9) Extension Services

MAF is restructuring itself to enhance its capacity of responding to farmers' needs in the evolving market economy. From the lessons learned and experienced in the Mekong coastal area growth phenomenon, the government recognized that MAF is a partner, supporting farmers' needs and providing information and technical assistance to overcome problems of farmers and villages.

Community and farmer's needs are communicated to the Farming System Extension Workers (FSEW) in the district. What the district cannot solve, is sent to a Subject Matter Specialist (SMS) in the province, and what the province cannot solve is sent to the Central level for resolution. Consequently, each government level above the district functions has a supportive role. This approach emphasizes: (i) encouraging farming communities to express their problems; (ii) helping the communities to participate in finding solutions to their problems; and (iii) giving communities the opportunity to gain access to the resources to solve their problems. Hence, the Ministry is driven by farmer and community requirements.

In practice, the DAFO and PAFO staff have many constraints in providing proper extension services to farmers. Among these are the shortage of qualified personnel at both district and provincial level, inadequate training, lack of mobility, lack of equipment and lack of operational budget. Under the new structure proposed for reorganization, they would be divided into three sections: an Extension Section, Regulatory Section and an Administrative Section, replacing the sub-sectoral units. Since this system is newly introduced and underway, and such institutional restructuring activities may take more time, the efforts for achieving the target should be continued steadily.

10) Agricultural Promotion Bank

Farmers are raising the issues on the APB's performance: i.e., (i) the network of credit is limited, (ii) staff of APB are short, (iii) the amount of funds are insufficient, and (iv) the services of APB are insufficient and only a limited amount of loan is available. On the other hand, APB staff are claiming that: (i) farmers have limited chances of getting a loan, (ii) farmers have limited information about the loan, (iii) farmers don't keep the return period and returning amount, and (iv) access to the market is lacking.

To improve these issues, the following counter measures are needed:

- strengthening and expansion of APB's activities;
- securing of domestic fund for investment of agricultural and rural development;

- effective use of short term loan; and
- strengthening of the relations between financing authority and other ministries.

11) Marketing

No systematic market research has been undertaken, and understanding of market channels and condition is still superficial. The current system of production, and intensification or diversification of agricultural production, is constrained by:

- lack of production, trade, management, and market experience;
- minimal understanding of existing markets;
- previous bad experiences with contract production;
- low local demand for diversified food commodities;
- non-existence of local processing facilities that could absorb large quantities of agricultural crops;
- low level production and management technology;
- limited number of traders interested in trading agricultural commodities;
- weak commercial networks existing throughout the country.

The implication of future integration into the regional market is not clearly understood. With a small population, minimal monetarisation of the rural economy, and low demand for diversified products, the opportunity for internal market expansion is limited. More systematic market research should identify the competitive advantages of the regional environments and develop strategies to provide attractive incentives for farmers, traders and investors for regional market operations.

IV-3.3 Basic Concept for Regional Agriculture Development

In view of the issues as discussed above, as well as the government policy for the agriculture sector, the goal of the regional agriculture development plan is proposed as summarized below.

- Realization of market oriented agriculture with effective and integrated use of the limited resources in a sustainable manner;
- Sufficient incomes for enjoying stable living in the rural area through agricultural activities; and
- Promising agriculture for the younger generations.

In order to achieve the above goal, the basic concept for regional agriculture development may be set as follows:

- The agriculture sector in SKR should secure the basic food for people in the region and to contribute to development and stabilization of the regional economy;
- The agriculture sector in SKR should play a leading role in market oriented agriculture to other provinces;
- Within SKR, the region along the Mekong should play a leading role in market oriented agriculture to be expanded to the eastern region in order to alleviate the economic differences among the regions;
- SKR should be a base of food supply to the habitual food deficit areas in mountainous region, as well as to the areas suffered from natural disasters; and
- The agriculture sector in SKR should be a base of livestock products supply for export.

IV-3.4 Development Strategy

1) General

Through the experiences accumulated by many government projects, it is clear that the government is always facing difficulties in limited funds to realize the programs. Further, it is found that the development programs should be sustainable with participation of the beneficiaries. In this connection, the following practical development strategies are proposed for SKR agricultural development:

- To encourage the beneficiaries, the development programs should be originated from their real needs and practical with their efforts; e.g., (i) selection of motivated farmers groups and their extension, and (ii) strengthening and promoting production groups;
- The fund extended to the beneficiaries should be revolved in principle to continue the program's activities in a sustainable manner; and
- To promote the farmer's independent sprit, it must be cleared what should be done by the government and what can be done by the farmers themselves through participatory consultation at village levels.

2) Midterm and Long Term Strategy

Dependent on the priority, urgency and required period of the development programs, the midterm (2000 – 2010) and the long term (2010-2020) strategies for development are proposed as follows:

(1) Midterm (2000-2010)

- Lowland (Mekong coastal) region: to encourage the current momentum to market oriented agriculture by promoting more cash crop production (e.g., peanut and maize) through the contract farming system;
- Eastern region: to improve the present subsistence agriculture by the government technical support, information and credit, as well as the support for social infrastructure for poverty alleviation;
- Increase in production according to the increase in local demand, as well as for import substitute commodities;
- Internal regulatory and external trade policy adjustments to expand exports, particularly for quarantine of animals and their export;
- A priority is accorded to minimal and effective public investments such as community based small scale irrigation programs in mountainous remote areas for poverty alleviation; and
- Increase in productivity by improvement of water management of the existing irrigation facilities.

(2) Long Term (2010-2020)

- Promoting market oriented agriculture in the eastern region according to the improvement in the agricultural and social circumstances in the region;
- Promotion and increase in production of strategic exporting animals such as cattle and native chickens in addition to increase in local demand;
- Public investments to medium scale irrigation development programs giving priority to the economic feasibility based on the government financial background.

3) Area-based Approach

In view of the differences in social, economic and topographical situations in SKR, the Study area is divided into three regions, namely (i) lowland region along the Mekong, (ii) central region and (iii) eastern region. District names are summarized on the following page.

Table IV3-9 Demographic Feature by Region

Region	Population (persons)	District (nos.)	Village (nos.)	Household (nos.)	Persons/HH (persons)
Both Provinces					
1. Lowland	490,934	8	818	84,108	5.8
2. Central	340,877	9	848	58,056	5.9
3. Eastern	189,910	7	677	32,050	5.9
Total/ Ave.	1,021,721	24	2,343	176,557	5.9
Khammouan Province					
1. Lowland	137,158	3	260	24,314	5.6
2. Central	95,729	3	320	18,096	5.3
3. Eastern	61,944	3	220	11,252	5.5
Total/ Ave.	294,831	9	800	53,662	5.5
Savannakhet Province					
1. Lowland	353,776	5	558	59,794	5.9
2. Central	245,148	6	528	39,960	6.1
3. Eastern	127,966	4	457	20,798	6.2
Total/ Ave.					

