Action plan will be as follows:

(a) Training of female community workers through the network of women's union
(b) Health and nutritional education for women
(c) Promotion of home garden for better nutrition
(d) Participation in the training of agricultural extension and in Rice Bank
(e) Alleviation of women's worklord by the improvement of domestic water supply

3.2.3 Further Study

Since the efforts to understand rural conditions and the needs of farmers have been concentrated on the lowland areas due to time constraint, the survey result cannot be applied directly to the upland areas. The lowland settlers are keen to stop slash-and-burn cultivation, but whether hill people have the similar intention should be ascertained.

Moreover, the model of development project should be modified in order for its expansion in any case. Further study on the upland area is necessary to assimilate the project into surrounding areas. It is recommended that further study should include the following survey items to compare the similarities and differences between the two areas.

(1) Farmers' attitude to slash-and-burn cultivation
(2) Land scarcity and the response of ethnic groups
(3) Government forest policy and the response of ethnic groups
(4) Constraints and potential to development of village organizations
(5) Socio-economic interaction among ethnic groups

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Table

Table MC-1 Population by Districts in Oudomxay Province

District	1983	1984	1985	1986	1987	1988	1989	1990	1991
Xai	27,592	28,628	29,703	30,778	31,892	33,047	34,243	35,482	37,446
Ben	20,784	21,158	21,539	21,920	22,308	22,703	23,105	23,635	24,053
Hun	30,903	31,905	32,939	33,973	35,040	36,140	38,275	38,628	39,768
Sub-total	79,279	81,691	84,181	86,671	89,240	91,890	95,623	97,745	101,267
(Ratio/total %)	34	34	34	34	34	35	35	35	35
La	13,542	13,783	14,029	14,275	14,525	14,779	15,038	15,031	15,648
Namo	18,411	18,748	19,166	19,584	20,010	20,446	20,892	21,460	21,937
Nga	18,913	19,390	19,879	20,368	20,869	21,382	21,908	22,576	23,131
Pha Oudom	23,347	23,415	23,483	23,551	23,619	23,687	23,756	23,103	23,170
Pak Tha	8,131	8,684	9,275	9,866	10,494	11,162	11,873	12,526	13,324
Pak Beng	17,108	17,565	18,034	18,503	18,984	19,478	19,954	20,615	21,151
Hongsa	27,455	28,142	28,846	29,550	30,277	30,010	30,742	32,712	33,510
Xieng Hone	30,146	30,783	31,434	32,085	32,749	33,427	34,119	36,360	37,113
Total	236,332	242,201	248,327	254,453	260,767	266,261	273,905	282,137	290,251

Data source: Department of Economic Planning and Finance, Oudomxay Province

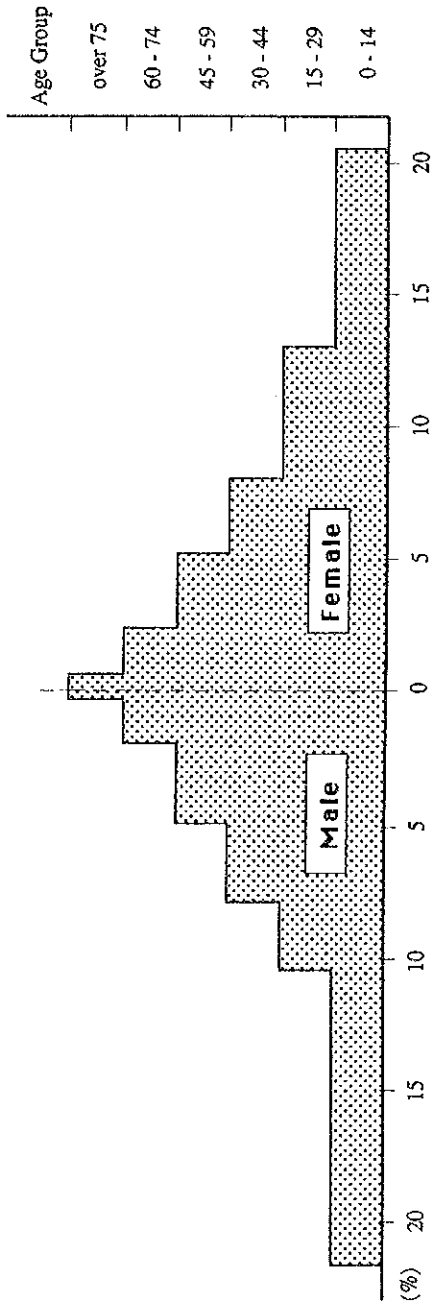
Population growth rate/year:	Oudomxay total	2.60%
	Xai District	3.89%
	Beng District	1.84%
	Hun District	3.20%

Table MC-2 Population Structure in the Oudomxay Province in 1985

Age Group	Sub-total	Percent of Age Group	Male	Female	Percent of Female
0 - 14	78,761	42.1	40,229	38,532	48.9
15 - 29	48,812	26.1	22,734	26,078	53.4
30 - 44	29,935	16.0	14,451	15,484	51.7
45 - 59	19,146	10.2	8,731	10,415	54.4
60 - 74	8,744	4.7	3,791	4,953	56.6
over 75	1,717	0.9	634	1,083	63.1
Total	187,115	100.0	90,570	96,545	51.6

Data Source: Population in Lao PDR (in Laotian), 1992 by the Ministry of Economic Planning and Finance, the Department of Statistics.

Figure



Note: This figure is prepared on the basis of the Table MC-2.

Fig. MC-1 Population Structure in 1985

THE LAO PEOPLE'S DEMOCRATIC REPUBLIC MINISTRY OF AGRICULTURE AND FORESTRY
AGRICULTURAL DEVELOPMENT PROJECT TO CONTROL SLASH AND BURN CULTIVATION IN OUDOMXAY PROVINCE
NIPPON KOEI CO., LTD. CONSTRUCTION PROJECT CONSULTANTS, INC.

ANNEX-MD
AGRICULTURE

ANNEX-MD AGRICULTURE

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX

1. INTRODUCTION

This ANNEX-MD presents the results of agricultural survey made in the study area as well as Oudomxay province. This ANNEX consists of:

(1) identification of the current agricultural situation in the study area;

(2) study on current constraints for agricultural development in the study area;

(3) formulation of the programs for the increase and stabilization of agricultural productivity through elimination or alleviation of various agricultural constraints in contributing to the control of slash-and-burn cultivation; and

(4) proposing of the agricultural development action plan which forms part of the integrated rural agricultural development in the study area.

2. PRESENT CONDITIONS

2.1 Crops and Cropping Patterns

Similar to other districts in Oudomxay province, the main crop grown in the study area is rice, a staple food crop of the people, followed by maize, sesame, cotton and other crops, as shown below:

(1) Rice: cultivated area of both lowland and upland rice occupies more than 80% of total cropped area in the study area mainly for home consumption. The cultivated area of upland rice equals to about 83% of total rice cropped area. The gultinous rice is dominant over the whole study area, and non-gultinous rice such as IR-708 variety is cultivated in very limited areas. Most of slash-and-burn cultivation is practiced in the hilly and mountain areas. On the other hand, lowland rice cultivation is limited in the flat valley bottoms.

(2) Maize: generally, maize is inter-cropped with upland rice in the study area. Maize is the important food crop to supplement the shortage of rice. When rice production in the former year is not sufficient due to weather and other conditions, cultivation areas of maize become increase.

(3) Sesame: cultivation of sesame as one of cash crops mostly for export to Thailand and China becomes popular in the study area, and the planted area is increasing in recent years. Sesame is also inter-cropped with upland rice.

(4) Cotton: cotton which is also important cash crop in the study area as well as Laos is cultivated mainly by Lao Loum groups in small flat upland adjacent to the villages. Cotton cultivation is gradually increasing which seems to be due to increase in home consumption and in internal trade.

(5) Other Crops:

(i) Garlic and onion are cultivated usually in rice field and flat upland, and these will be prospective cash crop for both internal and external trade which could be grown in lowland rice field with irrigation as a secondary crop in the dry season.

(ii) Mulberry cultivation for sericulture is seen in the limited undulating lowland in Hun district. It is reported that about 30 households are currently engaged in the traditional sericulture to produce silk mostly for export to Thailand.

(iii) Other crops: Tobacco production is prevailing in and around the Beng town. Pineapple is grown in steep-sloped hills. Sugar cane is grown in home yards mostly for home consumption. Cassava, Banana, Papaya, etc. are grown in home yard and/or inter-mountain valley bottoms. However, cultivation area of these crops is very small in size.

Mainly because of the shortage of available water during the dry season, cultivation of crops is concentrated in the wet season from May to September. Most of the agricultural land is left fallow and used for livestock grazing during the dry season, except for very limited area where vegetables are grown. The cropping calender of main crops is given in the following table and general cropping pattern over the study area is shown in Fig. MD-1.

Crops	Seeding	Transplanting	Harvesting
Lowland rice	Jun	Jul-early Aug	Oct-early Dec
Upland rice	May-early Jun	-	mid-Sep-Oct
Maize	Apr-early May	-	Aug
Tobacco	mid-Nov-Dec	-	end-Mar-May
Cotton	May	-	Oct
Sesame	May	-	end Oct

2.2 Crop Yields and Production

Harvested area, production and yield of both upland and lowland rice in the study area are estimated as follows on the basis of the data obtained from district offices:

Year	Harvested Area (ha)			Production (ton)			Yield (ton/ha)		
	Lowland	Upland	Total	Lowland	Upland	Total	Lowland	Upland	Average
1987	2,360	13,460	15,820	5,990	18,150	24,140	2.5	1.4	1.5
1988	2,490	12,900	15,390	6,960	17,570	24,530	2.8	1.4	1.6
1989	2,490	11,990	14,480	7,460	16,240	23,700	3.0	1.4	1.6
1990	2,580	12,220	14,800	7,560	17,040	24,600	2.9	1.4	1.7
1991	3,050	12,750	15,800	8,600	16,620	25,520	2.8	1.3	1.6
Average	2,590	12,670	15,260	7,310	17,120	24,500	2.8	1.4	1.6

Though there is annual fluctuation of rice production due to drought and other factors, the average yield of both lowland upland rice in recent five years is estimated at about 2.8 tons/ha and 1.4 tons/ha in paddy, respectively.

In order to check the present yield level of lowland and upland rice, the yield survey is carried out by the sample cutting survey method; details are given in ANNEX-FC AGRICULTURE of Volume III Feasibility Study on Model Areas Scheme. According to the survey results, the average unit yield of lowland rice and upland rice is estimated at 2.6 tons/ha and 1.4 tons/ha, respectively. The results indicate nearly the same figures as the statistical data mentioned above.

The present low crop yields of rice in the study area are caused mainly by the (i) no adoption of improved varieties and farming practices; (ii) no use of farm inputs such as fertilizer and agro-chemicals; (iii) limited and unstable supply of wet season irrigation; and (iv) steep slope topography in upland which leads to difficulties in weeding and plowing.

In addition, the harvested area, production and yield of the major secondary crops such as maize, sesame and cotton are also estimated on the basis of the district data as follows:

Year	Harvested Area (ha)			Yield (ton/ha)			Production (ton)		
	Maize	Cotton	Sesame	Maize	Cotton	Sesame	Maize	Cotton	Sesame
1987	-	-	-	-	-	-	-	-	-
1988	490	-	160	2.1	-	0.9	1,030	-	150
1989	-	100	310	-	0.3	0.5	-	30	160
1990	890	200	1,230	1.6	0.9	0.6	1,450	170	700
1991	2,270	500	3,210	1.7	0.7	0.9	3,950	360	2,990
Average	1,220	270	1,230	1.8	0.7	0.8	2,140	190	1,000

Note: Yields are estimated on the basis of district data.

As seen in the above table, sesame production increases considerably in recent years because of increasing export mainly to China and Thailand. This suggests that the production increase of this cash crop should be encouraged to generate more farm income of the farmers and to promote the use of edible oil by the people in the future. The above data also show a considerable increase of maize production in spite of only the supplemental food crop for home consumption.

Garlic and onion will also be prospective cash crop for both internal and external trade, which could be grown in lowland rice field with irrigation as a secondary crop in the dry season, but reliable data on these crops production are currently not available.

2.3 Farming Practices

2.3.1 General

The farm management system is mainly based on village-level cooperative works of small farmers groups, so-called "Nuay" in Lao. Usually, Nuay consists of 10 to 15 farm

families in neighbourhood. Nuay is more dominant in slash-and-burn cultivation (upland rice) than those in lowland rice field. Farm work by Nuay in upland rice field covers tree-cutting, burning, sowing, weeding, harvest and transportation of harvested rice. In lowland rice field, transplanting, harvest and transportation of harvested rice are done by Nuay. The system by Nuay may be utilized as a base for establishing the farmers organization in the future.

2.3.2 Slash-and-burn Cultivation

The upland farming in the study area is mostly shifting slash-and-burn cultivation with one year cropping followed by 3 to 5 years fallow. Since the upland farming depends entirely on rainfall in the wet season, crop production under this farming is unstable, varying from year to year. Cropping in upland system is practiced regardless of the land slope, and protection methods against soil erosion are non-existent. There is no great difference in slash-and-burn cultivation practices between the ethnic groups of Lao Loum and Lao Theung who settled in lowland areas. In recent years, fallow period is becoming shorter due to the population pressure on land and the present policy of the government for forest area. Land preparation (plowing) and fertilizer application are also not practiced, except for only attention to weeding and protection of crops from animals. Inter-cropping method is widely practiced in the upland rice field to minimize the production risks such as drought, pests and diseases. The common farming practices of slash-and-burn cultivation are summarized as follows:

(1) Land Preparation: after cutting bushes during the period from February to early April, the land is set fire in April to May by "Nuay". Then, the land is cleaned of ember stems and branches, and encircled by fencing in April to May by individual farmer.

(2) Sowing and Weeding: sowing is done by dibbling at the beginning or middle of May, depending on the first heavy rains. Weeding is the most labour consuming activity and usually done by cooperative work. Two to three times of weeding are practiced during one cropping season.

(3) Harvesting: harvest of rice is done by hand. After the harvest, the fence is dismantled and the wood is brought back to the house to be used for firewood.

The required farm labour of slash-and-burn cultivation is estimated by the farmers interview survey as follows:

Faming Practice	Required Labour
Fencing	16
Slashing	38
Burning	5
Sowing	17
Weeding	56
Reaping	27
Threshing	19
Transportation	20
Total	198

Source: Farmers interview survey made by the study team.

As seen in the above table, a series of farming practices for slash-and-burn cultivation are labour consuming practices especially slashing and weeding, in spite of low crop yield. The labour shortage is observed during the peak labour requirement period in the study area.

2.3.3 Lowland Rice

Most of lowland rice receives supplemental irrigation from the brushwood weirs mostly constructed by the farmers themselves. Any fertilizer and agro-chemical are not used. Photosensitivity varieties with different flowering stage are widely used. The main varieties of lowland rice are Do, Do kadao, M.tai, Pa, M.naga, M.shing, Fouengkham, Makbeat, etc. All these varieties are local gultinous one with 130 to 150 days of growing period. Farmers choose their varieties, based on their traditional experience in rice cultivation, minimisation of production risks, available family labor and their taste, without any information and technology transfer from the institutes concerned. Seeds are mostly produced by farmers themselves. The farming practices of lowland rice cultivation in the study area are summarized as follows:

(1) Land Preparation: land preparation of lowland rice, which includes plowing, harrowing and puddling, is done by local-made plow and puddler with buffalo after the first heavy rains in June.

(2) Transplanting and Weeding: after land preparation, transplanting is done by cooperative work. One or two times of weeding are practiced by hand during the growing period. However, weeding of lowland rice field looks like rather careless as compared to the upland rice field.

(3) Harvesting: harvest of lowland rice is made by using sickle.

As compared to the slash-and-burn cultivation, the labor requirements for weeding and transportation are considerably low in lowland rice cultivation as follows:

Faming practice	Required labour
Nursery	10
Plowing	37
Transplanting	28
Weeding	17
Reaping	27
Threshing	24
Transportation	5
Total	148

Source: Farmers interview survey made by the study team.

2.4 Livestock

Similar to other northern provinces of Laos, livestock sector in Oudomxay province as well as the study area has a significant importance to the economy of farmers. The present livestock raising is dominated by small-holders who own small number of livestock as part of the subsistence agriculture. Livestock in the farmer's economy is used to supply animal protein, for farm works, to gain cash income, etc. The livestock production is also one of the main export items in the study area, especially to Thailand.

It may be said that almost all the farmers in the study area raise some livestock. Buffalo is the main livestock as a draft animal for farming and also for sale. Cattle is usually not used for farming, but for sale to get cash for special expenditures in the farmer's livelihood. The information on livestock in the study area in recent years is summarized as follows:

(Unit: No. of head)

Livestock	1987	1988	1989	1990	1991
Buffalo	23,300	27,400	22,300	18,800	22,400
Cattle	8,760	10,370	9,300	11,150	13,370
Horse	-	-	-	-	2,070
Pig	22,100	31,300	39,400	32,300	44,300
Goat	4,890	5,900	3,000	3,080	4,400
Poultry	105,000	140,000	97,000	118,000	156,000

Source: Provincial Office.

Usually, buffalo and cattle are grazing freely in the surrounding lowland rice fields, hills and forests. There is no attempt on improved ranging and the only source of supplemental fodder for the animals is rice straw left after the harvest of the wet season lowland and upland rice. These low input technology for livestock raising results in low returns to the farmers (traditional smallholder). In addition, such low returns from livestock discourage the adoption of more productive technologies and the use of improved breeds.

In the study area, the vaccination program is currently implemented with the assistance of the Quaker Service in Laos and UNDP/FAO (Management and Operation of

Vaccine Production and Distribution Project) to promote and support for vaccination services by the district office with supply of necessary facilities and equipment.

2.5 Sericulture

There are about 30 farmers, who are engaging in silkworm rearing, in the villages of Nakhong, Napang, Navang and Bouamlao in Hun district. The mulberry fields are scattered in terraces with a deep soil layer along Beng river and natural mulberry is also utilized in Navang village. The variety of silkworm is polyvoltine local one and the cocoon is exported to Thailand or sold to Luangprabang Province through middlemen. The selling prices of raw silk are Kip 8,000 to 10,000 per kg for the white type and Kip 10,000 to 12,000 per kg for yellow one respectively.

Sericulture work is commonly divided into two activities in the villages, one is silkworm rearing works such as production of silkworm eggs, feeding and raw silk reeling, for which women are mainly responsible and the other is field works for mulberry trees, for which men are responsible. Silkworm rearing is carried out three to four times a year, using the spaces under the floor of each house as a silkworm rearing house. Young silkworm is reared by a covered silkworm rearing method with bamboo basket and cloth. Feeding is done with chopped mulberry leaf or chopped mulberry shootlet-supplying during a young silkworm period and with unchopped mulberry shootlet-supplying during a grown period. There seems to exist some damages by Parasitic flies (*Tricholyga Sorbillans Weideman*) considering the present silkworm rearing form conditions in the region.

It is said that silkworm rearing had been very common and widely spread for long time in the region, however because of internal disturbances and lack of labor force, and more high priority of rice cultivation today a lot of people stopped the silkworm rearing and still remaining only in the limited areas.

2.6 Fishery

The fish culture is not practiced in an intensive way in the study area. It is reported that there are about 20 ponds constructed and managed by the provincial office in and around Xai city. The size of a pond is about 0.2 ha in water surface on an average, and the water source is spring water from the surrounding mountains. About 3,000 fish fingerling are grown in such small ponds at the initial stage, however, marketable product is estimated at 60% of the total number of fingerling. According to the information from an irrigation construction

company in Xai, the construction cost of a small size of fish pond with 20 m width, 30 m length and 1.5 m in depth, is Kip 225,000.

Fish being raised is "Panei" and "Paninh" in Lao (carp group). The fingerlings were once brought in from the Provincial Fishery Station in Luang Prabang, but they are now self-supplied. The product is sold at Xai market at a price of Kip 800 to 1,000 per fish. Although such a small-scale fish culture is considered as one of effective ways for increase in farmer's cash income, constraints to further development will be small and restricted markets and difficulties in transporting fresh fish to villages.

