markets to the farmers. They have also been promoting commercial crops such as tomatoe for processing into paste and vegetable seeds. SATs are teaching the farmers how to grow these new crops. This includes transfer of technology and instruction in production techniques. Since the LNO has arranged the guaranteed sale of the new crops, farmers only stand to profit by their efforts. If successful, in the future, farmers can increase their income five fold by adopting these new cropping patterns. As yet, a separate cost/benefit analysis can not be performed. The cost-benefit of the SAT is included in the evaluation of the total system at the beginning of this paper.

8.4.2 Replicablilty of SATs Highly motivated individuals must be requited for work in SAT. They must have a willingness and

dedication to the work. They should receive proper training, outside the project area if necessary. Overtraining of staff should be avoided as overqualified individuals may be tempted to work away from the project. Within the SATs, effective supervisors and leaders are required. Job assignments to the SATs must be for a satisfactorily long period of time to assure dedication: three years at the least. The terms and requirements of employment must be made very clear in the beginning.

8.4.3 SATs can easily be replicated. However the above requirements should be met in order to ensure their effectiveness. Government budgets can be made to hire temporary employees. The RID's budget pays the SATs at LNO.

8.4.4 SAT Recommendations

1. SATs need to be better trained in how to estimate crop areas, report on varieties of crops and locate the exact areas where various varieties are being cultivated. They should be trained to provide market analysis for the farmers.

2. Training can be both at the LNO project area or elsewhere such as in universities or places where specialized skills are avialable.

8.5 REVIEW OF NESSI.

8.5.1 NESSI information indicates that the LNO had formed better water groups than the NESSI program. Although NESSI can benefit from the experience of the LNO, the two projects are not comparable because of their size difference. NESSI is for small irrigation projects while LNO is much larger in size.

9. RECOMMENDATIONS FOR THE INTEGRATED APPROACH

1. The integrated, concentrated and complementary efforts of various agencies will accelerate farmer utilization of the potentials inherent in irrigated agriculture.

2. The success depends on the cooperation of these departments as well as the techniques of the integration to be used. Each department representative has to find ways to work together with others.

3. A coordinating mechanism should be established to link the major irrigation projects now being developed in the NE. This mechanism would address the technical, operational, research and training problems common to the projects.

5. Better coordination and joint efforts among all sectors involved.

6. Crop production inputs, extension advisory services, farmer training, credit, marketing outlets and other agricultural needs are to be continued the integrated program.

7. Greater decentralization with effective machinery at the regional and local level to coordinate the sectoral activities of national departments operating in this project area and regional and local department.

8. The success of this project initiated by one department agency often depends on complementary actions taken by another department.