Source: Basic Statistics about the Socio-Economic Development in the Savannakhet Province 1998 and that in the Khammouan Province 1998.

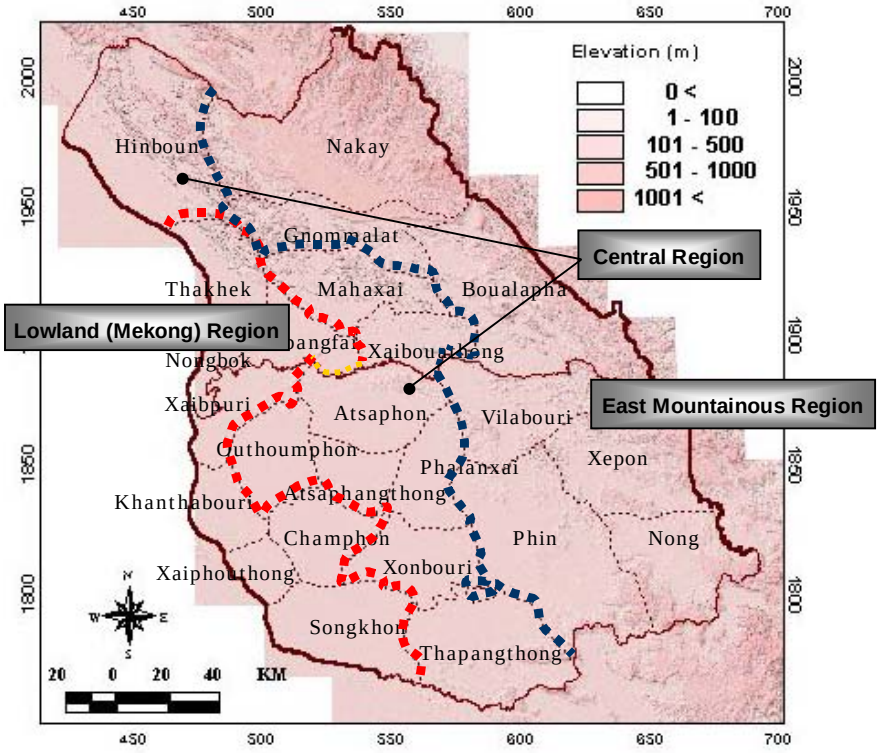
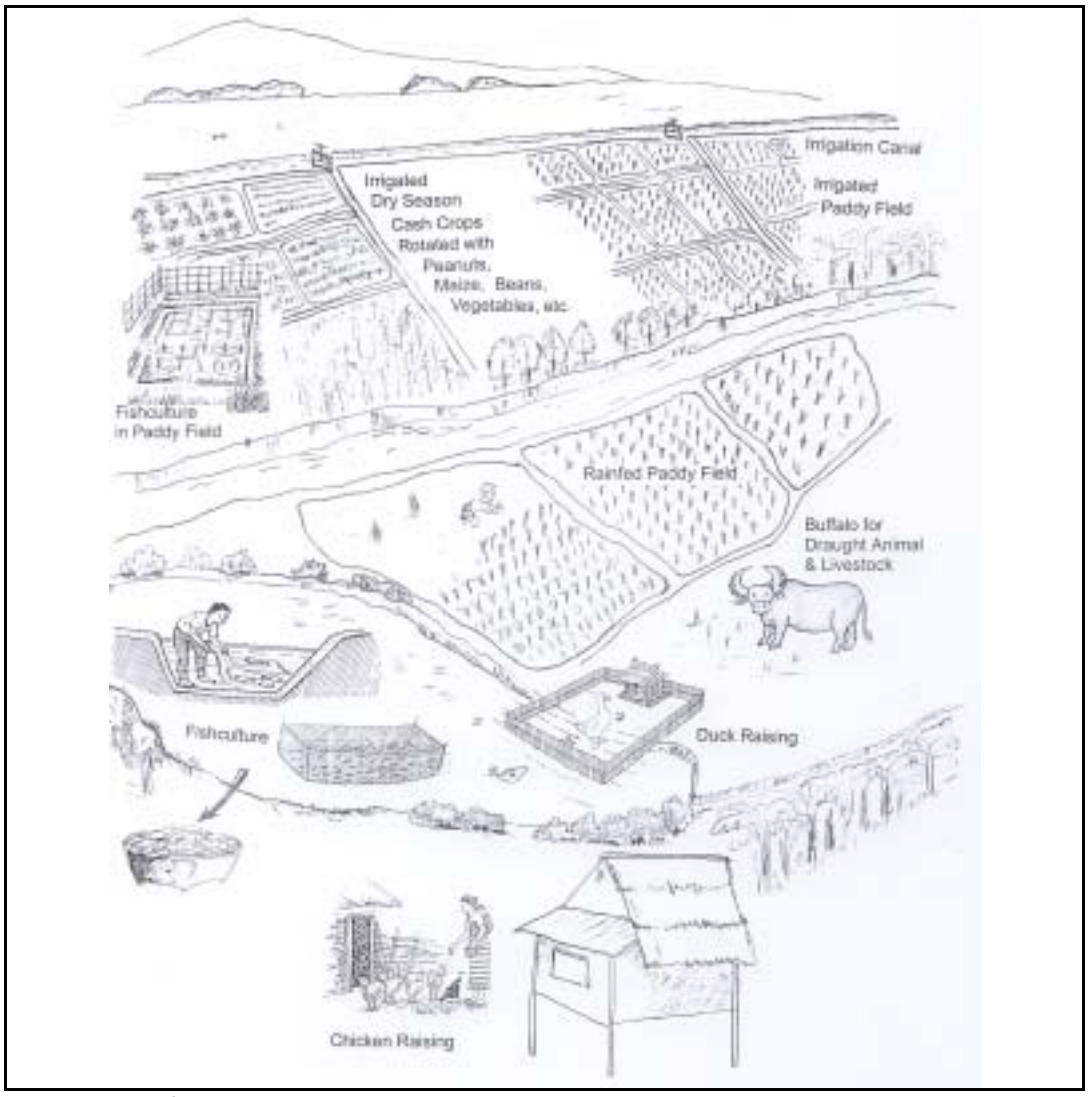


Figure IV3-4 Region and Districts in SKR

(1) Lowland (Mekong) Region

In the plain along the Mekong and in the watersheds of Xebangfai, Xechamphon, Xebanghieng and its tributaries, rice cultivation is a dominant farming system. However, the real economic situation is that even rice farmers earn about 50% of their incomes from livestock. This indicates that “animal raising” is a key factor in the farm economy. Thus, it is recommended that “animal raising” be integrated in the components of agricultural development. People in the lowland region have been raising buffaloes as a draft animal as well as livestock. Cattles are also raised as livestock grazing in the surrounding forest and in paddy fields in the dry season. In view of the limited forests for expansion of pasture in the lowland region, livestock for development should mainly focus on small to medium animals such as poultry and pigs. Cattle raising will also be increased if the land for pasture is made available. In addition, due to the topographical conditions, there exist a lot of fish ponds and potential for fish pond development. Fishculture is also a popular and promising economic activity in this area. In view of the regional characteristic situation, the **“Integrated Farming System with Rice + Small Animal + Fishery”** is recommended for an agricultural development approach in the lowland region.