2.7 Agricultural Support Services

2.7.1 Extension Services

Actually, no extension services by the government institutes are being carried out for agricultural improvement in the study area mainly due to lack of well-organized agricultural extension system and manpower as well as sufficient budget. At the central government level, Agricultural Extension Agency has been established under the Department of Agriculture and Extension in early 1992. All the provincial and district offices of agriculture and forestry will be centralized into this national system. These provincial and district offices will have a primary function for providing extension services for disseminating agricultural techniques and supplying planting materials improved through research and multiplication activities.

Agricultural extension services in the study area are currently under the responsibility of the department of agriculture and forestry services in the provincial office and agriculture and forestry services section of each district concerning the study area. The organization and staffing of the above department and sections is shown in Fig. MD-2 to Fig. MD-4 and Table MD-1. The agriculture and forest section of each district consists of technical groups such as irrigation, livestock and veterinary services, forestry, and agriculture. Each group has a little extension activities, but has no qualified extension workers and facilities. Among these sections, livestock and veterinary services are provided for training of farmers on vaccination of livestock periodically at present.

2.7.2 Farmer's Organization

There are no farmer's organization established in the study area under the government arrangement other than village committee, village unit (Nuay) and women's union.

The farmer's organization aiming at economic or social activities is not formulated in the study area as well as in the province.

(1) Village Committee: the village committee has a political structure composed of a Village Chief and his Council. The chief is elected by villagers and recognized by the government authorities. His task is to govern the village, to settle conflicts such as irrigation water distribution, crop damage by animals, etc. and to collect government taxes. Most of villages has Rice Storage (Sang Kao) which has a function of storing paddy collected as taxes, supplying food for village guests, and function of rice bank (for details, refer to the following sub-section of Agricultural Credits).

(2) Nuay: most of the villages related to the study area are divided into several Nuay, each consisting of 10 to 15 families in general. The chief of Nuay is appointed by the village chief. The main activities of Nuay are cooperation in farming among farmers of a Nuay and some time between Nuays.

(3) Women's Union: every woman who is more than 18 years-old (in the case of woman who already married, more than 16 years-old) can become the member of the women's union. The member fee is Kip 5 per month for women who are getting salary and Kip 1 per month for women of farm family. In the case of Beng district, population of women who can be the member is 5,194 in total. However, actual number of women with membership is only 286.

The activities of the unions are generally low, because the union had more political character in the past. Therefore, re-organization of the union is requested so as to promote more economic and social activities of the women under the introduction of the New Economic Mechanism (NEM). Recently, some new trials are being made by the government with an assistance of Lao Quaker Service, which include the promotion of appropriate technology to lighten workload of the women, cotton cultivation, establishment of village rice bank, etc.

2.7.3 Agricultural Credit

There are formal and informal agricultural credit systems covering the study area. The formal credit system is handled by the Lane Xang Bank (LXB), while the informal credit system is operated by villages.

(1) Formal Credit

LXB has Oudomxay provincial branch office located in Xai city and a district branch office located in Hun town, and is lending rural credit covering the study area. Currently individual farmers can receive credit only through group lending arrangements. Farmers within the same village who are interested in receiving credit must form a group which is jointly liable for the loan given to each member. There are three categories of terms of loan by the purpose of loans, as follows:

Duration	Purpose	Interest Rates
Short term (1 month-1 year)	Purchase draft animal, seed, fertilizers etc.	5%/year
Medium term (1 month- 3 year)	Land clearing	4%/year
Long term (1 month - 5 year)	Purchase livestock	2%/year

Source: LXB Oudomxay Branch Office.

The Oudomxay branch has started its operations in mid-March 1991, and the amount of rural credit lent during one year of 1991/92 was as follows:

(Unit: 1,000 Kip)

Items	Xai	Beng	Hung
1. Purchase draft animals			
Amount	13,313	3,060	3,400
No. of village	8		
No. of family	82	17	22
No. of groups	20	4	7
2. Land clearing			
Amount	8,578	7,103	7,772
No. of village	7	5	5
No. of family	67	40	57
No. of groups	19	7	11
3. Purchase livestock			
Amount	6,930	0	0
No. of village		0	0
No. of family	26	0	0
No. of groups	7	0	0

Source: LXB Oudomxay Branch Office.

(2) Informal Credit System

There are informal credit systems in the study area such as rice bank and monetary fund for rural credit. The rice bank is customary system mostly operated by each village, and any family of village who is short in food is possible to borrow paddy with some interest rates which vary village by village. Some villages have a monetary fund based on disposition of properties formed by the former farmers cooperatives. The member of village is possible to borrow money from the fund for food (mainly paddy) or for commercial activities with an interest of 3% to 5% per month.

2.8 Findings of Current Agricultural Conditions

The findings of current agricultural conditions in the study area through the field works are summarized as follows:

(1) Despite the fact that the existing farm lands in the study area have a potential of increasing crop yields, no packages of farming techniques have been developed, based on field trials of improved varieties of crops, appropriate planting time and fertilizer practices suited to the differences in the physical conditions.

(2) Almost all the farmers in the study area do not show their interest in the dry season cropping. It is considered that the following negative factors give the farmers less incentive and they may think that dry season cultivation would be risky with a low economy of production.

(i) Low reliability of available water supply from both rainfall and irrigation as compared with the wet season,
(ii) Difficulty in control of the crop damage from free raising of livestock, especially in small scale irrigation scheme, and
(iii) Traditional attitude of farmers to work during dry season.

(3) Availability of certified seeds is very limited and farmers are using their own seeds of local varieties. Continue to be used as these varieties are adapted to local micro-environments and held alleviate risk due to their tolerance to adverse conditions such as drought, but there are no room to improve their low yielding characteristics.

(4) The dominant varieties used in the lowland rice fields are photo-sensitivity varieties which promise the regular farming practice to the farmers, because the timing of flowering stage is fixed annually. But it is difficult to disperse the labor intensive period and this may cause the labor shortage. Further, these varieties can not adapt to the double cropping, even if irrigation water is available throughout the year.

(5) Inter-cropping method is widely practiced in the upland rice field to minimize the production risks due to heavy damage such as drought, pests and diseases. This method also provides long harvesting period of food crops and high cropping intensities in a limited field area. On the other hand, this method causes low yield and quality of products mainly due to difficulties in proper crop management.

(6) In Laos, agricultural technicians and farmers are becoming aware of the benefits of fertilizer and agro-chemicals. Demand for these farm inputs has increased and is expected to continue to increase. In the study area, however, such fertilizers and agro-chemicals are not used even for lowland rice as well as for upland crops, because actually no services for supply of these materials are provided by the government institutes.

(7) Since there is no basis of researched techniques, credible extension services for increase in crop production by farmers could not be provided sufficiently by the offices concerned for good and profitable farm management. In fact, almost all the farmers in the study area are presently isolated from receiving information and technology useful for increase of their crop production.

(8) Livestock is important to farmers economy in the study area but productivity is still low mainly due to (i) the poor performance of the public sector in the area of disease prevention and control, and (ii) depressed farm level prices and restricted marketing channels.

(9) Free ranging of the livestock causes serious problems to cultivated crops especially in the dry season which have to be protected by labour consuming fences. A lot of damage is also caused to forest plantations where the young seedlings are often stamped on or grazed by the cattle.

3. AGRICULTURAL DEVELOPMENT PLAN

3.1 Constraints to Agricultural Development

Various constraints to the agricultural development in the study area may be classified into the following two categories. Each of these constraints does not affect the low productivity independently, but relates closely each other.

(1) Physical Constraints

Physical constraints directly affect to the increase in crop production of the study area are summarized as follows:

(i) Difficulty in appropriate planting time due to unstable rainfall and supplemental irrigation especially in the beginning of wet season,
(ii) Little potential for dry season cultivation because of insufficient supply of dry season irrigation,
(iii) Lack of secondary and tertiary irrigation canals makes sufficient supply of irrigation water to each farm plot difficult, and
(iv) Lack of farm road network makes sufficient farm management difficult in rice field as well as in upland of the hilly areas located far from villages.

(2) Technical and Institutional Constraints

Technical and institutional constraints cause the present low productivity of crops and livestock in the study area, which are summarized as follows:

(i) Low level of farming techniques because of very limited transfer of information and technology for introduction of improved farming practices due to the poor institutional organization with very limited technical staff for proper and timely agricultural extension services,
(ii) Shortage of necessary farm inputs such as certified seeds, fertilizers and agricultural chemicals because of the poor organization and activities for supply of basic farm inputs such as improved seeds, fertilizers and agro-chemicals,

(iii) Low level of livestock raising techniques for meadow management and fodder crops production, and poor activities of organization for control of livestock epidemics,

(iv) Lack of experimental and research works for increase in crop and livestock production which will be the basis for transfer of information and technology,

(v) Lack of organizations and system for marketing of farm inputs and products, and

(vi) Poor activities of organizations for agricultural credits with attractive terms and interests.

3.2 Agricultural Development Plan

3.2.1 Development Concept

The strategy and policy for successful implementation of the proposed rural agricultural development hinge on the elimination or alleviation of various constraints and should reflect the NEM policies. In addition, the final targets of the proposed agricultural development can only be achieved through comprehensive development of not only direct measures for increase in agricultural productivity but also other supporting measures such as strengthening of the government institutes, improvement of rural socio-economic conditions in the study area, etc.

Among them, the increase and stabilization of agricultural productivity through elimination or alleviation of various agricultural constraints that currently exist is considered to be the single most important factor in contributing to the control of slash-and-burn cultivation. The basic concept for the proposed agricultural development will be as follows:

(1) Intensification of farming in both lowland rice field and upland for increase in crop production.

(2) Extension of improved farming.

(3) Diversification of cropping system.

On the basis of these basic concept, the following measures are considered to formulate the proposed agricultural development plan:

(1) Improvement and Strengthening of Agricultural Support Services

(i) Strengthening of Extension Services: especially for transfer of packaged farming information and technology, necessary actions on how to encourage the farmers for increase in crop production, and on how to promote the farmers' participation in crop diversification.

(ii) Strengthening of Veterinary Services: increase in livestock productivity with improvement and strengthening of livestock grazing techniques as well as of public services for disease control and marketing system.

(iii) Establishment of Efficient Marketing System: establishment of efficient marketing system is one of the important factors to vitalize the regional economy as well as to develop agriculture for increasing productivity of the main crops and also by promoting crop diversification. Expansion and improvement of the existing marketing system with establishment and development of organization and facilities will be essential for the market improvement in the study area.

(2) Establishment and Operation of Integrated Agricultural Station

Confirmation of the adaptability of crops both in lowland rice field and sloping land, of year-round farming system in the gentle slope lands, and of alley cropping system in the steep slope lands is essential for increase and stabilization of agricultural productivity and will have to be made through various field trials at a well-designed agricultural station. In addition, the station will prepare concrete action plans for further development in cooperation with the provincial and district staff. This will contribute to improve their technical and managerial capability for continuous agricultural development in the study area and Oudomxay province as well.

3.2.2 Agricultural Development Plan

In line with the above development concept and measures to be considered, the following development plans are proposed to this Master Plan:

(1) Increase and Stabilization of Agricultural Productivity

The scheme component for increase and stabilization of agricultural productivity includes two action plans such as (i) improvement and

strengthening of agricultural support services, and (ii) establishment and operation of integrated agricultural station. The programs in each action plan are summarized as shown below.

(i) Improvement and Strengthening of Agricultural Support Services

In order to provide more agricultural support services for farmers, this component will provide various programs (i) to strengthen the extension services; (ii) to strengthen the veterinary services; and (iii) to establish efficient marketing system. The work items of each program mentioned above will be as follows:

(a) Strengthening of Extension Services

This program will provide various support (i) to strengthen extension service sections of each district office; (ii) to station additional extension workers at such sections; (iii) to extend and settle the improved farming techniques for more crop production in lowland rice field, gentle sloping upland fields and steep slope land; (iv) to arrange programs for women's group; and (v) to promote sericulture.

The present technical and managerial capability, staffing and facilities of the provincial and district offices are weak to provide appropriate extension services for the farmers that are inevitable to achieve the increase in agricultural productivity. A nation-wide plan for the institutional improvement has been studied by the international institutes in Laos. In line with such a nation-wide plan, this program will provide the following facilities and equipment to support their activities:

- Office buildings including storage and garage.
- Staff quarter, if necessary.
- Supply of necessary equipment for each office.
- Station of additional extension workers to provide more extension services, especially for lowland rice and second crops production.

- Training of extension workers at the "integrated agricultural station" to be established.

Activities under this program to be carried out in these extension offices will be as follows:

- Extension of improved farming system in the lowland irrigated rice field, gentle sloping upland field and steep slope areas through introduction and distribution of improved crop varieties, demonstration of pest-disease control and soil improvement techniques, and training of farmers groups.
- Extension of improved sericulture.
- Periodical opening of women's school for improvement of people's life standard, promotion of health education and basic literacy education.

(b) Strengthening of Veterinary Services

In the study area, vaccination promoting activities are on-going supported by Quaker Services in Laos and UNDP/FAO. Therefore, this program will be proposed for further extension of vaccine injection for disease control of livestock and promotion of veterinary services to the farmers. However, the program will be necessary to subject ad hoc study at the implementation stage in connection with the progress of these current activities, and will be prepared at the integrated agricultural station.

(2) Establishment and Operation of Integrated Agricultural Station

It is essential to establish and operate an integrated agricultural station in order to develop packaged farming techniques or system for lowland irrigated rice field, gentle sloping upland field and sloping areas, based on various field trials of crop varieties, appropriate planting time, fertilizer practices, weeding, etc. suited to the differences in the physical conditions of the study area. For this purpose, the following works will be carried out under this action plan:

(i) Construction of main office with storage and garage
(ii) Construction of research and training house

(iii) Construction of staff quarters
(iv) Construction of workshop
(v) Development of trial plots including lowland rice and gentle sloping fields
(vi) Supply of machinery and equipment necessary for O&M of the station
(vii) Supply of O&M equipment for the model areas to be developed

The station will carry out the following programs in collaboration with national research institutes, international organizations and other economic cooperation organizations:

(i) Development and extension of intensified farming in lowland rice field
(ii) Development and demonstration of year-round farming in gentle sloping upland field
(iii) Development of farming system in sloping areas for the future
(iv) Introduction and extension of improved sericulture in collaboration with the sericulture centre in Vientiane
(v) Selection of improved varieties and multiplication of seeds for distribution farmers through the extension office
(vi) Training of extension workers in the district extension offices and the staff of the rice banks
(vii) Post evaluation of the model areas development will be made, which will be useful for preparation of concrete plans and programs to be executed in the future development stage in cooperation with the province and districts. The plans and programs will include further improvement and strengthening of marketing system, veterinary services, preparation of measures to environmental problems, and further rehabilitation of existing irrigation system and social infrastructures, etc. During the preparation, the staff of the provincial and district offices will be trained to improve their technical and managerial capability for continuous rural agricultural development by their own effort in the future.

4. DESCRIPTION OF THE PROJECT

4.1 Strengthening of Agricultural Extension Services

(1) Objectives:

(i) extend and settle the improved farming techniques of farmers for both lowland rice field and hilly areas cultivation,
(ii) contribute to increase the crop productivity and to diversify the cropping system,
(iii) contribute to suitable, economical and sustainable land use both in lowland and hilly areas,
(iv) contribute to control the slash-and-burn cultivation activities, and
(v) contribute to improve the women's ability and to accelerate their activities.

(2) Project Description:

(i) construction of extension service office in Beng and Hun districts (the integrated agricultural station will provide an office space for the extension service of Xai district),
(ii) provision of necessary equipment for extension services,
(iii) station additional extension workers,
(iv) provision of training to the extension workers in the integrated agricultural station, and
(v) execution of the following services by the extension workers:

(a) Short term (for model areas scheme)
- distribution of extension seeds and seedlings which will be produced in the integrated agricultural station,
- introduction and demonstration of improved irrigated lowland rice farming and training of farmers,
- establishment of women's school for improvement of life standard, health education, basic literacy education, garden farming, and
- introduction and promotion of sericulture.

(b) Medium and long term (for entire of study area)

- distribution of extension seeds and seedlings which will be produced in the integrated agricultural station,
- introduction and demonstration of improved irrigated lowland rice farming and training of farmers,
- introduction and demonstration of improved irrigated gentle sloping upland farming which will be developed in the integrated agricultural station and training of farmers,
- introduction and demonstration of improved steep sloping land farming which will be developed in the integrated agricultural station and training of farmers,
- establishment of women's school for improvement of life standard, health education, basic literacy education, garden farming, and
- introduction and promotion of sericulture.

(3) Project Duration: Short term: 6 yeras (1995 to 2000)
Medium term: 5 yeras (2001 to 2005)
Long term: 5 yeras (2006 to 2010)

(4) Project Execution: the Agriculture and Forestry department of the provincial government will be responsible for this program in cooperation with the Integrated Agricultural Station.

(5) Comment: during the short term development phase, the extension services will be concentrated in the model areas scheme. In the medium and long term development phase, agricultural extension services will be expand with sufficient trained staff to the study area.

4.2 Strengthening of Veterinary Services

(1) Objectives:

(i) extend and settle the improved grazing techniques of farmers,
(ii) increase efficiency of the animal health services by providing of vaccines antigens, diagnostics and drugs, and better disease control, and
(iii) contribute to increase livestock productivity.

(2) Project Description:

(i) provision of training to the extension workers in the integrated agricultural station, and
(ii) execution of the following services by the extension workers:
  (a) introduction and promotion of improved livestock rasing system to the farmers, and
  (b) providing of vaccines antigens, diagnostics and drugs.

(3) Project Duration: 10 years (2001 to 2010)

(4) Project Execution: the Agriculture and Forestry department of the provincial government will be responsible for this program in cooperation with the Integrated Agricultural Station.

(5) Comment: during the short term development phase, a concret action plan for the strengthening of veterinary services will be established on the basis of the data and imformation of on-going Lao-Quaker and the UNDP/FAO projects by the integrated agricultural station.

4.3 Establishment and O&M Integrated Agricultural Station

(1) Objectives:

As a long term objective for implementation of the proposed rural agricultural development in the study area, it is essential to establish and operate an integrated agricultural station in order to develop packaged farming techniques for both lowland rice and upland crops, based on various field trials of crop varieties, appropriate planting time, fertilizer ptactices, weeding, etc. suited to the differences in the physical conditions of the study area.

For such an agricultural station, the proposed program is to construct the necessary buildings and supply farm plots facilities and equipment, and to establish the organization including the staffing required for the activities to be executed by the station for the model areas at the short term development stage. This station will be opened in the suburbs of Xai city and near to Xai Model area, through re-organization of a project office to be established for the purpose of implementing the proposed model areas.

(2) Project Description:

(i) Buildings for office and research work, training of extension workers and farmers, and machinery workshop for repairing and maintenance of the machinery necessary for operation and maintenance facilities to be constructed in the model areas.

(ii) Construction of farm plot to be used for experiments, training and demonstration work of the improved farming system on the lowland rice, upland farming including in gentle and steep sloping areas and feed crop management.

(iii) Facilities and machinery required for the research and extension work such as farm machinery, audio visual aid and laboratory apparatus, etc.

(iv) Machinery for operation and maintenance of the irrigation and road facilities in the model areas as well as the facilities in the station. Required number of staff and dimensions of facilities, etc. are designed in the further study.