Source: JICA Study Team

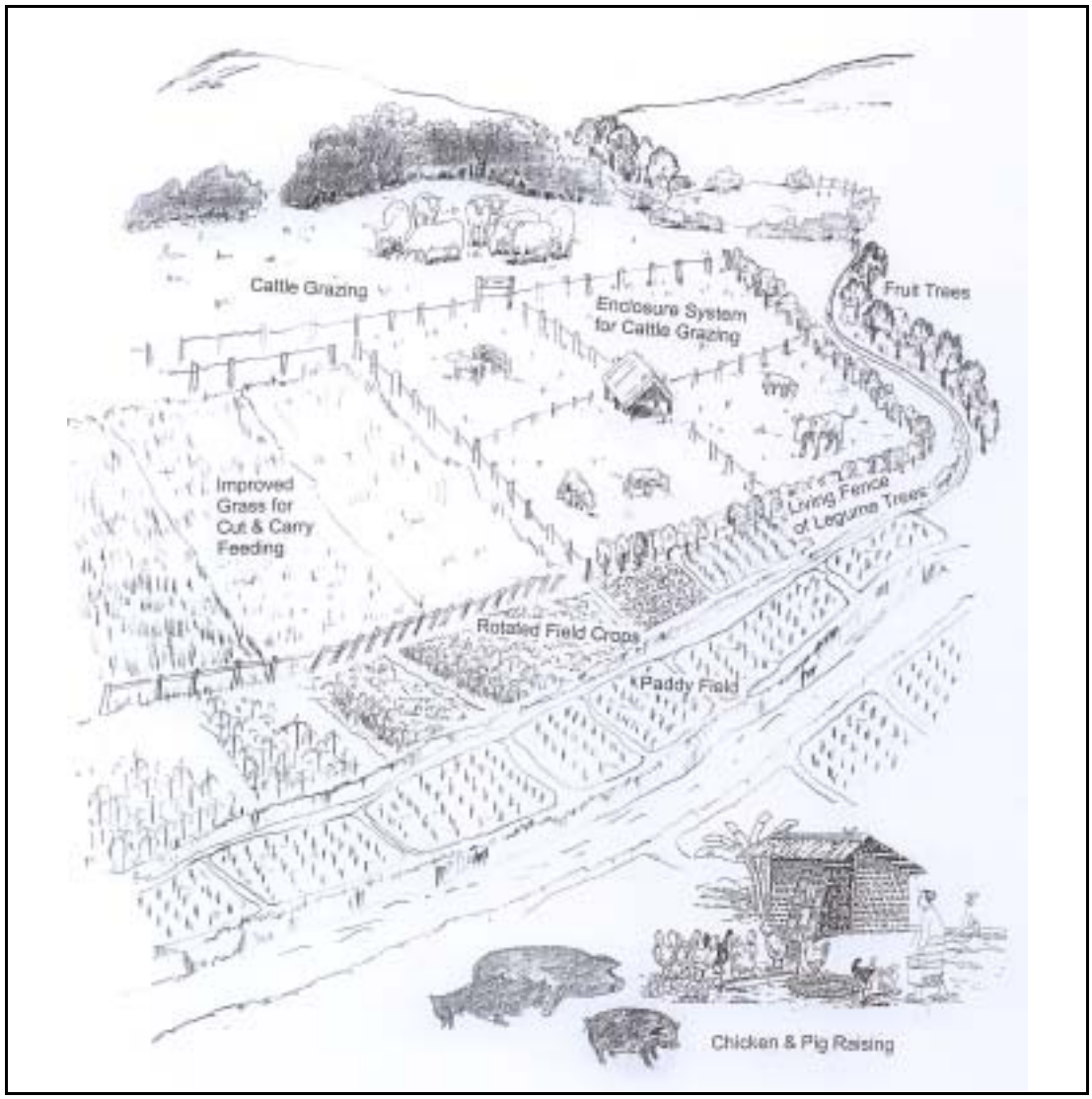
Figure IV3-5 Integrated Farming in Lowland Zone

(2) Central Region

From a farming system point of view, it can be said that the farming system in this region is similar to that of the eastern remote region. In other words, farmers depend on large animal raising in combination with a limited paddy field. However, since the land forms of this region are gentle rolling hills in general, they are more advantageous with rather broad forest areas, which enable them to raise more large animals. The paddy fields are also more beneficial than the eastern region, even though the average farm size itself is rather small compared with the lowland region. This region is also advantageous in terms of accessibility.

Under such a situation, it is expected that market oriented farming, the momentum of which currently exists in the lowland region, will be extended from this region to the eastern region step by step. Since cattle raising is one of the most promising

components in SKR, **"Integrated Farming System with Large Animal (cattle) + Rice"** is recommended as an agricultural development approach in the central region.