The station will carry out the following main work in collaboration with national research and extension institutes, international organizations and other economic cooperation organizations:

(i) Research and Trials

(a) Research and field trials will be carried out to develop the improved farming techniques for intensified lowland rice cultivation, which will include:

- selection of superior varieties of rice and other crops, and collection and introduction of crop varieties inside the study area as well as other areas of the country and outside the country;
- soil fertility improvement for increase in unit yield of crops by applying fertilizers, green manure, compost, etc.;
- crop protection technology improvement such as pests and disease control and weed control, etc.;
- improvement of cultivation method in combination with the variety trials, such as planting timing, nursery preparation method, planting density, etc. not only for the lowland rice cultivation but also for secondary crops in the lowland rice field such as wheat, rapeseed, potato, dry onion, etc.;
- harvesting, post-harvesting and quality control technology improvement;
- establishment and standardization of cultivation technology and preparation of materials for extension to farmers;
- demonstration of the improved farming method in the model areas through district agricultural extension offices;
- improvement of farming practices with introducing and improving farm tools and equipment such as plough, harrow, weeder-wheel, etc.; and
- training of farmers on the improved farming technology.

(b) Research and field trials for developing year-round upland farming system in gentle sloping area will include:

- introduction and selection of superior varieties of upland rice and other secondary crops such as sesame, maize, etc.;
- introduction of irrigation farming in the upland where irrigation water is available;
- improvement of crop cultivation system for proper management of each kind of crop by applying pure standing method in a separated field plot for each crop;
- establishment of crop rotation system including alley cropping to maintain and improve soil fertility, weed control and crop productivity for sustainable agriculture;
- introduction and establishment of soil fertility management technology by applying green manure and mulching, etc.;
- diversification of the existing monoculture of rice by growing such crops as sesame, cotton, ground nuts, spice crops, vegetables, fodder crops, tree crops, etc.; and
- cooperation to demonstration, extension and training of extension workers and farmers on the above farming technology.

(c) Research and trial works will also be carried out for extension of improved sericulture technique, including introduction of improved variety of silk worm and mulberry tree.

(ii) Training and Guidance for Extension Workers and Farmers

(a) Training of extension workers in both lowland rice and upland crop farming techniques.
(b) Training of farmers in both lowland rice and upland crop farming.
(c) Direct guuidance to agricultural extension offices for demonstration of lowland rice and upland crop farming in the model areas.
(d) Training of farmers for extension of improved sericulture technique in collaboration with the Hatxyphong Sericulture Pilot Station centre in Vientiane (Hatxyphong).

(e) Training of staff of the proposed rice bank.

(iii) Seed and Seedling Multiplication

(a) Introduction and selection of superior varieties of rice and other crops.
(b) Multiplication and distribution of improved seeds and seedlings to farmers through the extension office in each district.

(iv) Operation and Maintenance

(a) Operation and maintenance of the project facilities in the model areas such as irrigation system and road network.
(b) Repair and maintenance of machinery and equipment for the operation and maintenance.

(v) Study, Planing, Monitoring and Evaluation

(a) Study and preparation of concrete action plans and programs to be executed at the medium and long term development stages for further improvement and strengthening of marketing system, veterinary services, preparation of measures to environmental problems, and further rehabilitation of existing irrigation systems, new irrigation development, and rehabilitation of social infrastructures. During the preparation, the staff of the provincial and district offices will be trained to improve their technical and managerial capability for continuous rural agricultural development by their own effort in the future.
(b) Monitoring and evaluation of the agricultural development scheme in the model areas.

(3) Project Duration: Short term: 6 yeras (1995 to 2000)
Medium term: 5 yeras (2001 to 2005)
Long term: 5 yeras (2006 to 2010)

(4) Project Execution: the Ministry of Agriculture and Forestry will be responsible for this program.

5. REFERENCES

1. National Agriculture and Forestry Research Master Plan Volume 1 and 2, July 1991 by National Agricultural Research Center.

2. Some Suggestion on the Technique for Intensive Agriculture of Seasonal Rice (Lao version), April 1992 by Department of Agriculture and Extension.

3. Lowland Rice Cultivation (Lao version), 1987 by Ministry of Agriculture and Forestry.

4. Fruit Tree Plantation (Lao version), by Ministry of Agriculture and Forestry.

5. Industrial Crops Plantation (Lao version), by Ministry of Agriculture and Forestry.

6. Some Sickness of Animal in Lao PDR (Lao version) by Ministry of Agriculture and Forestry.

7. Alley Cropping (Lao version), by Sombath SOMPHONE, RIFS Project.

8. 1991 Wet Season Research Program in brief, by Lao-IRRI Project and National Rice Research Program.

9. The Lao-IRRI Project and the National Rice Research Program for the Lao PDR in brief, by Lao-IRRI Project

Table

Table MD-1 Agricultural Staffing of Province and District

	Province	Xai	Beng	Hum
1. Directorate	1 - Director I* 1 - Deputy I**	1 - Director 1 - Deputy III*	1 - Director II* (cum incharge of forestry)	1 - Director IIx1* 2 - Deputy IIx1**, IIx1***
2. Administration	1 - Theorist I* 2 - Agro-econ. Ix1, IIx1** 2 - Accountant IIIx2 1 - Medical care IIIx1 1 - Typist 2 - Driver 1 - Sweeper			
3. Agriculture	8 - Agronomist IIx7, IIIx1 for project: IRRI x 4 China x 2 UNDP x 2 2 - Agro-mecha. IIx2	1 - Agronomist (highschool)	1 - Agronomist no grade (Secondary school)	1 - Agronomist II* (cum chief Dep.)
4. Livestock and Veterinary	5 - Veterinarian Ix2 IIx2 IIIx1 1 - Driver	3 - Livestock and veterinary IIIx3	2 - Veterinary Ix1 (from Russia) IIx1	1 - Veterinary II
5. Irrigation	Planning 2 - Technician IIx2 Survey and Design 1 - Engineer Ix1 3 - Technician IIx3 5 - Trainees IIIx5 Irrigation Construction Company 1 - Engineer Ix1 (Vietnamese) 2 - Technician IIx2 3 - Trainees IIIx3	4 - Irrigation IIIx4* (one is deputy chief)	2 - Irrigation IIx1 IIIx1	4 - Irrigation II**x1, IIx1 IIIx2 (one is cum deputy chief)
6. Forestry	Survey and Contract 12 - General IIx9 forester IIIx3 Nursery 3 - Forester IIx3	1 - Forester II	2 - Forester IIx1* no grade x 1	3 - Forester II*** (one is cum deputy chief)
7. Meteorogy	Xai Station 3 - Meteorologist IIx1 IIIx2			

Note: Officer with astarisk(s) is same person.

Figure

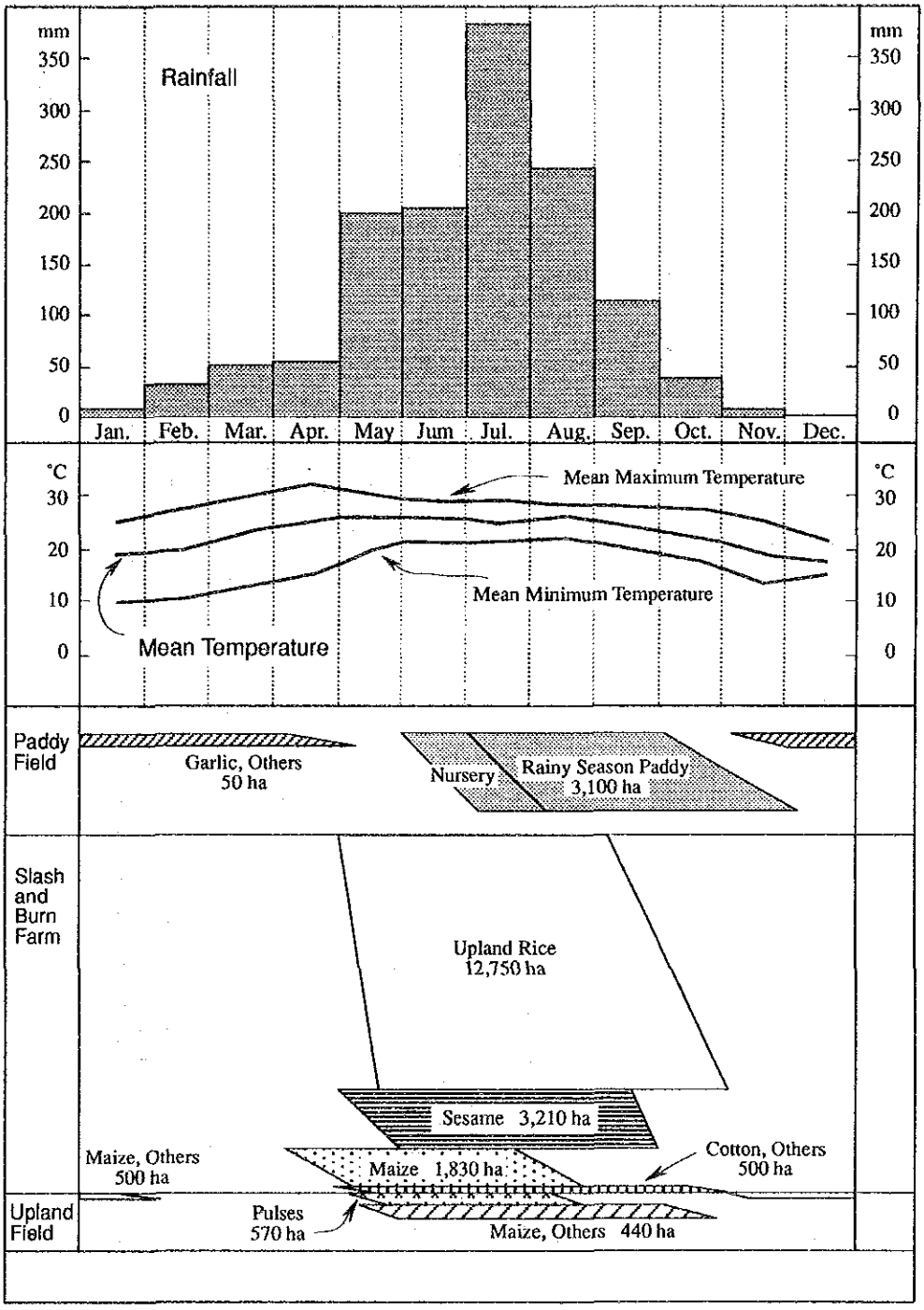


Fig. MD-1 Present Cropping Pattern

THE LAO PEOPLE'S DEMOCRATIC REPUBLIC MINISTRY OF AGRICULTURE AND FORESTRY
AGRICULTURAL DEVELOPMENT PROJECT TO CONTROL SLASH AND BURN CULTIVATION IN OUDOMXAY PROVINCE
NIPPON KOEI CO., LTD. CONSTRUCTION PROJECT CONSULTANTS, INC.

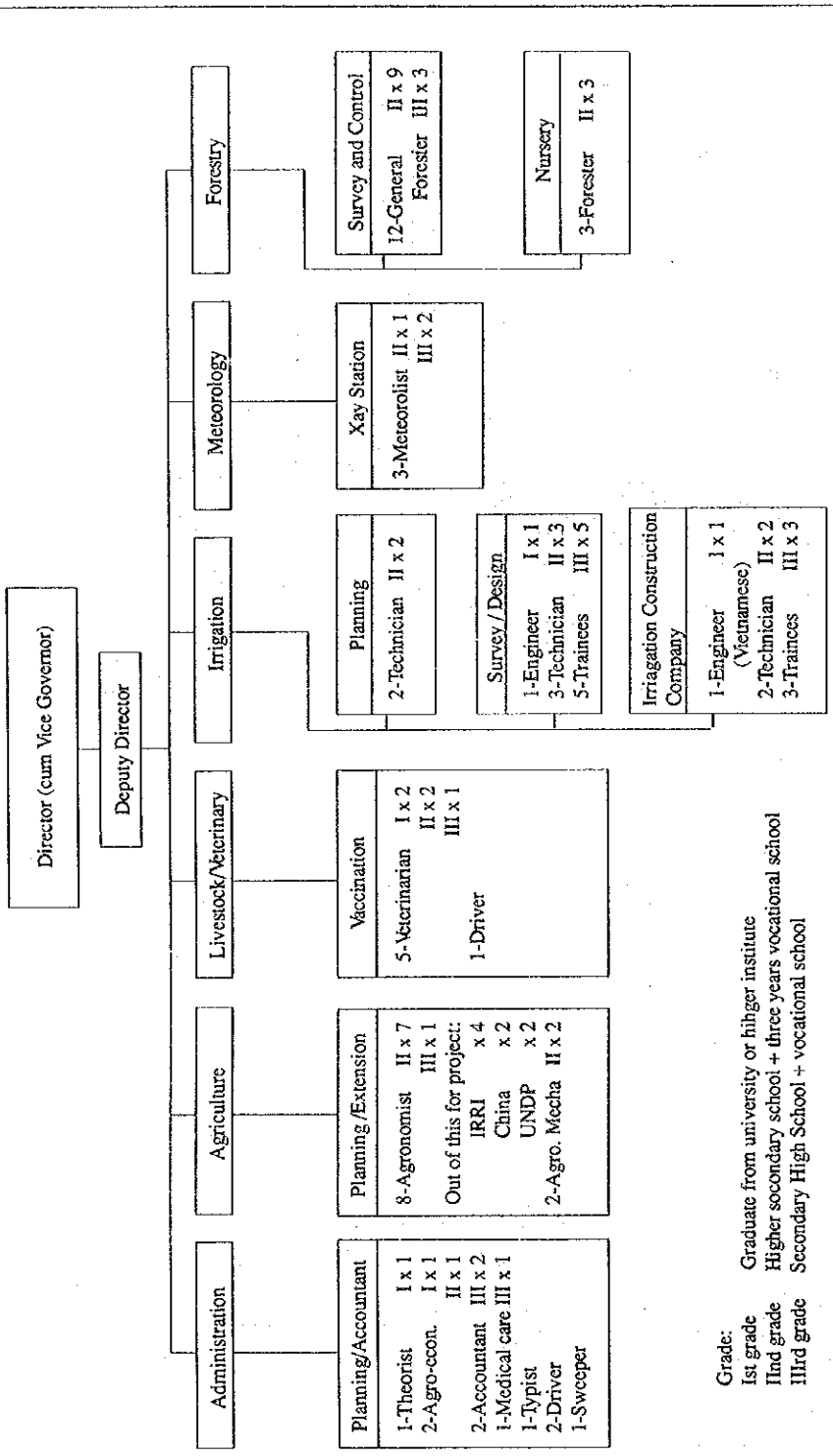


Fig. MD-2 Organization and Staffing of Department of Agriculture and Forestry Services in Oudomxay Province

THE LAO PEOPLE'S DEMOCRATIC REPUBLIC
MINISTRY OF AGRICULTURE AND FORESTRY

AGRICULTURAL DEVELOPMENT PROJECT
TO CONTROL SLASH AND BURN CULTIVATION
IN OUDOMXAY PROVINCE

NIPPON KOEI CO., LTD.
CONSTRUCTION PROJECT CONSULTANTS, INC.

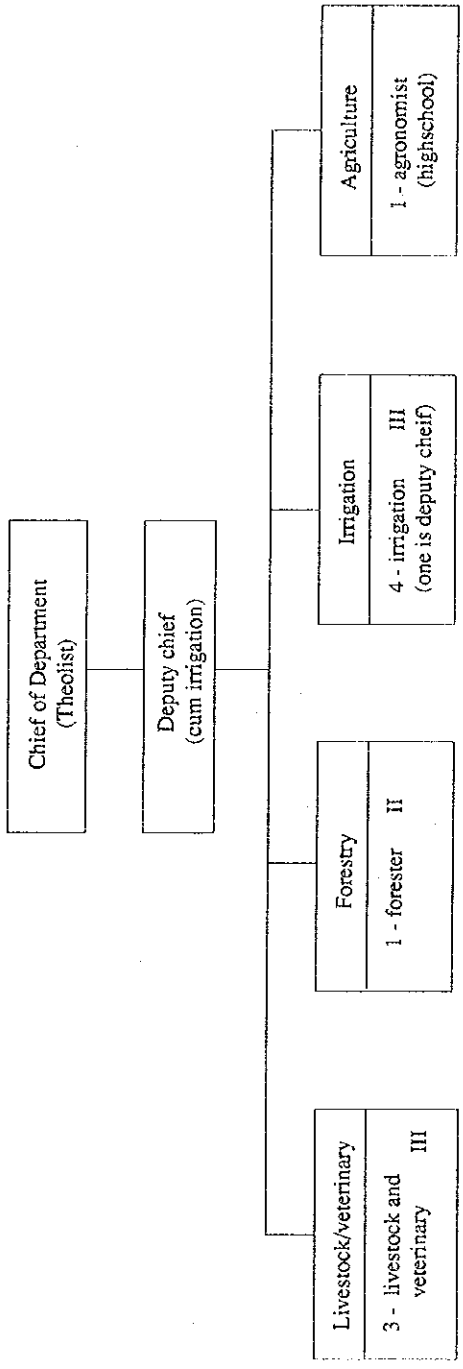


Fig. MD-3 Organization and Staffing of Department of Agriculture and Forestry of Xai District

THE LAO PEOPLE'S DEMOCRATIC REPUBLIC
MINISTRY OF AGRICULTURE AND FORESTRY

AGRICULTURAL DEVELOPMENT PROJECT
TO CONTROL SLASH AND BURN CULTIVATION
IN OUDOMXAY PROVINCE

NIPPON KOEI CO., LTD.
CONSTRUCTION PROJECT CONSULTANTS, INC.

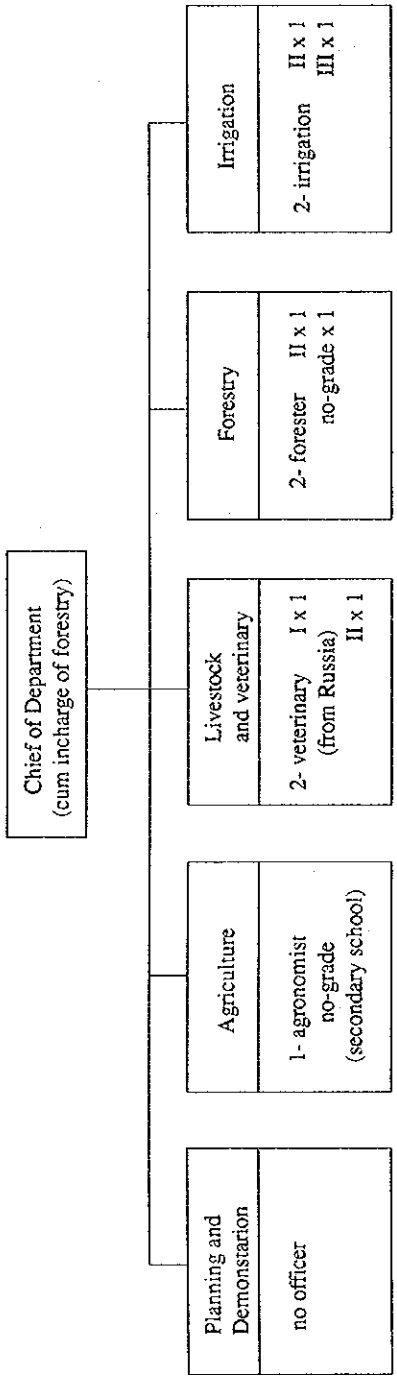


Fig. MD-4 Organization and Staffing of Department of Agriculture of Beng District

THE LAO PEOPLE'S DEMOCRATIC REPUBLIC
MINISTRY OF AGRICULTURE AND FORESTRY

AGRICULTURAL DEVELOPMENT PROJECT
TO CONTROL SLASH AND BURN CULTIVATION
IN OUDOMXAY PROVINCE

NIPPON KOEI CO., LTD.
CONSTRUCTION PROJECT CONSULTANTS, INC.