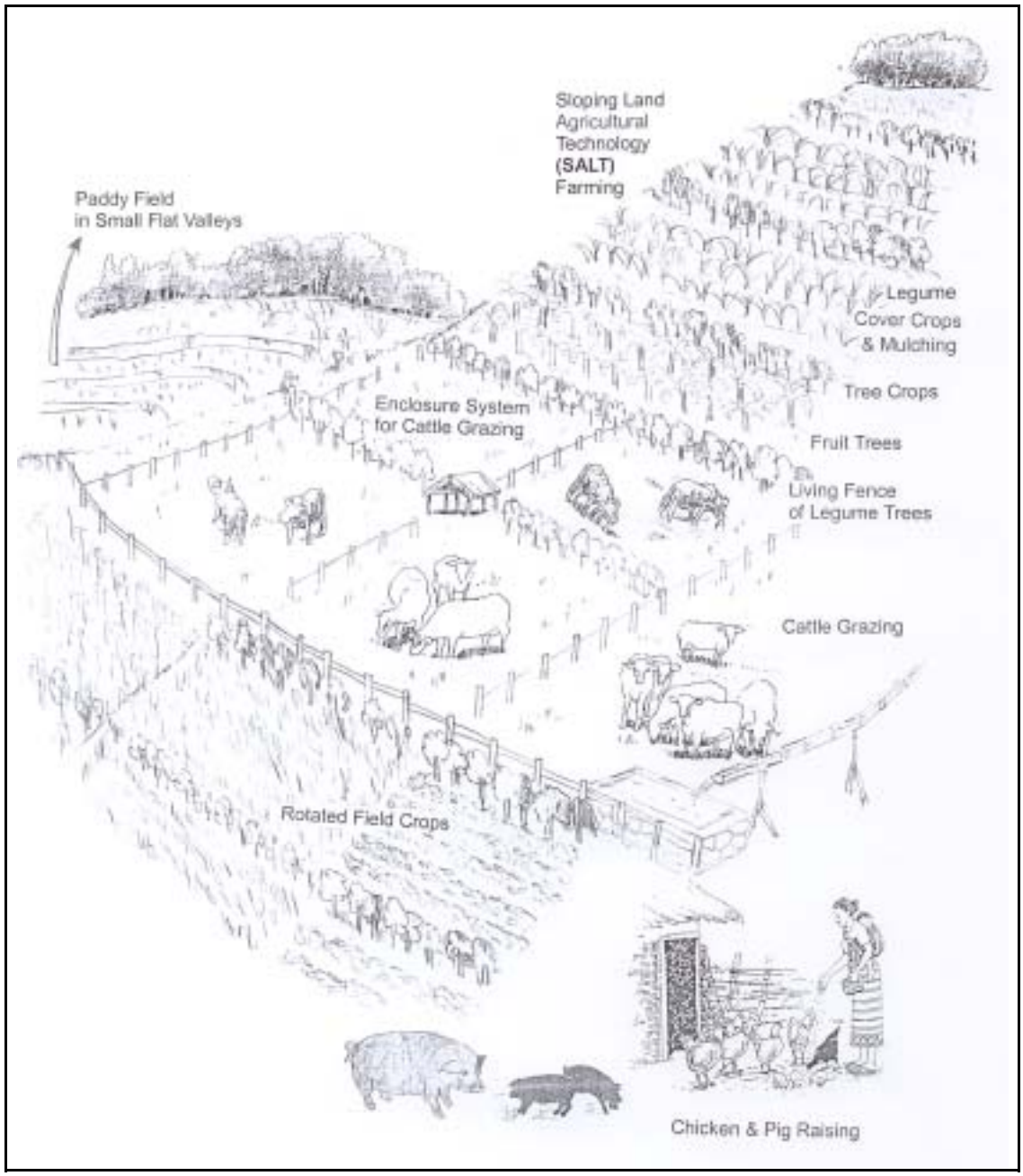
Source: JICA Study Team

Figure IV3-6 Integrated Farming in central Zone

(3) Eastern Mountainous Region

Even in the highland areas, the farmers grow wet land rice in small flat valleys for self-consumption. On the other hand, the forest area extends more widely than in the lowland area. Since large animals, particularly cattle, have promising market demand in the future, it is recommended that cattle raising be promoted in the eastern region. Due to limited feed or natural grass available in the dry season, increase in cattle raising will be limited to the present extensive/traditional system. In order to increase the number of cattle, introduction of an appropriate and semi-intensive raising system, improvement of pasture with better quality grass,

and securing of feed in the dry season are essential. The community-based raising and management system will be also promoted. Considering the concept of (i) avoiding farm management risks, (ii) promoting diversification, and (iii) maximizing the use of natural resources and recycling, the **"Integrated Farming System with Rice + Large Animal + Fruit Tree"** is recommended as an agricultural development approach in the rural remote areas. In view of market development through promotion of the local industry, the possibility of agricultural processing of fruit and industrial crops is to be examined as well.



Source: JICA Study Team

Figure IV3-7 Integrated Farming in Eastern Maintainous Zone

4) Farmer Driven Approach

Farmer-driven or community-based development should be promoted so that the project can be more earnest and practical for the beneficiaries. The government is embarking on new institutional initiatives to support its agricultural development strategies. The demand for services will be farmer-driven, and this mechanism will upgrade the capacity of districts, and extend productivity through delivery of applied technology on farmers' fields. Through trials and demonstrations, farmers will develop a menu of production choices in concert with the market price signals. DAFO staff will be retrained as Farming System Extension Workers (FSEW) and will directly service farmers through a system of regular visit circuits among zones of specific villages. The DAFO farming system workers will be backed up by Subject Matter Specialist (SMS) at the provincial level.

It is clear that improvement and stabilization of the farm economy will finally contribute to improvement of the regional economy, as well as to the achievement of the government policy of (i) food security, (ii) diversification, and (iii) poverty alleviation. The components such as "Human Resource Development", "Capacity Building" and "Strengthening of Supporting Service" should be included in the proposed farmer's driven programs through practical supporting activities and on-the-job training.

IV-3.5 Sectoral Development Plan and Production Target

1) Rice Production Plan

(1) Objectives and Strategy

Savannakhet and Khammouan provinces have two important objectives in rice production; namely (i) to supply rice within the provinces, and (ii) to supply surplus rice to the other rice deficit provinces in the country, playing a role of "rice storage in Lao PDR". According to the assumption of the rice balance in 2000 (see Table IV3-10), it is estimated that about 55,000 tons of rice (40% of total provincial demand) in Savannakhet province and about 38,000 tons (70% of total provincial demand) in Khammouan province are surplus in 2000. In the light of the limited budget of the government, it is proposed that such a level of production should be maintained without any big investment.

An increase rate of paddy field area is projected so as to meet the requirements for incremental population until 2020, as summarized below.

- Population in Savannakhet: 760,000 in 2000 ~ 1,245,000 in 2020;
- Population in Khammouan: 308,000 in 2000 ~ 505,000 in 2020;

- Incremental population in both provinces: 682,000
- Requirement for rice: 150 kg/capita/year in 2020 x 1.3 = 195 kg (with 30% stock)
- Requirement for paddy: 195/0.62 = 314 kg/capita/year x 682,000 persons = 214,000 tons/year;
- Requirement for paddy field: 214,000 /4 tons/ha = 53,500 ha
- Incremental paddy field area (wet season) with an annual increase rate of 1% for 2000 to 2010, 2% for 2010 to 2020: estimated at 53,700 ha in total.

(2) Phased Development

Under such projections, the following settings are made to project the rice balance in both provinces until 2020:

- Lowland paddy field area (Wet season, Dry season irrigated): Annual increase of 1% in 2000 to 2010, 2% in 2010 to 2020;
- Upland paddy field area (slash and burn): Decreased to zero by 2020 (the government target);
- Yields of rice: 3.0 ton/ha in 2000 to 3.5 ton/ha in 2020 for wet season rice; 4.0 ton/ha in 2000 to 5.0 ton/ha in 2020 for dry season irrigated rice;
- Irrigation development for 2000 to 2010: Strengthening of O&M of the existing irrigation schemes and participatory small scale irrigation schemes such as CMISP and DIDMP by ADB as well as ADP by WB; and
- Irrigation development for 2010 to 2020: Medium scale irrigation schemes according to the economic feasibility.