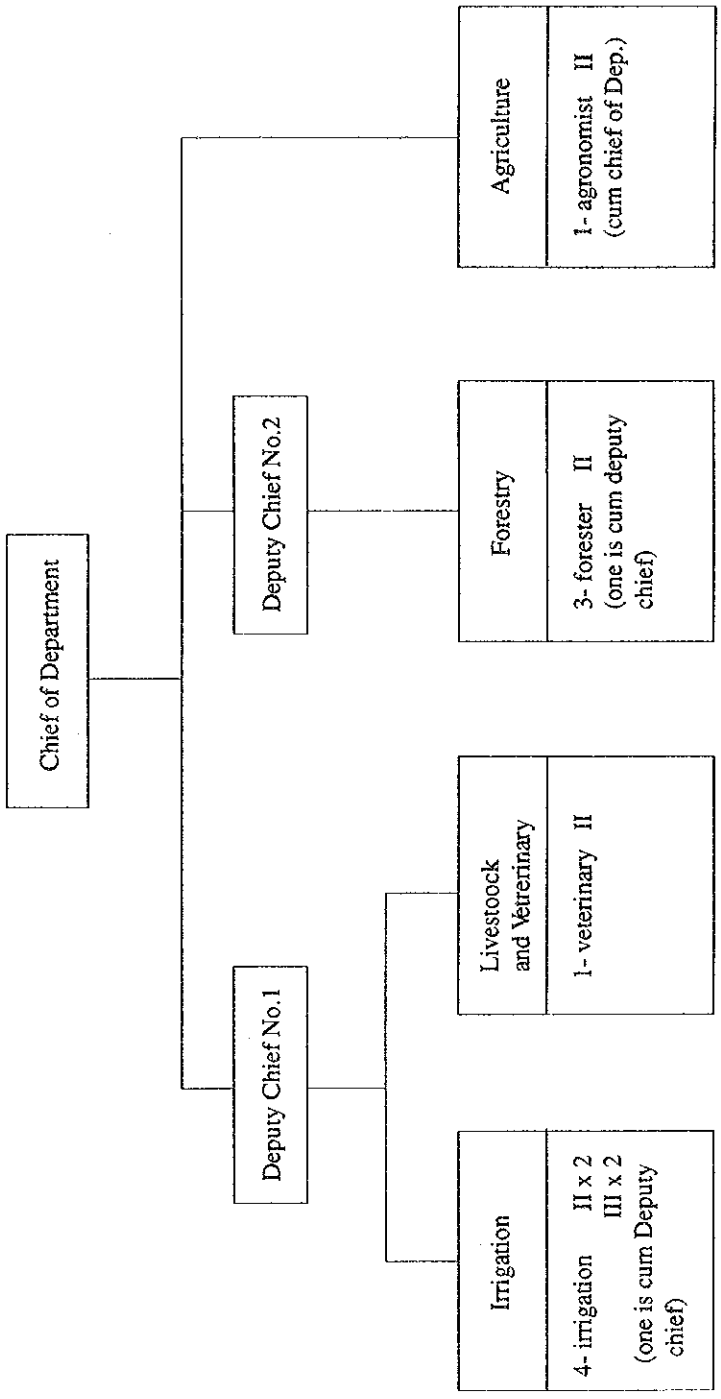


Fig. MD-5 Organization and Staffing of Department of Agriculture of Hun Dixtrict

THE LAO PEOPLE'S DEMOCRATIC REPUBLIC MINISTRY OF AGRICULTURE AND FORESTRY
AGRICULTURAL DEVELOPMENT PROJECT TO CONTROL SLASH AND BURN CULTIVATION IN OUDOMXAY PROVINCE
NIPPON KOEI CO., LTD. CONSTRUCTION PROJECT CONSULTANTS, INC.

Appendix

APPENDIX-MD SERICULTURE IN LAOS

1. Introduction

Sericulture in Laos has its long history, mainly having been a side business for the people in mountainous regions. However, owing to the internal disturbances in 1970s, producing areas of silkworm were considerably reduced and are still remaining scattered in such regions as the suburbs of Vientiane Municipality, and Luangnamtha, Xiengkhouang and Oudomxay provinces.

After the revolution, no aggressive strategies for the development of sericulture have been carried out up to now under the prior policies for food crop production and strengthening of livestock farming. Hatsayfong is one of the examples to show a low priority among the agricultural development programs in Laos, which were transferred to a private sector from the state organization. However, more positive policy for sericulture development is expected because that the demand for the cocoon as raw materials, and silk textile for folkcraft and high-class clothes is still seem to be high and proper production areas in the hilly and mountainous regions are widely spread in the country, which shows a high potential of sericulture development.

2. Feature of Each Producing Area

2.1 The suburbs of Vientiane Municipality

There are 30 ha of total areas in the Vientiane plain region and to be 70 ha in the future plan. A 10 ha of which is located in Latkoay village near Thangone Farm, managed by 28 farmers. They started silkworm rearing house on August 1990 under technical guidance by the Agriculture Semi-enterprise of Thangone Farm. It is welcomed by the people as one of good side businesses, even though the mulberry trees are not growing well with a lot of weeds in bad drainage conditions of the cooperative mulberry fields. The variety of silkworm is yellow and a semi-improved polyvoltine. The cocoon produced in the village is sold to the enterprise at a rate of 1,500 kip/kg and the cocoon drying and raw silk reeling is done in Hatsayfong Silk Pilot Station. It is said that a textile factory started silkworm rearing by direct management in the region however, no detailed data is available.

2.2 Luangnamtha Province

Silkworm rearing is encourage by the government as one of the counter measurements to poppy growing in this region, with an assumed total area of more than 5 ha. The variety is seemed to be semi-improved polyvoltine. The cocoon is reeled by hand and sold to Thailand in the form of self-made cloth or raw silk. The selling prices of raw silk are 9,000 kip/kg for white type and 12,000 kip/kg for yellow one respectively with a total export volume of 2,000 kg in 1989.

3. Hatsayfong Silk Pilot Station

Hatsayfong Silk Pilot station was established by the technical and economic assistance of Japan in 1960s. located in Hatsayfong district of Vientiane Municipality and now under the Agriculture Semi-enterprise of Thangone Farm administratively, where a Japanese volunteer is working for the station.

At present, the station is the only one semi-governmental organization of sericulture in Laos, the activities of which are study of silkworm rearing, demonstration, silkworm eggs distribution and training of technicians and raw silk rearing directly by buying cocoons from the farmers, being equipped with facilities and technicians for continous work of a sericulture such as mulberry cultivation , silkworm rearing, silkworm eggs production, silkworm eggs preservation, cocoon drying, raw silk reeling and inspections. However, owing to limited budgets and staff, technical advice by the staff is not carried out for other farmers than that of Thangone Farm.

The Study of silkworm rearing in the station consists of variety and cultivation tests of mulberry trees, line-separation of silkworm, improvement of silkworm rearing technique and improvement of silkworm rearing house, etc., however, the level of technology is still low and the exchange of technology is encouraged between Laos and Thailand or India these days.

Sericulture traders concerned, especially filature traders, are interested in increasing cocoon production and some traders are recently coming to the station to sound the availability of increase. It is also said that there exist some powerful silk textile traders other than individual farmers, who are engaging silkworm rearing as side business, and these traders want to stabilize and increase the production of the cocoon and some of them are trying to participate in direct management of production, however no detailed information is available.

ANNEX-ME
AGRO-ECONOMY AND MARKETING

ANNEX-ME AGRICULTURAL ECONOMY AND MARKETING

TABLE OF CONTENTS

LIST OF TABLES

1. NATIONAL BACKGROUND

1.1 Location and Area

Lao PDR (Laos) is a landlocked country with a total area of 236,800 km^2, surrounded by China, Vietnam, Cambodia, Thailand and Mynmar, located between latitudes 14 and 20 degrees north and longitude 100 and 108 degrees west. The Mekong river, originating in China traverses the country from North to South, and it drains the whole country, except a small North Eastern portion. The alluvial plains and older terraces of the Mekong and its tributaries cover about 20% of the national territory and the rest part is mountainous.

The country has 17 provinces, 113 districts, 937 sub-districts and 11,582 villages, and the country is officially divided into three main regions from agricultural point of view as follows:

(1) The Northern Region: This region comprises the eight provinces of Phongsaly, Luang Nam Tha, Oudomxay, Bokeo, Luang Prabang, Houaphanh, Xayabouri and Xieng Khouang.

(2) The Central Region: This region comprises the Vientiane Prefecture, and Vientiane, Borikhamxay, and Khammouane Provinces.

(3) The Southern Region: The region comprises the provinces of Savannakhet, Saravane, Sekong, Champasack and Attapeu.

1.2 Population

According to Basic Statistics (1975-1990), the estimated total population of Laos in 1990 was 4,170 thousand. The population density was estimated at 18 per km^2 and least densely populated in the South East Asian countries. The annual population growth rate is estimated at about 2.9% and the population in year 2000 is expected to be about 5.5 million. About 85% of the total population is living in rural areas and their main occupation is agriculture. There are about 70 ethnic groups which are commonly divided into the lowland Lao (Lao Loum, about 56% of the total population), the midland Lao (Lao Theung, 34%) and the upland Lao (Lao Sung, 9%) and others include Vietnamese, Chinese, Indians, etc., 1%. The population is unevenly distributed, about 60% is living on the plains of the Mekong and its tributaries, while the others with different ethnic backgrounds are confined to the mountains. Lao Loum mostly resides in lowland river valley where they practice lowland rice based

agriculture. Lao Theung practices traditional shifting cultivation on the medium altitude uplands. Lao Sung resides the high altitude uplands.

1.3 National Economy

Gross Domestic Product (GDP) by industrial origin is given in Table ME-1. Agriculture is the mainstay of the national economy, the sector produced, in 1990, about 60% of GDP followed by services sector of about 24% and industry sector of about 16%, respectively. GDP per capita in 1990 is estimated at about US$120 (1989 constant). In 1985, the government initiated an reform of its system of economic management. The objectives under NEM are to improve the public sector enterprise management and increasing the role of the private sector. Agricultural sector, as seen above, employs about 85% of the population while Lao agriculture is still predominantly subsistence-oriented with less modernized farming practices. Slash and burn cultivation systems still account for about 40% of crop production per year.

1.4 Land Use, Slash-and-Burn Cultivation

About 75% of the land surface is mountainous and in these areas only the narrow valleys are suitable for cultivation. About 380,000 ha are lowland rice field, and about 215,000 ha are upland rice field including slash-and-burn cultivation area. About 260,000 ha are for other crops of which 20% is coffee. Pasture and range land is about 800,000 ha.

Despite the low population density, slash-and-burn cultivation systems have exerted pressure on the land and some 200,000-300,000 ha of forest are reportedly destroyed every year, including an estimated 100,000 ha of primary forest. Traditional slash-and-burn systems were generally in harmony with the environment, when there was no land pressure in the hill to mountainous ares and a family of about six persons could have a total area of about 20-25 ha for adoption of the rice-based slash-and-burn system under a ten-year fallow cycle.

1.5 Agricultural Development Policy and Strategies

New Economic Mechanism (NEM) has been developed as a strategy for improving productivity and efficiency of Lao economy. Under the policy directions basic agricultural development directions have been formulated. The agricultural development policy under the Second Five Year Plan (1986-1990) is reiterated in the draft of Third Five Year Development Plan (1991-1995) as follows:

(1) ensure food self-sufficiency and food security
(2) reduce the area subject to slash-and-burn cultivation
(3) properly manage and conserve forest resources, and
(4) expand the agro-forestry based industrial processing sector

Agriculture is the largest industry in the country and given high priority for further development. For this purpose, the government attention will be focused on the following key areas:

(1) Land use regulation: clear property right on land is important to enhance the allocation of land resources. A system of land use and land right will be established.

(2) Subsidies and project intervention: competition will be encouraged in the provision of agricultural inputs. With competition, the farmer is in control since he will have alternative choices, if he is not satisfied with any supplier. The government will concentrate on developing a competitive supply, processing, and marketing network.

(3) Marketing and trade control: monopoly and trade control and practices in local and foreign trade in agricultural commodities will be avoided by the government or by state enterprises. These include marketing practices such as monopoly trade and processing rights in certain strategic commodities for state enterprises, monopoly supply of agricultural inputs, and use of licenses and quotas to restrict market access. A legal basis for trade transactions will be developed.

(4) Agricultural taxation: differential agricultural output taxes which causes distortions on the choice of crops to be grown will be eliminated. Agricultural taxation suitable to Lao conditions will be determined and developed. Land taxes based on the classification of land potential, rather than actual production, will be examined, in order to avoid disincentives on choice of crops.

The strategy for irrigation development will be (1) to curtail the flow of resources into high cost larger scale irrigation systems; (2) to turn these public sector schemes to the farmers communities as much as possible; and (3) to concentrate on a much more moderate level of resources on the support of water users associations which control their irrigation

systems. In this connection, efforts will be made to improve the efficiency of existing irrigation systems through rehabilitation and maintenance.

The government irrigation agencies will be redirected to provide a support function to farmers' associations formed on the irrigation schemes, instead of undertaking direct investment on the development of new schemes.

The productivity, economic returns, and export earning of the livestock sector will be maximized by accelerating commercial development of this sector, with the private sector being encouraged to play a dominant role in production, marketing and investment.

In order to encourage the livestock export, export taxes on livestock trade will be abolished, with reliance instead ob direct level taxes on production in general to generate revenues from the sector.

The government recognizes that fishery is an important and relatively inexpensive form of food source. The development of fishery, especially by the private sector, will be further encouraged through the provision of restocking the lakes, the establishment and expansion of fish farms, the improvement of fishing methods in the rivers, and the provision of adequate transportation and storage facilities for the purpose.

2. REGIONAL ECONOMY

2.1 General

Agriculture is the main industry which employs more than 95% of the total population of the province. Rice is the staple food and the main agricultural product, followed by sesame and other minor crops such as beans and some vegetables. Rice is cultivated in the lowland rice field with irrigation or under rainfed condition, and also cultivated in the upland rice field (slash-and-burn cultivation). The total area of lowland rice field in 1991 was about 9,800 ha and that of upland rice field was about 31,000 ha. The production of rice in the lowland and upland was about 26,600 tons and 41,000 tons in paddy, respectively.

Livestock such as buffalo and cattle is important product for export as well as for farm power and local consumption. The number of buffalo and cattle in 1990 was about 80,400 and 57,000, respectively. Beside the products in the farms and of livestock, they collect various kinds of forest products such as cardamom, benzoin, bamboo shoot, mushrooms, and many kinds of animals and fishes.

2.2 Population

The population of Oudomxay province is 291,000 in 1991, about 7% of total population of Laos. The population by district in the province is summarized in Table ME-2. The annual population growth rate for the province during 1983 to 1991 is estimated at about 2.6%, while the rate for Xai, Beng and Hun is estimated at 3.89%, 1.84% and 3.2%, respectively. The population density in Xai, Beng and Hun districts is estimated at 17, 16 and 22 persons/km^2, respectively.

According to the Department of Statistics, the death rate of infant under 4 year-old in 1986 was estimated at about 52% in the province, and the natural increase rate of population in the province was estimated at 2.41% per annum for 1990. The population structure is very young, as seen in Table ME-3, and Fig. ME-1. More than 42% of total population is under 14 year-old, while about 6% of the population is above 60. The population structure predicts rapid population growth in the near future, and population pressure on land in the rural society increases further.

The population in the province is divided into three broad ethnic groups, say Lao Loum, Lao Theung and Lao Sung, and the proportion of each ethnic group to the total

population is 28.9%, 56.9% and 14.2%, respectively (Chazee, 1991, La Province de Oudomxay).

2.3 Economic Activities of Main Ethnic Groups

Similar to other provinces of Laos, the economic activities of people in Oudomxay province are generally characterized based on the activities of the ethnic groups, say Lao Loum, Lao Theung and Lao Sung. In most cases, an ethnic group is the base to organize a village or community, and follows a similar traditional way of economic activities of each ethnic group, mainly agriculture, though there are also villages which are composed of two groups or some time three groups.

(1) Lao Loum

Originally, the Lao Loum are people from the lowland areas whose main agricultural activity is the cultivation of irrigated or rainfed lowland rice on terraces or flat valley bottom. During the last decades, however, the population has increased to such an extent that new opening of paddy field becomes difficult gradually, mainly because of limited availability of easily terraceable land. Therefore, the Lao Loum also started to cultivate upland rice on the adjacent hill slopes by slash-and-burn farming. In fact, there are many hills where slash-and-burn cultivation is being practiced by the Lao Loum groups with a short fallow period of 3 to 4 years in the study area.

(2) Lao Theung

On slopes at medium altitude of approximately 500 - 1,000 m in elevation, various ethnic groups, collectively known as Lao Theung, have their shifting agricultural fields. They are practicing an ecologically much more stable system of shifting cultivation, whereby a large number of fields are cropped for one or two years in combination with a fallow period of 5 to 15 years, depending on soil conditions and availability of land although upland rice is the main crop in general other crops such as cassava, maize and chillies are also part of the cropping patterns.

In the study area, there are also the Lao Theung groups who moved from the hill areas and established their villages along Route No. 2. They are engaged partly in lowland rice cultivation. However lowland available for these groups is generally limited because most of paddy field is already in use by

the Lao Loum groups. Therefore, their main farming activities are slash-and-burn cultivation on the adjacent hill slopes with a short fallow period of 3 to 4 years. So far as slash-and-burn cultivation on the hill slopes adjacent to the main road is concerned, little variation in upland rice cultivation methods between the Lao Loum and the Lao Theung groups is being observed in recent years.

(3) Lao Sung

On the higher hill slopes, above approximately 1000 m, the so-called Lao Sung, mainly belonging to the Hmong people, cultivate poppy as a cash crop, and a number of subsistence crops such as rice, maize, tobacco and vegetables.

In the study area there are also the Lao Sung groups who moved from the higher hills and established their villages along route No. 2. These groups are engaged in slash-and-bun cultivation on the hill slopes adjacent to the road. Such hills, especially in the downstream area of Hun district, are completely slashed and burned for upland rice cultivation by these groups. These Lao sung groups residing on the hill slopes are obliged to be engaged in slash-and-burn cultivation because of no alternatives for their survival at present.

2.4 Food Balance in Province

The Northern Region consisting of eight provinces is a food deficit area as shown in Table ME-4. Oudomxay is also food deficit province in the Region. The food balance in the province in recent years is examined as shown below:

Year	Production* (ton)	Population** (No.)	Requirement*** (ton)	Balance (ton)
1986	79,370	254,450	89,100	-9,730
1987	103,890	260,770	91,300	+12,590
1988	68,490	266,260	93,200	-24,800
1989	96,500	273,900	95,700	+800
1990	99,700	282,140	98,700	+1,000
1991	67,540	290,250	101,600	-34,060
Total	515,490		569,600	-54,110
Average	85,900		94,900	-9,000

Note: *: Data obtained from Department of Agriculture, Oudomxay Province.
**: Requirement is estimated based on 350kg/capita/year in paddy.
***: Data based on Table ME-2.

The rice production in the province is not sufficient to fulfil the consumption of the province in total. About 9,000 tons of paddy is short per year on an average. In the year when the farm production affected adversely by weather condition, the farmers collect forest products to supplement the food shortage.

2.5 Marketing and Prices

2.5.1 General

Under NEM policy, marketing and prices of farm inputs and outputs are not controlled by the government and market-oriented prices are prevailing. Main products in the area is rice, and it is marketed through private channels mostly within the province. Other agricultural products such as sesame, cardamom are traded mostly for export to China and Thailand. The main agricultural products exported to Thailand from the area are buffalo, cattle, sesame and cardamom. Main agricultural products exported to China are sesame and cardamom. Cotton is a considerable commodity as the transit trading goods from Vietnam to Thailand. The province imports various kinds of daily consumables, construction materials, industrial products and medicines, etc.

Marketing system of agricultural inputs in the area has not been established yet and farmers are not accustomed to apply chemical fertilizers, and the marketing channel and prices of farm inputs such as fertilizers and chemicals have not been formulated yet. In Vientiane, the market channel of farm chemicals, fertilizes and seeds have been established, and the retail prices of these farm inputs are shown in Table ME-5, as references.