In addition to the above settings, the following measures are proposed to decrease the loss and risk of rice production with least investments in the facilities:

- Improvement of water management by WUA;
- Improvement of soil fertility of the paddy field by more inputs of organic manures;
- Applying improved varieties;
- Adjusting cropping pattern to avoid risks of flood, (i) by applying short period of growing varieties so as to harvest before floods, and (ii) by replanting just after flood season; and
- More intensive field management such as land preparation, weeding, fertilizing (timing, quantities, kind of fertilizer, etc.), timing of harvest, post-harvest activities, as well as cleaning of the surroundings to protect the paddy fields from mouse attack.

(3) Production Target

Based on the above assumptions, the rice production and rice balance sheet are proposed as shown below.

Table IV3-10 Projected Rice Production in SKR

Province	Khammouan			Savannakhet		
Year	2000	2010	2020	2000	2010	2020
Production ('000 tons)						
(1) Season Rice	162	195	264	350	422	571
(2) Irrigated Rice	45	56	74	86	107	141
(3) Upland Rice	1	0	0	2	1	0
Total Paddy Production	208	251	338	438	529	712
Cropped Area ('000 ha)						
(1) Season Rice	49.0	54.1	66.0	106.0	117.1	142.7
(2) Irrigated Rice	11.0	12.2	14.8	21.0	23.2	28.3
(3) Upland Rice	0.5	0.1	0.0	1.0	0.5	0.0
Total Paddy Cropped Area	60.5	66.4	80.8	128	140.8	171.0
Yield (ton/ha)						
(1) Season Rice	3.3	3.6	4.0	3.5	3.6	4.0
(2) Irrigated Rice	4.1	4.6	5.0	4.3	4.6	5.0
(3) Upland Rice	1.6	1.6	1.6	1.6	1.6	1.6

Table IV3-11 Projected Rice Balance in SKR

(Unit: '000 tons)

Province	Khammouan			Savannakhet		
Year	2000	2010	2020	2000	2010	2020
Requirement:						
1) Requirement (kg/milled rice/person)	170	160	150	170	160	150
2) Population ('000 persons)	308	395	505	760	973	1,245
3) Total milled rice required	52	63	76	129	156	189
4) Adjustment for stock (% of requirement)	30%	30%	30%	30%	30%	30%
5) Total milled rice required with 30% stock	68	82	99	168	202	243
Production:						
1) Total paddy production	208	251	338	438	529	712
2) Net paddy milled: less loss 16%	175	211	284	368	444	598
3) Milled rice production at 62% recovery	108	131	176	228	276	371
4) Net milled rice available: less other use 2%	106	128	173	224	270	363
5) Surplus/deficit	38	46	74	56	68	120
6) % against requirement	73%	73%	98%	43%	43%	65%

The tables show that about 40%~60% of surplus rice in Savannakhet province and 70%~90% of surplus rice in Khammouan province are expected, with the implication that SKR will continuously play a role of "a rice storage" for Lao PDR.

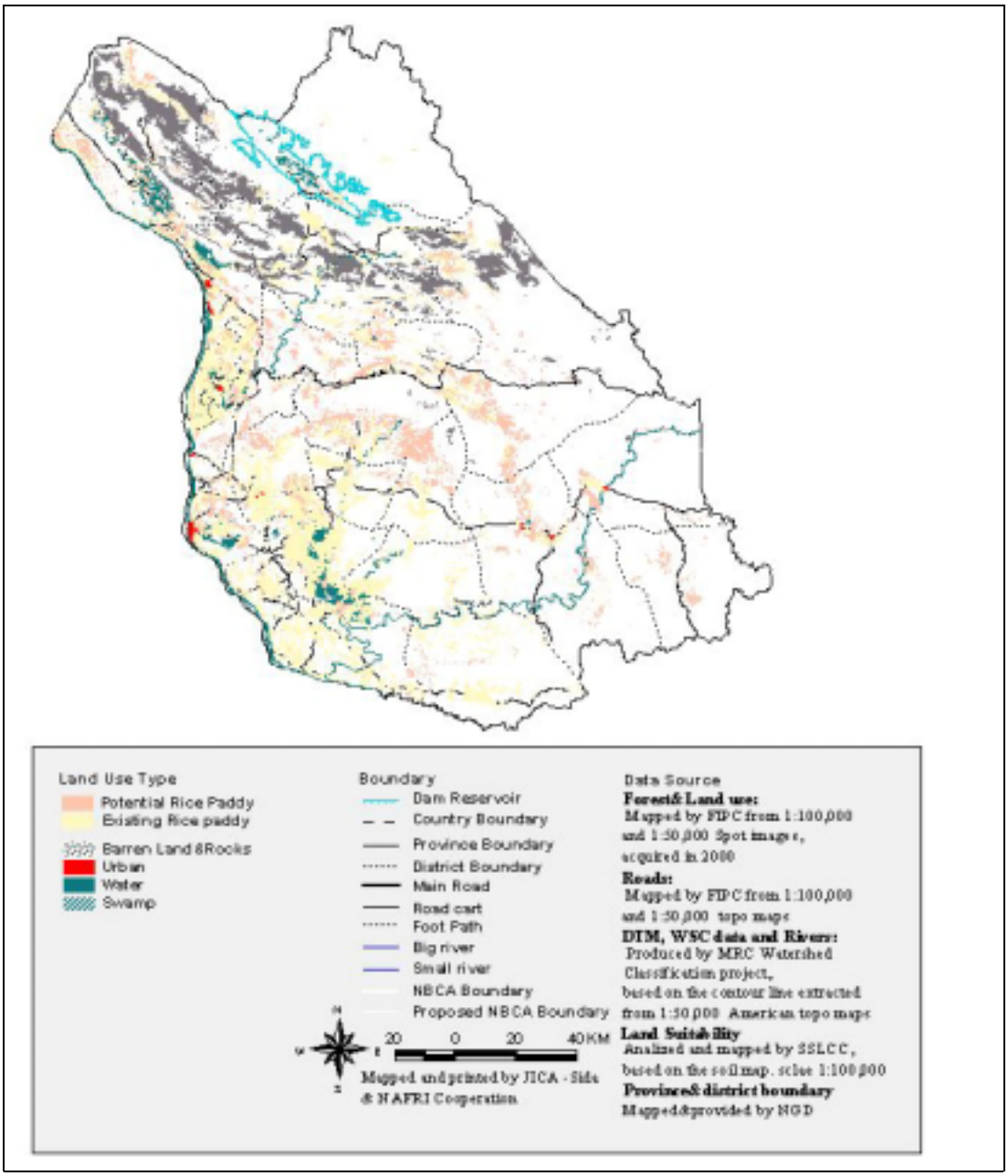


Figure IV3-8 Rice Paddy Area in SKR

2) Field Crops Production Plan

(1) Objectives and Strategy

Crop diversification is one of the government agricultural strategies. Thus, the objective of field crop production plan is to promote crop diversification, as well as to provide people with sufficient kinds of food required. Presently, there are a few cash crops other than rice grown in SKR; e.g., tobacco, maize, cotton and peanut. However, their production is limited in quantity. It may be because those cash crops are not attractive to farmers due to low yields, low quality, thus low prices,

which are results of limited technical support by the government and farmers' poor experience in those crops.

In consideration of the current momentum to market-oriented agriculture in SKR and the projection of future demand for meat, feed crops, and agro-processing crops such as pulse crops and fruits, there will be the possibility to promote those crops. With this in view, the following strategies have been taken into account for the field crop development:

- Production of field crops is to be increased in accordance with the increase in population and the change of food balance and taste;
- Demand for feed crops, particularly maize, will be considerably increased to cope with the increase in demand for meat consumption;
- Provincial feed mill factory in both provinces will encourage the farmers to produce maize in the future;
- Oil crops such as soybean and peanut are to be promoted in view of the demand for vegetable oil in Thailand as well as for local consumption;
- Savan Advance Agriculture Co. (vegetable oil factory) will be one of the leaders for marketing of cash crops;
- In order to maintain the humus level and soil fertility, appropriate inputs are essential. Particularly for the sustainable use of upland field, maximum inputs of organic manures are to be promoted due to the farmer's limited budget for chemical fertilizer;
- Provincial bio-fertilizer factory in both provinces will encourage the farmers to use organic manures in the future;
- Sloping Agricultural Land Technology (SALT) should be strongly promoted by supporting the staff of PAFO for sustainable upland agriculture; and
- In the long term, fruits, fruit trees and tree crops such as mango, orange, tamarind and coffee should be promoted together with agro-processing.

BOX-1 Fruit Tree Plantation

Khammouan province is considered to be highly suitable for fruits plantation judging from the land availability, soil, water and climate. However, fruits and vegetables processing is underdeveloped in Lao PDR due to little industrial accumulation. On the other hand, food processing industries are well developed in Thailand. Major Thai companies are producing for domestic and foreign markets either under licensing agreements, production contracts or joint ventures with foreign food companies such as Hagoromo in Japan. For the Thai food processing companies, fruit and vegetables as raw materials should be secured at the appropriate quality levels for their business expansion.

One Thai company has already initiated a factory operation in Nakhon Phanom or the opposite side of Khammouan. The company has an intention to add new lines, and fruit and vegetables production in Khammouan could be integrated into the company's scope of operation.

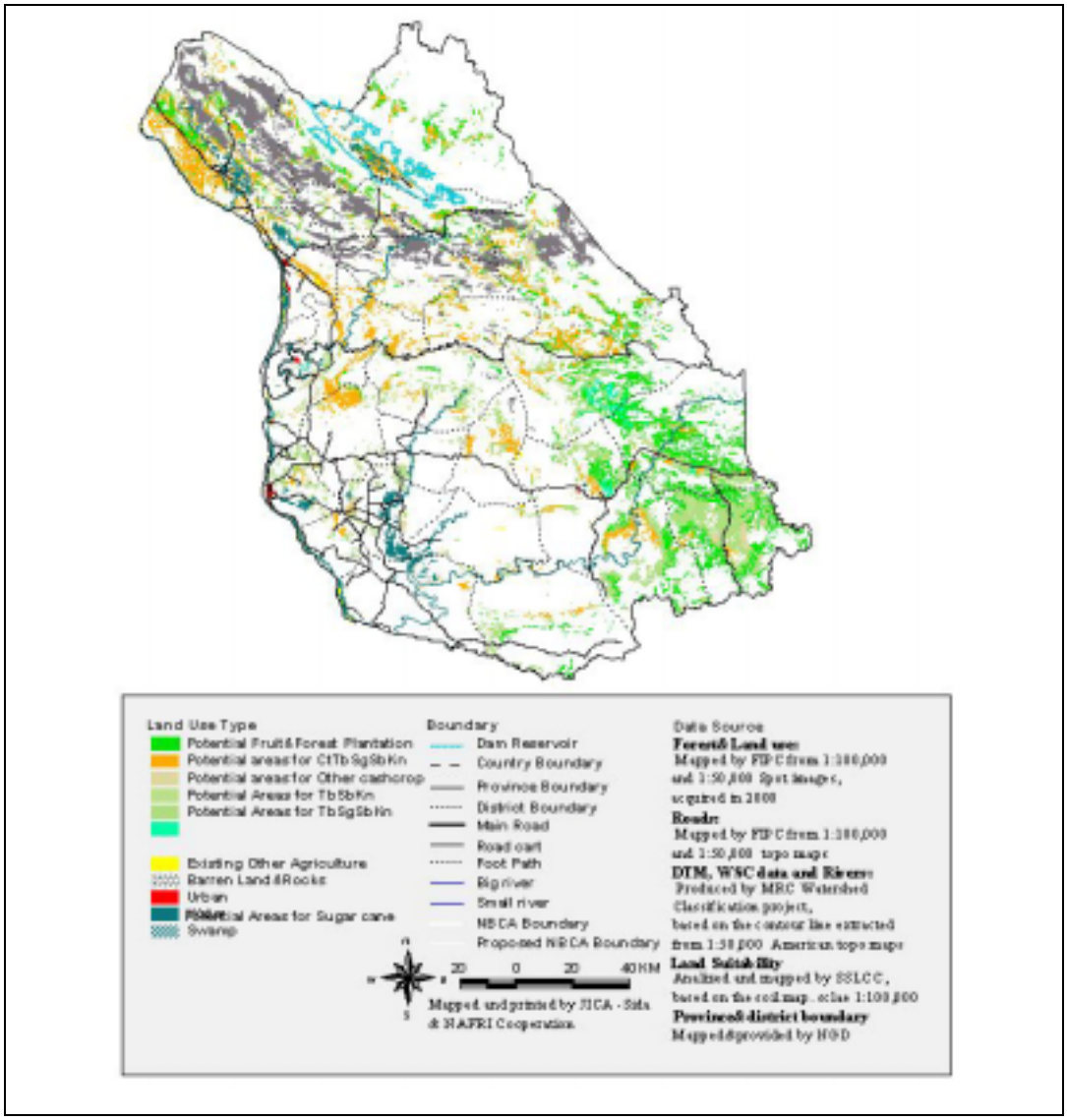


Figure IV3-9 Potential Area for Crop and Fruit Plantation

(2) Phased Development

By implementing the above strategies, the annual increase in the cropped area for major field crops and their yields are estimated as follows.