2.5.2 Marketing Routes in the Province

Xai is the capital of Oudomxay province and the centre for marketing of the province as well as in the study area, and Xai occupies important location of transportation routes for international transit trade among Thailand, China and Vietnam. The commodities imported from Thailand is passed through Houay Xai, 160 km north from Pakbeng, transported via Mekong and landed at Pakbeng for road transportation to Xai by national road No.2 which runs along the Nam Beng river. The goods to Vietnam from Thailand is sent after Xai via Nam Khoa. Agricultural products from the study area exported to Thailand are mainly shipped at Pakbeng and sent via Houay Xai. Agricultural products in the study area which exported to China is mainly transported via Xai and Boten.

2.5.3 Major Commodities Traded

Major commodities traded through Oudomxay province for 1989 and 1990 are as shown in Table ME-6 and their destinations and origins are summarized as follows:

	Thailand	China	Vietnam
Export	buffalo,cotton, sesame,cardamom, cattle, garlic	iron sheet, plywood, sesame, cardamom	motorcycle, slipper, seasoning,battery
Import	motorcycle, slipper, medical drugs, construction materials	battery,bicycle, sewing machine	cotton, clothes, fabric, cement

Imported items from Thailand are mainly industrial products, such as motorcycles, medicines, and construction materials, while exporting buffalo, sesame, cardamom and cotton. Trading with China, iron sheet and plywood, agricultural products such as sesame and cardamom. Trading with Vietnam is mostly concentrating on the export of industrial products imported from Thailand and China, and import of cotton to be exported to Thailand.

2.5.4 Retail Markets

There are common retail markets in the urban area of Xai and Hun. The market facilities were constructed by the private sector investment. The retailers tenant the shop space with payment. The open marketing space for agricultural products in both markets are managed by the government and every local farmers can use the space by some amount of payment, depending on the amount of their sales a day, usually Kip 10 to 50 per time. Retail market prices of agricultural products in Xai and Hun markets are listed in Table ME-07.

2.6 Land Tenure System

2.6.1 General

Officially, the basic principle is that land cannot be privately owned; it can only be "the property of the national community represented by the State". This declaration was emphasized in the recent Decree No.117 on Management and Use of Forests and Forested Land, published in 1989. According to this law, the people have the right of usufruct or the right of use of the land, but no right to buy or sell the land. However, this principle operates in urban areas or where the State's presence is felt. In most of the rural and remote areas, the customary land tenure system is apparently still working.

Generally, each village claims the ownership of a well-defined territory, with clear boundaries recognized by all the surrounding people. This right is acquired when families settle and take possession of uninhabited land thus creating a new community. Then, a village can be defined as an aggregate of families, usually forming a lineage or a segment of lineage and established on a territory. This right is acquired by all village families and allows use of land to be passed down from father to son. Strangers to the village can only gain access to the land after asking permission from the Council of Elders.

2.6.2 Customary Land Tenure System

There is customary land tenure system in the villages. Usually land is categorized as 1) primary forest, 2) degraded forest, 3) secondary forest (long fallow regenerating forest), 4) recent fallow, 5) shifting cultivation field, 6) non-irrigated rice field, 7) irrigated rice field, and 8) land for housing. All these categories of land belong to the village as a whole, and individuals are given the right to use it:

(i) Primary Forest and other Degraded Forest: as customary uses of the primary forest and other degraded forest, it is considered as common property, which everyone may only have right of use according to accepted traditional rules. The government has strong intention for conservation forest and appoints a government official in each village to follow the principles of forest preservation.

(ii) Secondary Forest and Shifting Cultivation Fields: on both secondary forest and land cleared for crop cultivation, people can exercise a right of use that becomes a right of possession when they manifest the will to work on a particular plot. When a plot is no longer cultivated, it becomes community property again at everybody disposal.

(iii) Irrigated and Non-Irrigated Rice Field: on the irrigated or non-irrigated rice field, the original right of possession becomes a right of property and they have a right of selling, buying, and transfer by inheritance of a specific piece of land.

2.6.3 Agricultural Taxation

Under Decree No.47 of June 26, 1989, all economic sub-sectors engaged in agriculture and livestock production are required to declare the areas of land, types of

cultivation and income from the scale of productions. The basis for the calculation of agricultural taxes on the production of cereals is the level of soil fertility and for the commodities as the actual income in cash or kind.

(i) There are four levels of taxes on low land rice field:

Yield (ton/ha in paddy)	Tax (kg in paddy)
> 3.5	140
3.0 - 3.5	120
2.5 - 3.0	100
< 2.5	80

(ii) There are two categories of taxes for upland rice (slash-and-burn):

Categories	Tax(kg/ha in paddy)
Cleared from secondary forest	50
Fixed, terraced or stable system	30

(iii) Coffee, cardamom, tea and tobacco, others: 5.0% of income

(iv) Fruits Trees and other crops: 3.0% of income

(v) Livestock traded: 5.0% of income

3. STUDY AREA

3.1 Basic Economic Condition in the Study Area

3.1.1 General

The rural economy is very small scale and under rather isolated circumstances, due to lack of transportation facilities, lack of timely information on markets and due to the subsistence level of the farmers economic activities. The main economic activities in the rural area is agriculture and the agricultural production is, in most of the area, mainly for self-sufficiency and very small portion for marketing purposes. Livestock rasing is also important economic activity in the villages.

Many kinds of animals and plants collected from the forest play the important role in the rural economy, such as cardamom, meat of animals, vegetables, etc. Cardamom is the important export product for Thailand and China, and others are mostly consumed by themselves and surplus is sold to the local market.

3.1.2 Food Balance in the Study Area

The food balance in the study area is examined based on the rice production and population in recent years as shown below:

Year	Production (ton)	Population (No.)	Consumption (ton)	Balance (ton)
1987	24,140	80,230	28,080	-3,980
1988	24,530	81,580	28,550	-4,020
1989	23,700	87,050	30,470	-6,770
1990	24,600	97,480	34,210	-9,610
1991	25,520	101,270	35,440	-9,920
Total	122,490	-	156,750	-34,260
Average	24,500	_	31,350	-6,850

Note: Consumption is estimated based on 350 kg/capita/year in paddy.

The production of rice in the study area is very short to fulfil the people's consumption in the area. The short amount of paddy has increased in every year and about 10,000 tons of paddy was short in 1991.

3.2 Marketing in Study Area

3.2.1 Present Marketing System

The study area is located along the Route No.2 which is the main artery for the marketing activities for China, Thailand as well as internal trade within the province.

Marketing activities for international trade with Thailand, China and other countries are mainly carried out by private traders licensed by the province.

Agricultural products in the study area are usually sold at the farm gate to the middleman appointed by the company and very little farmers carry the production and sell at the market in urban area.

There are permanent common retail markets in urban areas of Xai and Hun. There are a few retail markets in some villages along the route No.2, and these markets are opened periodically, usually three times a month, and almost without facilities.

3.3 Processing and Storage of Farm Products

3.3.1 Agro-processing

Most important agro-processing activity in the area is rice milling. There are privately owned rice mills in the villages. The number of rice mill in each village in the study area was surveyed as shown in Table ME-8. About 20% of villages in number have rice mill in their villages. The number of rice mill in a village is about one or two, but in some large villages which have relatively large area of rice field and along the main road, there are about six or more rice mills. Most of rice mills are one-pass steel huller type and operated with 12 to 16 horse power of diesel engine. The milling capacity is about 100 kg to 200 kg/hr input, and the milling recovery is about 60% on an average. These rice mill and engine are imported mainly from China and Thailand, and spare parts for rice mill is available in Xai and Hun markets. Milling charge is around Kip 10/kg in paddy, and bran is given to the miller. Most of families are willing to use rice mill, but still pounding method is the major part for rice milling for home consumption in many villages.

Production of tobacco for sale is very common in villages along the main road in Ben district. Ben district established a tobacco drying kiln and a storehouse for dried tobacco in 1988, and it was damaged by a storm in 1989 and stopped operation since that time.

A private company has started distribution of improved seed of tobacco plant in 1992, and has a plan to extend cultivation and drying technology, together with rehabilitation of the kiln.

Local liqueur or "Lao Lao" is made from rice mainly in Lao Loum villages and sold at market. It is commonly said that 0.5 to 0.6 litre of Lao Lao is made from 1 kg of rice. Other processed foods sold in market, but not in large scale are; 1) bean card or "Toufu" (soybeans), 2) sausage (pork), 3) fermented salt fish or "Som Pa" (river fish with rice), and 4) fermented bean or "Tua Nao" (soybeans).

Farmers have no custom to make use of vegetable oil and milk in the whole study area, but some kinds of vegetable oil imported from Thailand and China are found in Xai retail market. Women of Lao Loum have custom to do ginning and weaving of cotton which is grown by themselves for their own use and for sale. They also grow sugar cane for making crude sugar, but only for their home consumption.

Sesame is usually sold at farm gate to middlemen in the study area. The farmers dry sesame in the field under the sun before threshing, and the middlemen collect threshed sesame. The traders sometimes have troubles with merchants of Thailand or China due to low quality of sesame mainly with high moisture content and contamination, and results in low return to farmers. This is mainly because the farmers and middlemen have no improved post-harvest equipment and facilities for drying, cleaning and storing sesame before shipping.

3.3.2 Storage of Agricultural Products

Individual farmer family has its own granary to stock paddy for one year consumption and seed for next season. In almost all of villages, granaries of all families of a village are located together in a corner located a little apart from the village houses to avoid fire. The granary is lofted floor and constructed with wood and bamboo and thatched with grass.

There is a granary in each village or "rice bank" that is a system of savings-cum-rural credit of villagers in ANNEX-FB, Agriculture. Main problem which damages paddy in storage is rat, and any other serious problems are not recognized.

Each district has storage house for paddy collected from farmers as tax. The provincial government has a policy to collect tax in cash instead of in kind, and this will be applied 100% from 1993.

4. MARKETING AND PROCESSING DEVELOPMENT PLAN

4.1 Constraints to Economic Development and Marketing

4.1.1 Constraints to Economic Development in the Study Area

The present farmers' economic activities in the study area is mostly concentrated on agriculture at subsistence level to produce their food, especially rice. About 70% of rice production in the area depends on slash-and-burn cultivation and the rest on lowland rice farming. The present constraint to the regional economic development is a deficit of rice, and the rice production depends mainly on slash-and-burn cultivation being controlled under the government policy. Preliminary food balance study in the study area shows that the rice deficit in the area will increase due to high population growth. On the other hand, a considerable increase in rice production would not be expected, provided that 2,600 ha of present lowland field and 2.7 ton/ha of average crop yield are kept as they are without making any effort for more rice production. As examined in the following table, the rice deficit in the years of 2000 and 2010 is estimated at about 36,500 tons and 53,900 tons, respectively, even in the case 2 which is examined on the assumption that the average crop yield will increase to 4.0 ton/ha by some agricultural extension services.

District	1991*	1995	2000	2005	2010
Population*	101,300	114,600	133,900	156,700	183,700
Consumption ton)**	35,455	40,110	46,865	54,845	64,295
Production case 1 (ton)***	7,020	7,020	7,020	7,020	7,020
Balance(ton)	-28,435	-33,090	-39,845	-47,825	-57,275
Production case 2 (ton)***	10,400	10,400	10,400	10,400	10,400
Balance(ton)	-25,055	-29,710	-36,465	-44,445	-53,895

Note: *: Population projection is based on Table ME-9.
**: Consumption is estimated on the basis of 350kg/capita.
***: Production is estimated based on the average cultivated area of 12,600 ha of lowland rice in the recent five years, and 2.7 t/ha of yield in paddy for case 1, and 4.0 t/ha for case 2, respectively.

The land and water resources which could be developed for more rice production are very limited because of mountainous topography. This means that the increase in agricultural productivity in the existing lowland rice field is essential to cope with these situations. Even though various efforts are made for this purpose, the study area will still have to secure sufficient food for the people either by increasing upland rice production or through internal import from the provinces with food surplus in the country. The efforts for agricultural development in the study area should therefore be made not only for increase in rice production

but for promotion of crop diversification as well as increase in livestock production, in order to gain more cash to buy the people's staple food. Such efforts for agricultural development should also include a plan for improvement and establishment of an efficient marketing system in the area for trading both agricultural products and inputs.

4.1.2 Constraints to Efficient Marketing

The present constraints efficient to marketing of farm inputs and outputs in the study area are summarized as follows:

(1) Lack of marketing organization: farmers currently consider that they are suffering from the unstable market needs. In the past, they failed to sell their crop products which were requested by the traders. The main reason for the failure was due to inferior quality and very small quantity for international trade. In addition, no organization has been established to trade farm inputs especially fertilizers and chemicals in the study area.

(2) Poor road and transportation facilities: because of poor road and transportation facilities especially for villages in the hilly areas, villagers live under very isolated conditions, and they are not willing to introduce crop diversification because of poor access to markets.

(3) Poor information services on market: due to lack of roads, communication facilities and organizations to disseminate accurate information on the market needs, farmers are kept without relation with the markets.

(4) Lack of market and storage facilities and little chance for sale: the farmers usually sell their products directly to middlemen who are visiting the villages mainly along the main road, and they have custom to sell their products when they need cash, not depending on the request of the markets. Then, the individual farmer has no power to negotiate with the middlemen on the prices of commodities.

(5) Weakness in Credit Services: the farmers needs effective credit services to become more readily available for all areas of agriculture, not only for production but also for marketing activities, procurement of inputs, etc.

4.2 Basic Development Concept

4.2.1 Basic Concept for Market Development

The establishment of efficient marketing system is one of the important factors to vitalize the regional economy as well as to develop agriculture for increasing productivity of the main crops and also by promoting crop diversification.

Expansion and improvement of the existing marketing system with establishment and development of organization and facilities will be essential for the market improvement in the study area. For the improvement, the following items are especially focused on:

(1) Organization establishment and system improvement

Under the free market system, it is essential to keep the market-oriented principles, say to prepare commodities of quality and a certain quantity to meet market requirements, and to ship constantly or timely every year according to the requirements of market. In this connection, it is inevitable to establish a well-rationalized marketing system through organizing the farmers (as producers and users) to control quality and quantity of products, so that the farmers will become possible to negotiate with the traders on the appropriate prices of products as well as inputs through the organization; e.g. farmers cooperatives, local traders organization, etc. Furthermore, a whole sale system will be established to introduce a principle of competitive prices.

To formulate appropriate prices of the commodities at every level of market, accurate and timely information on markets such as required quantities of products and inputs is fundamental matter. Manpower development will also be necessary for operation and management of the system, organization, and also for collection and dissemination of information on market, etc.

(2) Facility development:

Together with the improvement of marketing system and organization, development of marketing facilities for collecting, cleaning, weighing, packing, storing and shipping are also required. Any farmer will be able to sell their products to the collection ware house operated by the organizations whenever they want to sell their products. Road is one of the essential

facilities for market development not only for transporting inputs and outputs but also for disseminating information on market to the villagers especially in the isolated areas.

(3) Strengthening of support services

The present staff engaged in the support services for marketing at provincial and each district level related to the model areas is as shown below.

Province		Xai		Beng		Hun	
10-Commerce	I x 1	1-Accountant	III x1	2-Teacher	II x 2	2-Accountant	I x 1
	II x 9			1-Commerce	III x 1		II x 1
1-Finance	I x 1						
2-Teacher	II x 2						

I, II, III mean grade of officers as first, second and third, respectively.

Most of officers in the districts seems to be not the specialist for marketing promotion but for acting as clerks, and they are also not well-informed and trained about the marketing system under NEM by the province or the central government. Most of them are just waiting some instructions from the province and not active to promote agricultural production and marketing of their own district.

To improve and strengthen the function and capacity of marketing support services at the province and the districts levels, it is essential to recruit specialists for marketing promotion of agricultural products and to give proper training on the marketing system under NEM. In addition, improvement of their office space and equipment is required sufficiently for collecting, analyzing and disseminating markets information from and to the central government, farmers and international markets especially in Thailand and China.

4.2.2 Basic Concept for Agro-processing Development

(1) Rice mill

The rice milling is the main agro-processing activity in the study area, and this activity and facilities have been developed well based on the small-scale rice mills. Considering the small village scale, and poor transportation facilities, the present system will be acceptable for promotion in the future. It

is considered that no special development program is formulated in the present study, except for the proposed "rice bank" which will belong to the farmers organization and be operated by the women's group in the model areas.

(3) Post harvest equipment and facilities for sesame

Sesame is important cash crop in the study area. It is usually exported to Thailand and China by private trading company, but some times has resulted in low prices due to low quality of sesame with high moisture content and contamination. It is inevitable to improve facilities for drying, cleaning and storing sesame before sell to company. The facilities should be equipped to the farmers' organization and operated by themselves so as to sell sesame in negotiated prices and to get farmers reasonable return of sesame cropping.

4.3 Marketing and Processing Development Plan

Market and processing development plan in the medium and long term development phases should be prepared in the short term development stage along with the introduction of new law and regulation on market such as whole sale marketing system, etc. and also according to the progress of agricultural development and promotion of farmers marketing organization.

The market and processing development plan is formulated taking into consideration the basic development concepts described above, such as organization establishment and system improvement, facilities development, strengthening of support services. The main commodities to be considered for market and processing development in the study area is mostly of the products of agriculture such as rice(paddy) and sesame at the short term development phase. The market development is necessary to be promoted not only for market facilities but also in consideration of post-harvesting/processing, storing, farmers organization promotion, women in development, and along with agricultural development. The proposed development plan is summarized as follows:

(1) Strengthening of Supporting Services

(i) Strengthening of Department of Commerce and Tourism of Oudomxay Province with office facilities and manpower improvement.
(ii) Strengthening of Section of Commerce of each district office in the study area with office facilities and manpower improvement.

(2) Improvement of Marketing System

(i) Whole sale system should be introduced to the marketing system in the area.

(3) Market organization and facility development

(i) Establishment of one Farmers Cooperatives in each district in the study area, with development of marketing facilities.
(ii) Manpower should be developed for strengthening of the established organization.
(iii) Development of common whole sale market facilities to be operated by the district offices.

Among the above development plans, "rice bank' as the prototype of the farmers cooperatives operated by the women's group in each model area will be implemented in short term development phase as the initial step of the market system development as well as promotion of establishment of farmers organization. Other plans proposed above should be studied in detail in the short term development phase for other phases along with necessity of improvement brought by the agricultural development in the future.

5. PROJECT DESCRIPTION

The program to be implemented in short term development phase in the study area is establishment of "rice bank" in each model area as the initial stage for the farmers cooperative establishment, and preparation of concrete improvement and development plan for support services to marketing system, organization and facilities described below:

5.1 Rice Bank Establishment Project in Model Areas

(1) Project objectives

Establish a Rice Bank under the farmers organization in each area. The rice bank is operated by the women's group in the area to activate and promote women in development. The rice bank has a function of savings-cum-rural-credit and marketing organization for farmers.

(2) Project description

(i) Office building:
One for each organization

(ii) Storage:
One in each organization, for paddy, rice,sesame, and other products and inputs

(iii) Drying yard:
Open concrete floor for drying agricultural products

(iv) Equipment:
One set of small scale rice mill(500 kg/hr input in paddy
Sesame cleaner, weighing scale, office equipment, etc.

(v) Training
Training on book keeping, accounting and organization management is carried out under the agricultural extension office in each district in cooperation with the proposed agricultural station.

(vi) Regulation preparation:

All farm families in the model areas should be member of the organization principally, and be settled in the general meeting of the members.

5.2 Project for Preparation of Market Development Plan

The proposed project is to prepare concrete market development plan for medium and long term development phases in the study area. The plan should include strengthening of supporting services by province and districts, introduction of whole sale system with necessary law and regulations, facilities and manpower development for whole sale market and promoted farmers cooperatives. This work should be carried out by the proposed agricultural station in the short term development phase. The required duration of study is about 15 months with 50 man/month of experts as follows:

Experts	Duration (Man/Month)
Marketing system planning	10
Agronomist	6
Livestock	6
Agro-economy	10
Cooperative system planning	10
Architecture	6
Institutional planning	6

5.3 Marketing Support Services Strengthening Project

(1) Project objectives

The purpose is to strengthen the function and capacity of support services for marketing in the Oudomxay Province and the districts in the study area

(2) Project description

(i) Office building:

Office space improvement for Department of Commerce and Tourism of Oudomxay Province, and Commerce Section of Xai, Beng and Hun districts.