Table IV3-12 Projected Cropped Area of Major Field Crops

(Unit: ha)

Province	Khammouan				Savannakhet			
Year	2000	2010	2020	(%),*/	2000	2010	2020	(%),*/
1. Maize	700	1,800	4,700	10	3,100	8,000	20,900	10
2. Starchy root crops	250	650	1,700	10	1,200	3,100	8,100	10
3. Mungbean	5	10	20	5	35	60	90	5
4. Soybean	50	130	340	10	0	50	130	10
5. Peanut	35	90	240	10	1,070	2,800	7,200	10
6. Tobacco	850	1,140	1,500	3	950	1,300	1,700	3
7. Cotton	50	130	340	10	900	1,500	2,400	10
8. Sugar cane	150	1,240	3,000	5	60	2,100	5,400	5
9. Coffee	15	2,020	5,300	5	15	2,000	5,300	5
10. Vegetable	1,900	2,100	2,500	**/	4,300	5,100	6,200	**/
11. Fruit	1,400	4,100	6,700	***/	3,000	10,200	16,600	***/

Note: */ Estimated annual increase, **/ Requirement for food balance per capita,
***/ Requirement for food balance plus estimated additional increase by commercial basis.
Source: Estimated by the SKT Study Team. Figures were rounded off.

Table IV3-13 Projected Yields of Major Field Crops

(Unit: ton/ha)

Year	2000	2010	2020
1. Maize	2.5	2.8	3.0
2. Starchy root crops	6.0	6.5	7.0
3. Mungbean	0.8	0.9	1.0
4. Soybean	0.8	0.9	1.0
5. Peanut	1.0	1.2	1.5
6. Tobacco	5.0	5.5	6.0
7. Cotton	1.0	1.2	1.5
8. Sugar cane	25.0	28.0	30.0
9. Coffee, */	0.7 (0.5)	0.7 (0.6)	0.8 (0.7)
10. Vegetable	5.0	5.5	6.0
11. Fruit	10.0	13.0	15.0

Note: */ The figures in parentheses are the yields in Savannakhet province.
Source: Estimated by the SKT Study Team.

(3) Production Target

Based on the above assumptions, production of the major field crops has been projected as shown below.

Table IV3-14 Projected Production of Major Field Crops

(Unit: tons)

Province	Khammouan			Savannakhet		
Year	2000	2010	2020	2000	2010	2020
1. Maize	1,750	5,080	14,100	7,750	22,510	62,600
2. Starchy root crops	1,500	4,220	11,800	7,200	20,230	56,500
3. Mungbean	5	10	15	30	50	90
4. Soybean	40	120	340	0	50	130
5. Peanut	35	110	350	1,070	3,330	10,800
6. Tobacco	4,250	6,280	9,200	4,750	7,020	10,300
7. Cotton	50	160	500	900	1,760	3,600
8. Sugar cane	3,750	34,840	90,800	1,500	58,740	162,500
9. Coffee	10	1,420	4,200	10	1,220	3,700
10. Vegetable	9,500	11,550	15,000	21,500	28,050	37,200
11. Fruit	14,000	53,300	100,500	30,000	132,600	249,000

Source: Estimated by the SKT Study Team. Figures were rounded off.

3) Livestock Production Plan

(1) Objective and Strategy

It is projected that the demand for meat in the local market will increase due to the trend of food balance and the requirement for nutrition per capita. In addition, it is expected that cattle and native chicken will be promising for export in the future based on the current trend of the market in neighboring countries and the advantaged natural conditions in SKR. Thus, the objective of livestock production plan is to provide people with sufficient livestock products, as well as to promote export to the neighboring countries.

Under such a situation, the following strategies are proposed for livestock development:

- Production of livestock is to be increased in accordance with the increase in population and the change of food balance and taste;
- Promotion of cattle raising for export by making more advantageous natural conditions;
- Promotion of native chickens for export, considering the trend of preference for native products or products by organic farming;
- Strengthening of the quarantine system for promotion of livestock export; and
- Strengthening of the livestock disease control.

Box-2

Tapping the Lao Milk Market

There is a Nakhon Ratchasima-based dairy company planning its business expansion in the northeastern Thailand and Lao PDR. Being one of the major milk producers in Thailand, the company is accumulating know-how of expanding dairy farming on the contract basis. According to the company, the milk market in Lao PDR is still small, but there is a good chance for dairy business targeted to the Lao domestic market.

According to the Thai company, Khammouan province in Lao PDR is one of the suitable locations for dairy farming. The company is confident to successfully train Lao farmers for dairy farming by providing with a one year training program at its own demonstration farm. Within one year, about 20 farmers or farming families can be trained. However, the real constraint for starting dairy farming in Lao PDR is the lack of initial capital of both contract farmers and the demonstration farm for buying cows.

Once a fund is made available and the demonstration farm is established for training and extension, the raw milk produced is to be processed into UHT milk packages in Nakhon Ratchasima in the short term. According to the chairman of the company, the milk processing operation plan is readily possible, and the milk production cost with such an operation will be about 50% lower than that of Thailand. In the long term, milk processing facilities should be set up in Khammouan when the Lao milk market grows to a reasonable scale for production.

Box-3

Focusing on a Market Niche of Native Chicken

10 years ago, nobody believed that a fully integrated poultry factory for export would be feasible in Ubon Ratchathani, Thailand. However, a BOI-certified, modern poultry factory has been in full operation now, and 35% of its poultry meat (400,000 chickens a week) goes to the overseas market. The company's major export markets are Japan and European countries, obtaining approvals for export to Japan in 1994.

For the production of poultry, Lao PDR currently does not have competitiveness due to lack of technical skills for meat processing at the internationally accepted quality as well as hygienic levels and lack of export certificates to other countries such as Japan. It seems difficult for the local poultry companies in Lao PDR to obtain export certificates to Japan and European countries in a short run. However, having suitable land for raising livestock, farmers in Lao PDR can grow "native chickens". In the Japanese market, native chickens are called "Jidori" and priced higher than ordinary chickens. In Thailand, it may not be possible to grow a large number of native chickens because of the land limitation.

Based on the understanding mentioned above, if Thai poultry companies, such as the one in Ubon Ratchathani, become interested in exporting native chickens to the Japanese market, poultry farmers in Lao PDR can provide their native chickens. Since Thai poultry companies doing export business have export approvals and sales channels overseas, there might be a chance that native chickens grown in Lao PDR are exported through those channels. In the long run, poultry processing companies in Lao PDR must obtain technical skills and export approvals with the experience accumulated in the export business through Thai companies.