(ii) Equipment:

Office equipment is improved necessary for collecting, analyzing and disseminating market information from and to the central government, farmers and international markets especially in Thailand and China.

(iii) Training:

Training on collecting, analyzing and disseminating market information from and to the central government, farmers and international markets especially in Thailand and China. And how to promote marketing activities under NEM.

5.4 Farmers Cooperative Establishment Project in Study Area

(1) Project objectives

The Rice Bank established in the short term development phase is expanded in function and the activities to cover the whole study area as the name of "Farmers Cooperatives" which mainly deals with savings, rural credits, and marketing of agricultural products and inputs.

(2) Project description

(i) Organization establishment:

One for each district, some branches in the study area if necessary.

(ii) Office building:

One for each organization, some branch offices in the study area if necessary.

(iii) Storage:

One in each organization, for agricultural products and inputs, some branch depots in the study area if necessary.

(iv) Equipment and facilities:

The required equipment and facilities are designed according to the development of agriculture in the study area.

(v) Training:

Training on book keeping, accounting and organization management, marketing and credit system is carried out mainly in the proposed agricultural station, but Vientiane and abroad if necessary.

(vi) Regulation preparation:

All farm families in the study area should be member of the organization principally, and be settled in the general meeting of the members.

5.5 Agricultural Whole Sale Market Establishment Project in Study Area

(1) Project objectives

The objectives of the project are to introduce whole sale marketing system and establish a whole sale market with necessary facilities in the study area.

(2) Project description

(i) Introduction of system:

Introduce necessary law and regulation on the whole sale marketing system in the study area

(ii) Organization establishment:

One for each district, and be operated by the district as common whole sale market.

(iii) Office and storage:

One for each organization, with necessary equipment and facilities.

(iv) Training:

Training on book keeping, accounting and organization management, marketing is carried out mainly in the proposed agricultural station, but Vientiane and abroad if necessary.

Table

Table ME-1 Gross Domestic Product by Industry (1989 constant prices in million Kip)

Industries/Items	1984 (actual)	1985 (actual)	1986 (actual)	1987 (actual)	1988 (actual)	1989 (actual)	1990 (estimated)	1991 (projected)	1992 (projected)	1993 (projected)	1994 (projected)	1995 (projected)
1 Agriculture	185,665	189,321	219,093	202,971	205,956	209,561	223,289	243,425	260,808	272,823	283,931	294,867
Paddy	95,442	100,789	104,763	87,820	72,481	101,439	107,761	117,507	124,993	128,958	131,907	134,563
Other crops	34,169	36,504	27,933	37,787	50,035	49,426	52,506	57,255	61,613	64,157	66,819	69,606
Livestock and fishery	23,377	24,598	26,124	24,485	25,473	27,773	29,006	29,908	30,708	31,475	32,232	32,986
Forestry	32,677	27,430	60,273	52,879	57,967	30,923	34,016	38,755	43,494	48,233	52,973	57,712
2 Industry	41,152	42,474	49,490	40,959	40,109	53,001	61,418	68,727	75,192	81,425	87,907	97,213
Mining and quarrying	935	1,027	1,247	969	760	1,048	1,066	1,084	1,102	1,121	1,140	1,160
Manufacturing	21,008	23,857	27,297	26,008	24,331	32,937	38,113	42,441	46,721	51,038	55,568	61,200
Construction	10,915	9,296	13,012	8,698	10,083	12,499	14,066	15,722	17,415	19,162	21,095	23,800
Electricity,gass and water	8,294	8,294	7,934	5,284	4,935	6,517	8,173	9,480	9,954	10,104	10,104	11,053
3 Services	56,764	63,667	62,263	67,864	72,018	83,117	89,722	97,006	105,264	113,105	121,228	130,569
Transportation	8,183	8,581	11,343	13,020	13,947	14,683	17,422	19,598	22,548	24,815	26,980	29,484
Wholesale and retail trade	23,752	25,840	28,338	30,054	26,749	34,344	35,352	37,629	39,880	42,151	44,534	47,497
Banking,insurance,real estate	175	181	346	1,314	773	798	886	960	1,041	1,128	1,222	1,324
Ownership of dwellings	3,618	3,726	3,838	3,952	4,070	4,188	4,646	4,905	5,179	5,468	5,773	6,095
Public administration and defenc	10,773	10,212	10,610	11,445	11,941	11,250	11,753	12,257	12,760	13,263	13,766	14,270
Other services	10,263	15,127	7,788	8,079	14,538	17,854	19,663	21,657	23,856	26,280	28,953	31,899
4 Import duties	391	619	1,205	607	1,823	2,574	3,063	3,231	3,545	3,899	4,157	4,455
5 GDP in 1989 constant Kip	283,972	296,081	332,051	312,401	319,906	348,253	377,492	412,389	444,809	471,252	497,223	527,104
Population(1000)	3,513	3,618	3,722	3,828	3,940	4,053	4,170	4,291	4,415	4,543	4,675	4,811
Exchange rate(Kip/US$)	253	424	400	385	477	719	710	748	774	800	836	875
GDP per capita(1989 costant US$)	112	114	124	114	113	120	126	134	140	144	148	152

Source: Five Year Plan of Lao PDR,1991(draft), Economic and Social Strategy and Planning Office, Ministry of Economy, Planinng and Finance.

Table ME-2 Population by Distrcts In Oudomxay Province

District	1983	1984	1985	1986	1987	1988	1989	1990	1991
Xai	27,592	28,628	29,703	30,778	31,892	33,047	34,243	35,482	37,446
Beng	20,784	21,158	21,539	21,920	22,308	22,703	23,105	23,635	24,053
Hun	30,903	31,905	32,939	33,973	35,040	36,140	38,275	38,628	39,768
Sub -Total	79,279	81,691	84,181	86,671	89,240	91,890	95,623	97,745	101,267
(Ratio/total%)	34	34	34	34	34	35	35	35	35
La	13,542	13,783	14,029	14,275	14,525	14,779	15,038	15,031	15,648
Namo	18,411	18,748	19,166	19,584	20,010	20,446	20,892	21,469	21,937
Nga	18,913	19,390	19,879	20,368	20,869	21,382	21,908	22,576	23,131
Pha Oudom	23,347	23,415	23,483	23,551	23,619	23,687	23,756	23,103	23,170
Pak Tha	8,131	8,684	9,275	9,866	10,494	11,162	11,873	12,526	13,324
Pak Beng	17,108	17,565	18,034	18,503	18,984	19,478	19,954	20,615	21,151
Hongsa	27,455	28,142	28,846	29,550	30,277	30,010	30,742	32,712	33,510
Xieng Hone	30,146	30,783	31,434	32,085	32,749	33,427	34,119	36,360	37,113
Total	236,332	242,201	248,327	254,453	260,767	266,261	273,905	282,137	290,251

Data source: Department of Economic Planning and Finance, Oudomxay Province, and district office of Xai,Beng and Hun.

Population growth rate/year:	Oudomxay total	2.60%
	Xai District	3.89%
	Beng District	1.84%
	Hun District	3.20%

Table ME-3 Population Structure in the Oudomxay Province in 1985

Age Group	Sub-total	Percent of Age Group	Male	Female	Percent of Female
0 - 14	78,761	42.1	40,229	38,532	48.9
15 - 29	48,812	26.1	22,734	26,078	53.4
30 - 44	29,935	16.0	14,451	15,484	51.7
45 - 59	19,146	10.2	8,731	10,415	54.4
60 - 74	8,744	4.7	3,791	4,953	56.6
over 75	1,717	0.9	634	1,083	63.1
Total	187,115	100.0	90,570	96,545	51.6

Data Source: Population in Lao PDR (in Laotian), 1992 by the Ministry of Economic Planning and Finance, the Department of Statistics.

Table ME-4 Rice Suplus/Deficit Provinces in Lao PDR

Province	Population (,000)	Irrigated		Seasonal		Upland		Total prod.	Reqirement	Surplus/ Deficit
		Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	Area (ha)	Prod. (ton)	(ton)	(ton)	(ton)
North										
Phongsaly	138	0	0	4,896	13,710	18,868	22,642	36,352	48,300	-11,948
Luang Nam Tha	110	12	35	4,469	15,640	13,358	20,036	35,711	38,500	-2,789
Oudomxay	283	150	341	9,400	31,020	31,037	54,314	85,675	99,050	-13,375
Bokeo	62	0	0	3,517	12,309	1,932	3,284	15,593	21,700	-6,107
Luang Prabang	332	1,005	2,968	8,363	22,825	33,743	45,864	71,657	116,200	-44,543
Houapahn	236	120	189	6,997	22,100	23,534	42,079	64,368	82,600	-18,232
Sayabouri	179	296	451	11,470	34,388	15,949	30,378	65,217	62,650	2,567
Xiang Kouang	183	0	0	10,903	32,940	9,339	15,025	47,965	64,050	-16,085
Subt-total	1,523	1,583	3,984	60,015	184,932	147,760	233,622	422,538	533,050	-110,512
Central										
Vientiane Pref.	428	5,502	18,161	38,962	117,847	711	854	136,862	149,800	-12,938
Vientiane	301	510	1,438	31,221	64,904	25,000	28,879	95,221	105,350	-10,129
Bolikhamsay	139	0	0	14,100	35,250	10,000	17,000	52,250	48,650	3,600
Khammouane	242	590	2,390	37,553	93,882	1,647	2,300	98,572	84,700	13,872
Sub-total	1,110	6,602	21,989	121,836	311,883	37,358	49,033	382,905	388,500	-5,595
South										
Savanakhet	620	1,300	4,169	82,458	233,638	7,765	9,806	247,613	217,000	30,613
Saravane	208	254	512	32,919	92,363	7,426	9,945	102,820	72,800	30,020
Sekong	58	0	0	1,215	2,350	6,087	6,462	8,812	20,300	-11,488
Champassak	455	474	1,322	71,940	155,623	5,544	10,989	167,934	159,250	8,684
Attopeu	78	0	0	9,097	23,695	2,980	4,470	28,165	27,300	865
Sub-total	1,419	2,028	6,003	197,629	507,669	29,802	41,672	555,344	496,650	58,694
Total	4,052	10,213	31,976	379,480	1,004,484	214,920	324,327	1,360,787	1,418,200	-57,413

Data source: National Forestry Management and Conservation Project.

Table ME-5 Retail Prices of Agricultural Inputs in Vientiane Market

Inputs	Unit	Price (Kip)
Seed:		
Lettuce	20(g)	350
Chinese cabbage	20(g)	350
Cucumber	20(g)	350
Celery	20(g)	350
Green leek	20(g)	750
Cauliflower	20(g)	750
Mustard	20(g)	600
Green bean	80(g)	1,100
Egg plant	20(g)	450
Sweet pepper	20(g)	800
Chili pepper	20(g)	450
Papaya	80(g)	1,100
Chinese radish	500(g)	2,450
Feeds:		
for broiler(less than3weeks)	30(kg)	8,300
for broiler(3 - 6 weeks)	30(kg)	8,200
for chicken	30(kg)	7,700
for pigrets(less than 1 kg)	30(kg)	9,600
for pig	30(kg)	10,550
for cat fish(1 - 3 month)	20(kg)	9,300
for cat fish(more than 3 month)	20(kg)	9,000
fro fish(more than 1 month)	20(kg)	8,300
Fertilizers:		
Urea(46%)	50(kg)	8,500
NPK(16-20-0)	50(kg)	8,800
NPK(15-15-15)	50(kg)	11,000
NPK(12-12-21)	50(kg)	14,000
Pesticides:		
Foriclon	100(ml)	750
Azodrin	100(ml)	1,200
Fosdrin	100(ml)	950
Mararon	100(ml)	1,250
Karate	100(ml)	2,000
	1(kg)	1,100
Fungicides:		
Dithane(45)	100(g)	1,250
Benlet	50(g)	3,050

Source: Private company in Vientiane, as of October, 1992.

Table ME-6 (1/5) Amount of Trade in Oudomxay Province (Summary)

(Unit:1000Kip)

Item	1989 Plan	1989 Actual	1990 Plan	1990 Actual	1,991 Plan
I Amount procured:	1,281,419	579,152	1,242,300	1,125,830	2,058,602
I-1 Within province	1,081,141	406,408	285,024	501,560	1,237,839
I-2 From central	0	0	285,024	0	0
I-3 Import	200,278	172,744	672,252	624,270	820,763
I-3.1 Thailand	0	0	0	0	0
I-3.2 China	133,178	43,347	148,527	379,058	464,553
I-3.3 Vietnam	67,100	129,397	523,725	245,212	356,210
I-3.4 Cambodia					0
II Amount sold:	1,311,198	639,592	1,166,969	793,903	2,004,109
II-1 Within province	807,890	185,761	290,700	257,796	555,254
II-2 Export	503,308	453,831	876,269	536,107	1,448,855
II-2.1 Thailand	325,689	284,879	305,802	257,398	267,925
II-2.2 China	110,519	49,517	272,796	268,663	908,320
II-2.3 Vietnam	67,100	119,435	297,671	10,046	272,610

Table ME-6 (2/5) Amount of Trade in Oudomxay Province (Procured Amount within Province)

		Unit	1989 Plan		1989 Actual		1990 Plan		1990 Actual		1991 Plan	
			Q'tity	Value	Q'tity	Value	Q'tity	Value	Q'tity	Value	Q'tity	Value
				(*1000)		(*1000)		(*1000)		(*1000)		(*1000)
I-1 Within Province Total				1,081,141		406,408		285,024		501,560		1,237,839
A	Agricultural Products:			554,578	859	97,297	3,023	202,224	1,410	187,385	5,402	856,800
1	Paddy	Ton	6,710	250,850	852	64,134	2,500	130,000	1,100	71,500	3,500	205,330
2	Sesame	Ton	112	22,392	2	559	188	52,224	308	102,704	1,780	623,000
3	Coffee	Ton	5	1,570	0	0	5	2,000	2	600	15	5,250
4	Garlic	Ton	151	25,236	4	694	10	2,000	0	0	90	15,120
5	Soybeans	Ton	0	0	0	0	20	2,000	0	0	17	2,600
6	Maize	Ton	0	0	0	0	300	13,000	0	0	0	0
7	Others			254,530		31,910		1,000		12,581		5,500
B	Livestock:			209,447 0		171,522		0 0		233,527		271,935
1	Cattle	Head	653	44,300	145	7,513			121	12,477	370	44,197
2	Buffalo	Head	1,590	165,147	2,648	161,938			1,333	220,675	1,650	224,413
3	Pig	Head	0	0	168	1,794	0	0	25	375	142	3,325
4	Goat	Head	0	0	82	277	0	0	0	0	0	0
C	Forest products:		0	317,116		137,589		82,800		80,648		109,104
1	Stic lac	Ton	32	10,005								
2	Benzoin	Ton	15	20,240	2.2	4,193	5	10,000	0.43	645	10	15,975
3	Cardamon	Ton	27	20,600	14	19,136	40	39,250	16.5	19,063	30	29,271
4	Dammar	Ton	0	0	4	200	5	500	4	181	15	3,447
5	Puak Bon	Ton	0	0	0	0	200	22,000	250	32,254	300	35,120
6	Puak Ko	Ton	0	0	0	0	50	5,000	84	9,607	100	11,183
7	Maktao	Ton	0	0	0	0	20	2,400	30	5,208	30	7,858
8	Others			276,276		114,060	0	3,650	0	13,690	0	6,250
I-2 Procurement form Vientiane				243,433		24,280		175,338		176,511		1,135,255
1	Plywood	*1000sheet	20	24,000	4	7,463	58	125,450	46	129,473	64	172,920
2	Iron sheet	*1000sheet	24	28,229	0	0	0	0	0	0	5	11,000
3	Detergent	Ton	40	7,000	15	6,750	0	0	1,919	12,096	0	0
4	Salt	Ton	200	6,000	0.27	104	0	0	0	0	0	0
5	Fuel			130,604		4,634		46,314	0	34,942	0	951,335
6	Otehrs			47,600		5,329		3,574	0	0	0	0

Table ME-6 (3/5) Amount of Trade in Oudomxay Province (Import)

			Unit	1989 Plan Q'tity	1989 Plan Value	1989 Actual Q'tity	1989 Actual Value	1990 Plan Q'tity	1990 Plan Value	1990 Actual Q'tity	1990 Actual Value	1991 Plan Q'tity	1991 Plan Value
					(*1000)		(*1000)		(*1000)		(*1000)		(*1000)
I-3.1	Import from Thailand				325,713		125,685		395,089		134,307		665,568
A		Foods											
	1	Seasoning	Kg	2,050	41,760	235	3,733	3,604	99,302	245	10,952	2,497	88,227
	2	Sugar	Ton	20	2,240	32	5,417	0	0	0	0	0	0
	3	Milk		0	21,120	0	0	0	0	104	1,694	100	1,400
	4	Soft drinks								65	334	300	3,253
	5	Others									10,752		9,267
B		Industrial goods											
	1	Fabrics	*1000m	10	4,080	0	0	0	0	0	0	0	0
	2	Motorcycle	set	72	31,100	127	51,220	45	31,645	19	16,165	165	151,500
	3	Pickup	set	0	0	4	7,808	4	18,000	0	0	22	118,950
	4	Bicycle	set	500	6,800	0	0	0	0	100	3,220	0	0
	5	Slipper		3,100	39,720	2,000	25,963	6,645	74,584	1,324	16,046	5,800	83,107
	6	Clothes			22,653		5,103	0	0		8,854		12,700
	7	Medical drugs			7,316		168		19,650		13,602		6,500
	8	Daily consumables			5,029		115		200		1,827		2,782
	9	Const. materials			67,160		19,292						22,415
	10	Generator	Set	17	4,858	3	864	9	1,500	0	0	0	0
	11	Iron sheets	*1000sheet					8	14,394	2	6,376	4	6,744
	12	Blanket	sheet					1,000	3,593	320	1,427	5,000	24,564
	13	Roofing tile	1000sheet					5	3,000	3.4	3,431	1,000	3,700
	14	Cosmetics									10,336		9,200
	15	Miscellaneous goods									10,725		10,000
	16	Office stationary									7,801		8,522
	17	Others			71,877		6,002		129,221		10,765		102,737
I-3.2	Import from China				133,178		43,347		148,527		379,058		464,553
	1	Fabric	1000m	50	10,000	12	2,576		0		0		6,350
	2	Shoes			0		426		0	200	280	24,000	13,920
	3	Sewing machi	No.	500	9,600	135	3,383	950	27,061	1,275	47,390	1,070	35,892
	4	Bycycle	No.	500	9,600	81	1,783	200	4,875	2,135	59,553	1,450	41,286
	5	Saw mill	No.	50	12,000	15	3,473	70	18,707	212	66,309	300	83,869
	6	Toarch battery	Case(24)	5,600	30,875	1,461	9,132	2,900	27,820	5,759	66,377	5,550	58,287
	7	Thermos	Case9120			1,392	1,966	150	1,505	35	360	0	0
	8	Daily consumables							0		5,435		6,877
	9	Construction materials							0		6,116		22,415
	10	Car	No.					2	9,800	5	23,725	0	0
	11	Sugar	Ton					10	2,000	52	15,749	70	21,530
	12	Rice mill	No.							45	8,805		
	13	Agricultural tools									4,797		
	14	Cement	Ton					150	31,783	587	43,524	1,880	83,910
	15	Generator	No.					2	980	3	2,077		0
	16	Tractor	No.							8	5,457	2	2,029
	17	Pick up	No.							2	8,050	8	78,400
	18	Others			61,103		20,608		23,996		15,054		9,788
I-3.3	Import from Vietnam				67,100		129,397		523,725		245,212		356,210
	1	Fabric	1000m	0	0	3	439		3,520		11,059		6,000
	2	Cotton	Ton	37	27,600	128	115,850	555	449,335	149	205,530	185	257,077
	3	Steel bar	Ton	465	9,300	50	7,472	350	41,150	9	1,934	2,820	55,250
	4	Clothes	Bag		11,200		3,800		6,100		12,556		7,911
	5	Daily consumables			5,000		1,836		2,660		8,305		19,512
	6	Bycyle	No.							200	4,134		
	7	Others			14,000				20,960		1,694		10,460
I-3.4	Import from Cambodia				0		0		0		0		210,000
	1	Rubber	Ton									500	210,000

Table ME-6 (4/5) Amount of Trade in Oudomxay Province (Sales Amount within Province)

			Unit	1989 Plan		1989 Actual		1990 Plan		1990 Actual		1991 Plan	
				Q'tity	Value (*1000)	Q'tity	Value (*1000)	Q'tity	Value (*1000)	Q'tity	Value (*1000)	Q'tity	Value (*1000)
I-1 Within Province Total					807,890		185,761		290,700		257,796		555,254
A	Foods				306,037 0		70,844	1,904	237,235	864	117,591	4,267	388,048
	1	White rice	ton		306,037		70,844	1,500	195,000	660	85,800	2,100	273,000
	2	Seasoning	kg					404	42,235	48	1,824	1,697	68,954
	3	Milk	case							40	772	100	1,670
	4	Sugar	ton							52	18,174	70	24,759
	5	Soft drinks	case							65	624	300	4,010
	6	Garlic	ton										
	7	Others									10,397		15,655
B	Industrial goods				501,853 0		114,917		21,365 0		119,849		143,504
	1	Mortor cycle	No.							18	20,934	55	62,480
	2	Bycycle	No.					400	13,450	1,530	50,490	1,450	47,478
	3	Pick up	No.					2	1,560	4	24,575		
	4	Daily goods			501,853		114,917		6,355		23,850		33,546
	5	Clothes							32,100		20,356		23,702
	6	Construction materials							73,361		15,900		66,670
	7	Generatror	No.						3,057	3	2,385		
	8	Torch battery	case(24)					3,400	28,838	4959	67,376	4,600	51,067
	9	Fuel							48,601		79,244		99,049
	10	Saw mill	No.					70	23,200	192	68,320	300	99,000
	11	Sewing machine	No.					950	32,000	1,155	46,260	1,070	41,280
	12	Medicine							21,662		805		7,475
	13	Agricultural tools									11,792		64,787
	14	Cement	ton					150	31,783	564	44,552	1,500	93,000
	15	Miscellaneous goods									12,330		11,500
	16	Car	No.										
	17	Tooth paste						100	1,600				
	18	Others			834,241		159,106		85,914		52,273		100,320

Table ME-6 (5/5) Amount of Trade in Oudomxay Province (Export)

			Unit	1989 Plan Q'tity	1989 Plan Value	1989 Actual Q'tity	1989 Actual Value	1990 Plan Q'tity	1990 Plan Value	1990 Actual Q'tity	1990 Actual Value	1991 Plan Q'tity	1991 Plan Value
					(*1000)		(*1000)		(*1000)		(*1000)		(*1000)
II-2.1		Export to Thailand			325,689		416,952		1,114,672		642,031		819,592
	1	Buffalo	Head	1,500	140,320	2,648	284,879	2,000	305,802	1,333	257,398	1,650	267,925
	2	Cattle	Head	300	16,360	145	10,379	71	3,195	121	13,728	420	45,377
	3	Pig	Head			187	2,273					50	1,750
	4	Goat	Head			170	1,031						
	5	Sesame	Ton	112	20,764	2	559	188	69,850	107	38,224	450	170,975
	6	Garlic	Ton	98	27,904	4	734					90	19,980
	7	Benjoin	Ton	10	20,650	4	7,462					10	11,653
	8	Cardamon	Ton	23	30,080	27	15,990	35	46,125	35	46,125	15	20,392
	9	Silk	Ton	5	19,750								
	10	Coffe	Ton					5	3,750				
	11	Palm nut	Ton					20	3,259	30	6,841	30	5,700
	12	Pua ko(balk of tree	Ton					50	7,361	84	16,758	100	12,666
	13	Pua Bong(balk of t	Ton					200	31,699	250	41,030	300	39,750
	14	Soy bean	Ton					20	3,200				
	15	Cotton	Ton			74	73,390	555	555,850	143	213,260	122	150,689
	16	Rattan	1000pieces										
	17	Steel bar	Ton				290	140	35,325	8	2,082	150	42,448
	18	Others			49,861		19,965		49,256		6,585		30,287
II-2.1		Export to China			110,519		49,517		272,796		268,663		908,320
	1	Stic lac	Ton	26	10,400								
	2	Caster beans	Ton	5	750								
	3	Iron sheets	1000Shc	4	54,880	3	5,352	6	19,075			6	18,845
	4	Plywood	1000shc	11	24,489	1	1,499	58	166,600	46,443	141,442	64	200,800
	5	Steel bar	Ton			43	6,459	140	35,325	8	2,082	150	42,448
	6	Maize	Ton					300	18,000				
	7	Cardamon	Ton					2	1,946	1,236	1,244	5	5,400
	8	Damar	Ton					5	834	4	1,632	15	4,741
	9	Blanket	Piece					1,000	6,325			4,000	25,300
	10	Rattan	Ton							14	7,558	25	8,320
	11	Sesame	Ton							200	78,203	330	124,930
	12	Orange	Ton									18	5,386
	13	Pig	Head							25	387	100	4,200
	14	Peanut	Ton									10	3,250
	15	Coffee	Ton							2	700	15	6,000
	16	Pear	Ton									100	88,000
	17	Rubber	Ton									500	290,000
	18	Others			20,000		36,207		24,691		35,415		80,700
II-2.3		Export to Vietnam			67,100		119,435		297,671		10,046		272,610
	1	Motorcycle	No.			88	74,800	45	39,712			110	131,212
	2	Slipper	Bag	2,900	13,625	1,137	14,885	4,400	84,456	65	1,235	3,150	66,386
	3	Thermos	Case(12	698	5,026	207	1,521	150	2,270			100	1,770
	4	Torch battery	Case(24	4,620	30,540	240	2,362	400	5,000			900	12,367
	5	Seasoning	Kg	600	14,500	36	1,057	2,350	71,822	166	6,300	800	34,670
	6	Pickup	No.					2	12,500				
	7	Water pumps	No.							5	1,425		
	8	Tooth paste								56	1,008	300	5,100
	9	Others			3,409		24,810		81,911		78		21,105

Table ME-7 (2/2) Retail Prices of Agricultural Products (1992)

(Unit: Kip)

	Agriculutral products	Unit	Xai market		Hun market	
			May	November	May	November
I. Meat	Beef	kg	1,200	1,200	900	1,100
	Buffalo	"	1,200	1,200	900	1,100
	Pork	"	1,200	1,200	900	900
	Chicken	"	1,500	1,000	1,500	-
	Fish	"	1,500	1,500	1,500	1,500
	Egg	piece	80	50		50
	Egg(duck)	piece		70		80
II. Cereals&grains	Paddy	kg	100	60	80	50
	Rice(milled)	"	150	150	100	120
	Maize(dried w/comb)	"	50			
	Sesame	"	300	350	350	350
	Soybean	"	-	600		500
	Mungbean	"	-	600		500
	Groudnuts	"	500	400	500	500
III. Vegetables	Sweet potato	kg	150	80	200	80
	Cassava(tuber)	"	100	120	100	120
	Garlic	"	500	600	600	600
	Onion(dried)	"	1,000			600
	Red onion(dried)	"	600	1,000	500	1,000
	Garlic leaves	"	1,000	800		300
	Onion leaves	"	1,000	800		400
	Coriander leaves	"	1,000	800		700
	Spinach	"	1,500	1,000		1,200
	Lettuce	"	200	700		500
	Pak bon(Ipomea sp.)	"	200	200	320	200
	Celery	"	500	600		600
	Cabbage	"	200	150	200	150
	Tomato	"	150	400	500	300
	Bean sprout(mung)	"	300	300		
	Cucumber	"	350	150		100
	Eggplant	"	600	120	350	120
	Green pepper	"	1,000	600	1,000	400
	Red pepper(dried)	"	1,000	800	1,500	600
	Pumpkin	"	100	100		50
	Black pepper	"	1,200	1,500		1,500
IV. Collected from forest	Barking deer	kg	800	1,500		
	Barking deer(dried)	"	1,500	2,000		
	Samber deer	"	1,000	1,500		
	Samber deer(dried)	"	1,600	2,000		
	Wild pork	"	700	1,500		
	Wild pork(dried)	"	1,500	2,000		
	Wild chicken	"	1,000	1,700	1,800	
	Wild chicken(dried)	"	1,500	2,500	2,000	1,000
	Squirrel	"	1,800	1,200	2,000	80
	Bsamboo shoot	"	700	100	400	100
	Ginger	"	500	200	300	100
	Galanga	"	500	200	300	50
	Rattan shoot	"	100	150	100	1,500
	Mushroom	"	500	2,000		
V. Fruits						
	Banana	kg	350	100	200	100
	Papaya	"		50	100	80
	Mango	"	700		300	
	Water melon	"	200			
	Tamarind	"	150	300		300

Table ME-7 (1/2) Retail Prices of Agricultural Products (Xai Market from 1987 to 1992)

(Unit: Kip)

Agriculutral products		Unit	1987	1988	1989	1990	1991	1992
I. Meat	Beef	kg	600	600	700	700	1,000	1,200
	Buffalo	kg	600	600	700	700	1,000	1,200
	Pork	kg	600	600	600	700	1,000	1,200
	Chicken	kg	500	500	800	1,000	1,000	1,500
	Fish	kg	300	300	500	800	1,300	1,500
	Egg	piece	20	30	40	50	50	80
	Egg(duck)	piece	30	50	70	80	100	
II. Cereals&grains	Paddy	kg	60	60	75	80	85	100
	Rice(milled)	kg	80	100	100	120	150	150
	Maize(dried w/comb)	kg	20	20	30	50	80	50
	Sesame	kg	100	150	200	250	300	300
	Soybean	kg	50	80	100	150	200	-
	Mungbean	kg	50	50	80	80	100	-
	Groudnuts	kg	80	100	100	150	150	500
III. Vegetables	Sweet potato	kg	20	20	30	50	50	150
	Cassava(tuber)	kg	20	20	30	50	50	100
	Garlic	kg	50	80	200	250	300	500
	Onion(dried)	kg	-	-	-	-	200	1,000
	Red onion(dried)	kg	100	100	150	350	500	600
	Garlic leaves	kg	-	-	-	-	-	1,000
	Onion leaves	kg	-	-	-	-	-	1,000
	Coriander leaves	kg	-	-	-	-	-	1,000
	Spinach	kg	100	100	150	200	400	1,500
	Lettuce	kg	60	100	150	200	300	200
	Pak bon (Ipomea sp.)	kg	-	-	-	-	-	200
	Celery	kg						500
	Cabbage	kg	100	100	150	200	200	200
	Tomato	kg	100	100	150	200	300	150
	Bean sprout(mung)	kg	50	80	100	150	300	300
	Cucumber	kg	20	50	80	100	150	350
	Eggplant	kg	20	50	70	100	150	600
	Green pepper	kg	500	600	700	700	1,000	1,000
	Red pepper (dried)	kg	500	500	600	800	1,000	1,000
	Pumpkin	kg	30	30	50	70	150	100
	Black pepper	kg	300	300	500	500	500	1,200
IV. Collected from forest	Barking deer	kg	900	800	1,000	1,500	1,800	800
	Barking deer(dried)	kg	1,200	1,200	1,500	1,800	2,000	1,500
	Samber deer	kg	800	800	1,000	1,500	1,800	1,000
	Samber deer(dried)	kg	1,200	1,200	1,500	1,800	2,000	1,600
	Wild pork	kg	800	800	1,000	1,500	1,800	700
	Wild pork(dried)	kg	1,200	1,200	1,500	1,800	2,000	1,500
	Wild chicken	kg	500	500	800	1,000	1,500	1,000
	Wild chicken(dried)	kg	1,000	1,000	1,500	2,000	2,500	1,500
	Squirrel	kg	600	800	1,000	1,000	1,200	1,800
	Bsamboo shoot	kg	60	80	100	100	200	700
	Ginger	kg	160	160	200	200	400	500
	Galanga	kg	20	20	30	30	50	500
	Rattan shoot	kg	40	40	100	100	200	100
	Mushroom	kg	500	500	800	1,000	1,500	500
V. Fruits	Banana	kg	80	100	200	200	300	350
	Papaya	kg	20	30	50	70	100	-
	Mango	kg	100	100	250	300	500	700
	Water melon	kg	100	100	200	200	250	200
	Tamarind	kg	80	80	150	150	200	150

Source: Xai district office, commerce section.

Table ME-8 Number of Rice Mill in the Study Area

Xai				Beng				Hun			
Name of Village	Number of Family	Ethnic Group	Number of Rice Mill	Name of Village	Number of Family	Ethnic Group	Number of Rice Mill	Name of Village	Number of Family	Ethnic Group	Number of Rice Mill
Bo Yai	180	LL	5	Napa Nua	100	LL	1	Vienthong	53	LT	1
Phen	42	LT	1	Napa Tai	42	LL	2	Fen	69	LL	2
Mai	43	LL	1	Named	156	LL	3	Sivi Lai	54	LL	1
Bo Noe	10	LL	2	Tha muen	53	LL	1	Nahom	67	LL	2
Kad	104	LL	4	Panthong	51	LL	2	Nongbaoden	28	LS	1
Ko Noe	96	LL	3	Houag Lo	52	LL	1	Nakhong	125	LL	5
Huaog Bo	26	LT	1	Sien Lee	38	LL	1	Naphan	52	LL	2
Nalam	20	LL	1	Von mon	0	LT	1	Phonsavan	152	MIX	3
Huaog Yan	10	LL	1	Naguoi	51	LT	1	Phonsavat	90	MIX	3
KM 22	31	LS	1	Ban Lai	67	LT	1	Nakham Tai	60	LL	2
Huaog Tam	27	LT	1	Tando	33	LT	1	Nakham Nue	50	MIX	1
Phouya Kha	29	LS	1	Na Guie	25	LT	1	Somphone	126	LT	2
Namon	28	LL	2	Ban Gno	91	LL	3	Mai	54	LT	1
Nagvan	50	LT	1	Na Lai	52	LL	1	Na	118	LT	2
Phou Khiaz	86	MIX	1	Pan Duia	62	LL	1	Somxai	176	LT	2
Navane	111	MIX	2	Pho Keo	74	LL	2	Mok Plai	38	LS	1
Mone tai	92	MIX	1	Ben Kham	79	LL	3	Saimoi	15	LS	1
Mone Nua	52	MIX	1	Na Van	0	LT	2	Done Kham	124	LT	1
Thama	95	MIX	2	Ben Luang	93	LL	6	Phone keo	29	LT	1
Nam Dine	29	LT	1	Houay La	49	LT	2	Na Guen	44	LL	1
Na Chak	70	LT	2	Tha Kat	84	LL	6	Lanyin	29	LT	1
KM 10	68	LT	1	Kone Kham	31	LT	1	Houag Pa	11	LS	1
Baok Hed	20	LS	1	Na Bone	54	LL	2	Vantan	63	LT	2
Mok Pood	27	LT	1	Ban Khone	45	LT	1	Pha Kham	31	LL	1
Nasaithoung	33	LL	1	Nam Lon	52	LT	1	Si Boun Hening	43	LL	1
Yao Yai	61	LS	1	Nam Hen	32	LT	1	Oudome	71	LT	1
Lao Va	37	LS	2	Phon Kham	66	LL	2	Nam Movi	38	LT	1
KM 44	39	LS	1	Sam Kham	97	LL	3	Phonsavan	54	LL	1
Lao Li	18	LS	1	Van Va	52	LL	2	Done Keo	115	MIX	1
KM 50	33	LS	1	Na Mone	20	LL	1	Done Na	50	MIX	1
Vie Yali	24	LS	1	Phai Kao	48	LS	1	Na Van	93	LL	1
KM 32	106	LT	3	Ban Lak	69	LT	1	Boam Loan	76	LL	2
Yeng	132	LL	2	Phoun Loun	65	LT	1	Mai	28	LT	1
Naloa	135	LL	2	Mou Chak	20	LT	1	Chantei Tai	62	LL	2
Don Keo	161	LL	1					Guei Pha	54	LS	3
Thin	106	LL	2					Nam Noue	46	LS	1
Na Sao	57	LL	1					Phien La	63	LS	1
Tial	95	LL	2					Houang La	42	LS	1
Houan Khoum	97	LL	2					Nam tiek	43	LS	1
								Don Cuone	58	LS	1
								Phian Ho	64	LS	1
								Nam Kha	49	LS	2
								Xiendy	129	LS	2
Total	2,480		61	Total	1,903		60	Toal	2,836		65

Table ME-9 Population Projection in Study Area

District	1991*	1995	2000	2005	2010
Xai	37,446	43,621	52,792	63,891	77,323
Beng	24,053	25,873	28,342	31,048	34,011
Hun	39,768	45,108	52,802	61,809	72,352
Total	101,267	114,602	133,936	156,747	183,685

* The population projection is based on Table ME-2.
Population growth rate/year applied are as follow:

Oudomxay total	2.60%
Xai District	3.89%
Beng District	1.84%
Hun District	3.20%

ANNEX-MF
IRRIGATION

ANNEX-MF IRRIGATION

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX

1. INTRODUCTION

This ANNEX presents the results of studies on the overall irrigation development which forms part of the proposed rural agricultural development in the study area under the Master Plan. In Laos, the irrigation development is the basic requisite for increase and stabilization of agricultural production, especially rice. The Government's strategy for irrigation development will be (i) to curtail the flow of resources into high cost larger-scale irrigation systems; (ii) to turn these public sector schemes to the farmers communities as much as possible; and (iii) to concentrate on a much more moderate level of resources on the support of water users associations which control their irrigation systems. In this connection, efforts are being made to improve the efficiency of existing irrigation systems through rehabilitation and maintenance.

In line with these development strategies of irrigated agriculture in Laos, the study on the proposed irrigation development in the study area is made under the Master Plan Study (the Study) on the Agricultural Development Project (the Project) in Oudomxay Province (the Province), as presented in this ANNEX.

2. PRESENT IRRIGATION SYSTEM IN STUDY AREA

Investigation of the present irrigation systems in the study area was made, mainly based on information and data obtained from the district offices. The following two types of irrigation systems exist in the study area.

2.1 Farmer and Community Managed Irrigation System

Most of the existing irrigation systems in the study area are farmer and community managed system (FCM system) with a small-scale indigenous brushwood weir constructed by farmers groups and communities themselves, using bamboo, wood, stone and clay soil. These irrigation systems are used for supplemental irrigation to wet season rice. Since the irrigated area by a system is commonly less than 50 ha, only a small group of farmers is involved, and therefore cooperation is not difficult to achieve. The canals and structures being small can be constructed largely by manual labour and the construction cost is generally low. However, the brushwood weirs are easily washed away at flood times. According to the irrigation section of the Province, the farmers groups re-construct such weirs two times on an average during the operation period. The re-construction of weirs requires heavy labour input by the water users.

The irrigation canal network in these systems is also constructed by the farmers and communities themselves, mostly without proper survey and design. Therefore, canal alignment and design are very primitive. Due to lack of canal structures, in addition, flow distribution is erratic and often affected by cross-drainage flows that may lead to canal breaches and/or silting. It can be said that all of these FCM system are in a great need of improvement and rehabilitation.

The existing FCM systems in the study area are 66 schemes in Xai district, 34 schemes in Beng and 22 schemes in Hun, covering 1,360 ha of lowland rice field in total (see Table MF-1). Among them, seven schemes, two in Beng and five in Hun, have permanent concrete weir constructed by the village community with financial assistance from the provincial and district offices, and the Lao Quaker services. Such an assistance was a supply of cement, reinforcement bar, tools for earth works, and transportation services. Since water availability in these schemes is limited to very small or nearly nil in the dry season, most of the schemes are not used for dry season farming.

For these FCM systems, it is said that the irrigation section of the provincial and district offices should provide some services for technical advice and consultation of weir site selection and canal route alignment, and for construction supervision. However, such services

are still very limited mainly because of insufficient budget and qualified staff, though many village communities are demanding for such services.

2.2 Medium Size Irrigation System

In addition to FCM system, there are also medium size irrigation systems with more than 50 ha of command area. These systems include those with permanent concrete weir constructed by the province and districts, and financial assistance from the Lao Quaker services, and also those with the farmer's brushwood weir constructed by farmers themselves. The command area of most of these systems is less than 100 ha. The weirs constructed by the province and other organizations, all of them are concrete permanent weir, are handed over to the village communities concerned. These medium systems in Xai, Beng and Hun districts are three, six and four schemes, respectively, with a total irrigation area of 1,302 ha (see Table MF-1).

Although the weir is permanent and generally kept in good condition, canal systems are constructed by farmers groups and very primitive. It appears that the canal construction was made without proper survey and design. Despite the fact that some amount of stream flow is still available in some of these systems even at the end of dry season, no crops are cultivated by the farmers with irrigation. In order to achieve efficient utilization of the existing permanent weir, rehabilitation of the main canal and additional construction of the secondary and tertiary canal network are required to increase crop production in these relatively modernized scheme.

The total number of existing small-scale and medium size irrigation systems in the three districts is 135 with a total irrigation area of 2,662 ha (also see Table MF-1), which means that an average command area of a system is estimated at about 20 ha. Location of the existing irrigation systems is presented in Fig. MF-1.

2.3 O&M of Irrigation System and Water Users Association

It is policy in all provinces that the cost for O&M of the irrigation systems should be born by users. All of the existing irrigation systems in the study area are operated and maintained by the farmers and communities. Usually, a village community has several family groups, each consisting of 10 to 15 families in general. These family groups (Nuay in Lao) are the unit for cooperative farming which also includes O&M of the irrigation system. The repair of weir and main canal is usually done by the community-based cooperative work. In this case, each family is asked to contribute the same amount of labour and also paddy to purchase some construction materials, so that every body participates in the realization of common unity

enterprises. Water distribution to each rice field in the village irrigation system is managed by each family group mostly without technical advices and guidances from the governmental services. When conflicts in proper water use occur, it should be discussed at first by the families concerned and then solved by the chief of the group. In the case of serious conflicts, the village communities, district office and provincial office settle the conflicts.

According to the recent information on the water users association, four (4) water users associations are formally established and authorized by the districts in the study area.

In the case of the association for Nam Kham irrigation system in Hun district which has a concrete weir to irrigate 68 ha of rice field, it consists of four villages and has the regulation for water distribution management which is prepared through discussions among farmers, irrigation members from each village and the irrigation staff from Hun district office. According to the regulation, four irrigation members, one from each village, are elected by all of the farmers concerned, and organize a committee to control the water distribution to each rice field as well as to maintain the whole irrigation facilities. Each farm family of the association should participate in repair and maintenance of the weir and canals as labor in accordance with the committee's decision. Such a labor contribution depends on the size of rice land holding of each family. In addition, each family should pay Kip 1,000/ha of charge per year to the committee. The activities and functions of other existing associations are nearly the same as those of this association. These water users associations will have to be strengthened for more efficient O&M of the improved irrigation system to be rehabilitated under the Project. The regulation for management of this irrigation system is attached to this ANNEX as an example.

Even in the irrigation systems where water users associations are not yet established, farmers participate in repair and maintenance of the weirs and canals under the leadership of the village community. These traditional O&M system will be the base for establishing new water users associations after the existing irrigation systems are improved and up-graded under the Project.

2.4 Support Services for Irrigation Development

The public services for irrigation development in Oudomxay are provided by the irrigation section in the Department of Agriculture and Forestry of the provincial administration. The irrigation section consists of three units for planning, survey/design and irrigation construction company (the state enterprise). Fifteen staff which include two engineers, nine assistant engineers and four technicians are currently working with the irrigation section. The activities of the irrigation section are still very limited because of budget problem and of the

mountainous province where flat land suitable for irrigation development is also limited. The irrigation section is now constructing only one concrete permanent weir upon request of the village community in Nam Mo district which is outside the study area. The irrigation construction company is constructing three canal networks for three small-scale irrigation schemes financed by UNDP and the Quaker services in Xai and Beng districts, as a contractor.

The district offices also have irrigation staff. In Xai district, five staff, including training staff, are working for irrigation services, among 13 staff in total. Out of seven staff in Beng district, two are irrigation staff, and in Hun four are irrigation staff, out of nine office staff. It may be said from these staffing arrangement that the Province puts emphasis on providing the irrigation services to the farmers. Practically, however, such services by each district are also very limited mainly because of insufficient budget and lack of qualified technical staff.

2.5 Constraints to Irrigation Development

2.5.1 Physical Constraints

The mountainous topography of the study area is one of the main physical constraints to further increase in crop production, especially rice. Flat lands suited to lowland rice cultivation with irrigation are limited to the flat valley bottoms in the main rivers such as Nam Beng, Nam Mao, and Nam Hin and their tributaries. Such valley bottoms are small in size, less than 50 ha with small catchment areas in most cases, and are nearly in full use for lowland rice cultivation at present. Also in mountain areas, there are some flat valley bottoms being used for lowland rice cultivation mostly under rainfed condition. However, they are scattered in very wide area, and the access to such valley bottoms is very poor with small footpath only.

There are many rivers in the study area. Among them, the main rivers which have relatively large potential for development of irrigated agriculture are the Nam Beng, the Nam Mao and the Nam Hin. The Nam Beng, which is a perennial water source, is currently not used for irrigation purpose because of a incised river that would require medium to large-scale weir and long headrace or pump equipment. Although the Nam Mao and the Nam Hin are also perennial river, they could not irrigate the whole of their command area in the dry season because of the limited amount of river water.

Many of their tributaries are used by the farmers for supplemental irrigation to wet lowland rice. Since most of them have small catchment area, however, they mostly dry up in

the dry season. Even if the existing irrigation systems were rehabilitated by permanent facilities, therefore, most of these systems could not irrigate the whole command area in the dry season, but stable supply of irrigation water to the wet lowland rice will be made available, especially at the beginning of wet season as well as at the time of peak irrigation requirement usually in August.

2.5.2 Institutional and Technical Constraints

Most of the constraints which are crucial to the irrigation development are institutional and relevant to the planning, design and construction of irrigation schemes, and the services available for O&M and cooperation of the water users in the management of water and maintenance of the scheme. The main constraints are :

(1) lack of experience in planning, design and construction supervision of the irrigation schemes;

(2) inadequate development of water users associations for control of O&M and settlement of disputes; and

(3) insufficient budget and qualified technical staff for providing timely and efficient public services to the water users.

3. PLAN OF IRRIGATION DEVELOPMENT

3.1 Development Concept

Most of the existing lowland rice field receives supplemental irrigation to wet season rice from small-scale traditional irrigation systems mostly constructed by farmers themselves. Most of these irrigation systems are located on the main rivers such as Nam Mao, Nam Beng, Nam Ko and their tributaries, and have good accessibility to the markets and administrative centres through the existing district and national roads. In addition, some of them already have concrete permanent weir, which also have a potential to achieve more favourable and faster rate of irrigation development through rehabilitation of canal network only. However, these systems are very primitive without proper investigation and design. Especially, the intake weirs are easily washed away at flood times because of indigenous brushwood weir. Therefore, the first priority should be given to the rehabilitation and upgrading of these existing irrigation system by constructing permanent weir together with well-designed canal network, for the purpose of increasing the agricultural production, especially rice in lowland field. In addition, consideration should also be paid for opening of new lowland rice field in the potential areas adjacent to the existing system, through the construction of new irrigation system or expansion of the existing canal network.

Therefore, it is proposed that the first priority for irrigation development under the Master Plan be given to the rehabilitation and upgrading program of the existing irrigation systems which currently cover 2,662 ha of lowland rice field in total, also taking into consideration the present government's strategy for irrigation development for the purpose of achieving the increase and stabilization of agricultural production as early as possible with an economical investment.

Construction of new irrigation system for upland in the hills adjacent to the model areas, depending on available water resources, will be carried out for execution of various research and pilot works related to the development of improved cropping systems. In the upland of Xai model area, farmers are growing wide varieties of vegetable with irrigation by bucket, using spring water coming down from the mountain. In addition, there are some small ponds constructed by farmers themselves for their small-scale fishery and also for irrigation purpose. In order to improve these facilities, a simple pipe irrigation system may be considered for more effective use of the limited spring water.

As mentioned in Sub-chapter F.2.5, there exist some valley bottoms being used for rice cultivation mostly under the rainfed condition. According to the irrigation section of the

Province, 13 valley bottoms with a total irrigable area of about 440 ha are identified in the study area for the future irrigation development. However, they are scattered in very wide remote area over about 558,000 ha, and the access to such valley bottoms is currently very poor. Under these circumstances, it is considered that priority in developing these remote valley bottoms will be to construction and/or rehabilitation of road network as the first step which will require large investment and time for its completion. In addition, data and information on these valley bottoms available for preparation of appropriate irrigation development program are very limited at present, and should be collected through further investigations.

In addition, some lands currently covered with bush and/or grass in most cases are found in Hun district and are estimated at about 600 ha by using 1/50,000 topo-maps. These lands could be developed for agricultural use in the future, though further investigations and studies should be made to confirm their agricultural potential and water availability for irrigation.

In the Master Plan, the second priority will be given to these potential lands, 1,040 ha in total, for further irrigation development with construction of new irrigation systems in these lands, depending on the availability of water for irrigation.

Further study on land resources in the study area by using 1/50,000 topo-maps shows that there would be 3,500 ha of land that could be developed for intensification and diversification of crop production through introduction of the year-round irrigation farming, depending on availability of irrigation water. These lands are located in gentle sloping hills with a land slope of 9 to 12 % scattered in the study area. The third priority will be given to the irrigation development in these lands in the Master Plan.

3.2 Plan of Rehabilitation and Upgrading of Existing Irrigation System

As shown in Table MF-11, there are 135 existing irrigation schemes with a total irrigation area of 2,662 ha in the study area. Most of them are very small village irrigation scheme with a command area of less than 20 ha, which are 100 schemes commanding 613 ha of lowland rice field in total. In addition, about 60 % of the 100 schemes in number is those which irrigate only 3 ha of rice field on an average. On the other hand, the remaining 35 schemes serve 2,049 ha of lowland rice field in total. Among all the existing schemes, only 14 schemes have concrete permanent weir constructed by financial assistance from the province, districts and other organizations such as Lao Quaker Service. All of these schemes are in a great need of rehabilitation and upgrading, especially village irrigation schemes with indigenous brushwood weirs constructed by farmers themselves.

3.2.1 Selection Criteria

Because there are a number of irrigation schemes to be improved under the Master Plan, the rehabilitation and upgrading of them will have to be carried out, through appropriate packaging of the schemes and stage-wise implementation schedule with priority ranking. The following criteria may be used for optimum selection of the schemes to be implemented at each stage of the irrigation development under the Master Plan :

(1) Potential Accessibility via Roads: the study area is currently served by the National Road No.2 which connects Xai, Beng and Hun districts. In order to obtain good access to markets and for rehabilitation of the schemes, road communication is essential. Priority will be given to the schemes located along or near the Road. The present situation of access to some potential schemes can be improved by road construction with a short distance. Where this is possible, priority is given also to such potential schemes.

(2) Size and present facilities of the Schemes: since the study area is located in the mountainous zone, flat land suitable for development of irrigated agriculture is limited, especially for opening of new lowland rice field. Therefore, one of the effective ways of increasing agricultural production in the limited flat land will be to rehabilitate the schemes with as large command area as possible. In addition, the more wide area can be served by an improved irrigation system, the less the investment per hectare will be. It is proposed in this criteria that the first priority be given to the schemes with a command area of more than 51 ha, and followed by the schemes that irrigate 21 to 50 ha of lowland rice field. In addition, priority is also given to the schemes which have potentials for opening new rice fields by extending the existing canal network, and to those who already have permanent concrete weir for which the rehabilitation of only canal network is required.

(3) Available Water Resources: the main rivers which have relatively large potential for irrigation development are the Nam Beng, Nam Mao and Nam Hin in the study area, and all of them are perennial river. Although the water in these rivers is abundant during the wet season, the amount of river water in the dry season decreases considerably. Also, their tributaries and other small rivers are mostly dry up. Therefore, priority is given to the schemes supported by large catchment area with a high runoff potential. In addition, priority is also given to the schemes where potential for development of

micro-hydropower generation in terms of available water and topography exists.

(4) Motivation of Irrigation Beneficiary : the basic ingredient for success of irrigation development is the cooperation of the beneficiary, say farmers. The farmer's involvement is essential for successful planning, implementation and subsequent O&M of the scheme. For this purpose, the establishment of well-organized water users association is essential. Therefore, the first priority is given to the schemes who already have such an association authorized and supported by the government institute, and followed by the schemes currently operated and maintained by the traditional cooperative system of the beneficiary's groups, even if the formal association is not established yet.

(5) Province's Priority Ranking : the province and district offices have detailed information on potentials for and plan of further irrigation development in the study area. Therefore, their identification of potential schemes for rehabilitation and upgrading should be taken into consideration for selection of priority schemes.

3.2.2 Plan of Rehabilitation and Upgrading

Based on the field survey and by using the above selection criteria, the selection of potential existing irrigation schemes in each district is made to prepare the stage-wise implementation of rehabilitation and upgrading of such schemes to be proposed under the Master Plan, except for those to be included in the Model Areas Development Scheme (the Scheme). The plan for rehabilitation of the irrigation schemes in each model area is discussed in detail in the separate Volume III Feasibility Study on Model Areas Scheme.

(1) Xai District

In Xai district, there are 69 existing irrigation schemes with a total command area of 998 ha of lowland rice field. They are all traditional village irrigation system with brushwood weir, except for only the Nam Hin scheme with permanent concrete weir. Among them, one scheme, which irrigates 196 ha of rice field, on the Nam Mao river will be rehabilitated by the Xai model area development program. Therefore, priority ranking of the remaining 68 schemes is studied for their stage-wise rehabilitation and upgrading, as shown below.

Out of the 68 schemes, those with a command area of more than 51 ha are two schemes, and those with a irrigation area ranging from 21 ha to 50 ha are nine schemes. The former includes the Nam Hin and the Houay Lai schemes. Since the Houay Lai is included in the rehabilitation program under the UNDP project, this is excluded from the study. The Nam Hin scheme currently irrigates 135 ha of lowland rice field extending on the left bank of the Nam Hin river and has a good access to Xai city, about 2 km. In addition, the scheme will have a potential to expand the irrigation area by constructing additional canals. The intake facility is permanent concrete weir and is maintained in good condition. However, the main canal should be rehabilitated, and additional canal network such as secondary and tertiary ones should also be constructed with an appropriate number of canal structures. Among the nine schemes included in the latter, two schemes are located in the UNDP project area, and are excluded from this study. Out of the remaining seven schemes, priority is given to three schemes on the Nam Mao river, because they locate near the National Road No.2 and well-managed by Thiao village. The schemes currently irrigate 80 ha of rice field in total with the traditional brushwood weirs, which should be rehabilitated by constructing concrete weirs and new canal networks.

As a result, four existing village schemes which cover 210 ha of lowland rice field in total are selected for the rehabilitation program at the medium term development stage of the Master Plan. The remaining 48 schemes with a total irrigation area of 334 ha, except for 16 schemes to be included in the UNDP project (total irrigation area : 258 ha), will be rehabilitated under the long term development program. Details of this study are shown in Table MF.2, and the summary is as follows :

Development Stage	No. of Scheme	Total Irrigation Area (ha)
Model Areas Scheme	1	196
Medium Term Program	4	210
Long Term Program	48	334
Schemes under UNDP project	(16)	(258)
Total	69	998

(2) Beng District

The district has 40 existing irrigation schemes, including six schemes with a command area of more than 51 ha. Out of the six schemes, five are related to Beng model area and will be rehabilitated by the model areas scheme. The

remaining Houay Nampa scheme with a brushwood weir on the Houay Nampa, a tributary of the Nam Beng, is located near the National Road No.2 and irrigates 54.5 ha of rice field, to which a priority for rehabilitation at the medium stage development is given. There are two schemes which are also located along the Road No.2. They have the intake weirs on the Nam Met, a tributary of the Nam Beng, to irrigate 52 ha of rice field in total. The Nam Met river is a perennial one and has some amount of river water even at the end of dry season. Priority for rehabilitation of the medium term development program may be given to these schemes in terms of good accessibility and potential for extension of irrigated farming in both wet and dry seasons. There are two more schemes with a command area of more than 30 ha and good accessibility to the Road No.2, to which the priority may also be given.

As a result, the above five schemes with a total command area of 179 ha are selected as priority ones to be rehabilitated under the medium term development program. The remaining 30 schemes which serve 439 ha of rice field in total will be rehabilitated at the long term development stage. For details, see also Table MF.2, and the summary is as follows :

Development Stage	No. of Scheme	Total Irrigation Area (ha)
Model Areas Scheme	5	221
Medium Term Program	5	179
Long Term Program	30	179
Total	40	839

(3) Hun District

The existing irrigation schemes in Hun district are 26, of which six schemes are related to Hun model area and will be rehabilitated under the model areas scheme. The schemes with an irrigation area of more than 51 ha are four, including two schemes to be upgraded under the model areas scheme. The remaining two are the Naxiandi scheme irrigating 178 ha of rice field with a brushwood weir and the Fen scheme that serves 57 ha of rice field with a concrete weir on the Nam Oun, a tributary of the Nam Beng. Although the Naxiandi is located in the remote area, about 27 km south-east from Hun district centre, its command area is large enough for increase in agricultural production especially wet season rice as well as for acceleration of rural socio-economic development. The Fen scheme has a potential to expand the irrigation area through rehabilitation of the canal network. Therefore, these

two schemes will be included in the rehabilitation program of the medium term irrigation development.

There are nine schemes with a command area ranging from 21 ha to 50 ha. Out of nine, three schemes are already included in the model area, and the remaining consists of two with concrete weir and four with traditional brushwood weir. Among them, three schemes with an average command area of about 36 ha of a scheme, two with concrete weir and one with brushwood, are selected to be included in the medium term rehabilitation program mainly in terms of good accessibility and appropriate size of the scheme. In addition, one more scheme with concrete weir is selected for the medium term program because of good accessibility and economical investment in rehabilitation of canal network only, though the command area is 19 ha. As a result, the schemes to be rehabilitated under the medium and long term development programs will be six and 14, respectively, as detailed in Table MF.2. The summary is shown below.

Development Stage	No. of Scheme	Total Irrigation Area (ha)
Model Areas Scheme	6	266
Medium Term Program	6	364
Long Term Program	14	195
Total	26	825

The stage-wise rehabilitation program of the existing irrigation systems in the study area is summarized as follows, based on the above study of priority ranking : The existing irrigation schemes to be rehabilitated at each development stage in the study area will be 12 with a total irrigation area of 683 ha under the model areas scheme, 15 covering 753 ha of total irrigation area, and 92 schemes with a total irrigation area of 868 ha, respectively, except for 16 schemes to be rehabilitated under the UNDP project.

Development Stage	Xai District		Beng District		Hun District	
	No. of Scheme	Total Irri. Area (ha)	No. of Scheme	Total Irri. Area (ha)	No. of Scheme	Total Irri. Area (ha)
Model Areas Scheme	1	196	5	221	6	266
Medium Term Program	4	210	5	179	6	364
Long Term Program	48	334	30	339	14	195
Scheme under UNDP	(16)	(258)	-	-	-	-
Total	69	998	40	839	26	825

Note: In this table, total irrigation area of the schemes to be rehabilitated under the Model Areas Scheme does not include additional irrigation area which will increase after the rehabilitation.