(2) Phased Development

In accordance with the above strategies, the annual increase in major livestock population and their increase rates are projected as follows:

Table IV3-15 Projected Major Livestock Population

(Unit: '000 heads)

Province	Khammouan				Savannakhet			
Year	2000	2010	,*/	2020 ,*/	2000	2010	,*/	2020 ,*/
Buffalo	80	90	,1/	110 ,1/	190	210	,1/	250 ,1/
Cattle	50	200	,2/	330 ,5/	210	790	,2/	1,290 ,5/
Pig	90	120	,3/	160 ,3/	220	300	,3/	390 ,3/
Poultry	470	710	,4/	1,410 ,4/	1,120	1,710	,4/	3,530 ,4/

Note: */ Estimated annual increase
1/ 1~2 % of annual increase for local consumption.
2/ 14~15% of annual increase for local consumption plus export.
3/ 2~3 % of annual increase for local consumption.
4/ 4~8% of annual increase for local consumption plus export.
5/ 5% of annual increase.

Source: Estimated by the SKT Study Team. Figures were rounded off.

(3) Production Target

Based on the above projection, production of the major livestock meat is estimated as shown below.

Table IV3-16 Projected Major Livestock Meat Production

(Unit: '000 tons)

	Khammouan			Savannakhet		
Year	2000	2010	2020	2000	2010	2020
Buffalo	3,240	3,760	4,240	7,520	8,240	10,000
Cattle	2,050	8,290	13,510	8,770	32,530	52,980
Pig	4,590	6,070	8,010	11,420	15,050	19,890
Poultry	1,930	2,900	5,790	4,580	7,000	14,470

Source: Estimated by the SKT Study Team, Figures were rounded off.

All the productions of livestock meat will cover the increase in local consumption in SKR, as well as some exports, particularly cattle and native chicken, in the future.

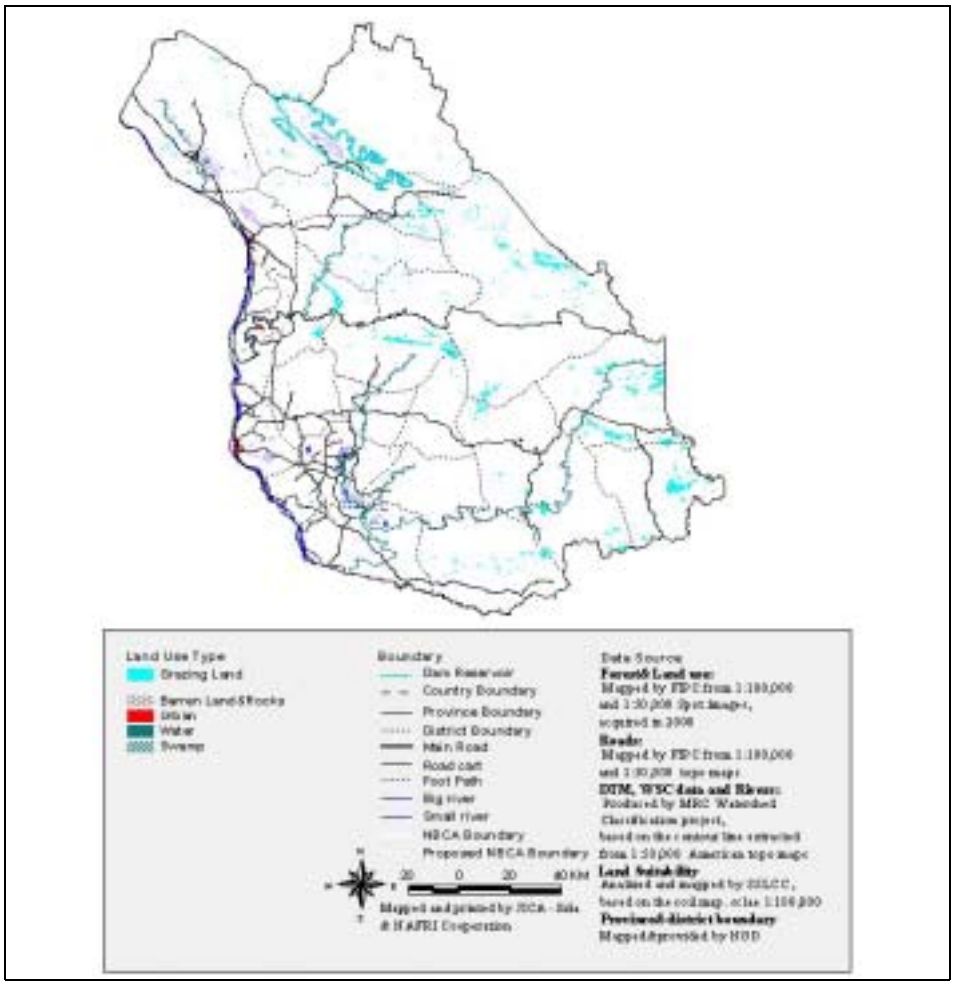


Figure IV3-10 Potential Grazing Land in SKR

4) Fishery Production Plan

(1) Production Increase

As mentioned earlier in the fish demand, annual fish shortage in Lao PDR in the year 2020 is around 116,000 tons. In Savannakhet and Khammouan, the total demands are 17,680 tons and 9,400 tons, respectively. Future development plan should focus on increasing production in two provinces by about 27,000 tons.

To meet this target, there are two sources of development, capture fisheries and aquaculture. In capture fisheries, when resources exploitation reaches at its maximum sustainable yield, the habitat/environmental enhancement should be taken into consideration.

The importance instrument in fishery resource utilization is the enactment of law and its enforcement, to regulate non-rationale exploitation of fishery resource, such as harvesting too small size of some species. Utilization of fish in the spawning season, which is commonly practiced in Lao PDR, should be regulated.

However, the most important method is to educate people to be aware of long-term problems.

The second source of production increment is aquaculture. In SKR, the development plan should have an objective of producing about 5,400 young aqua-farmers by the year 2020, who possess technical know how and practical experiences in aqua-farm.

(2) Post-harvest Handling

The post harvest handling of fish is important when the production is more than the consumption. Even though the present traditional fish preservation (smoking, dried, salting and fermenting) can remedy the problem to some extent, it cannot cover the demand for fresh fish in the remote area, particularly in the dry season.

Further, it may require some source of product development, not only for domestic consumption but also for foreign market. For instance, the “pladaek” is one of the popular products for Southeast Asian ethnic groups in the United States. Fish may also be processed by frozen, canned, or cooked in various ways.

(3) Environmental Enhancement

There are many ways of environmental enhancements, such as setting up of small barrage across the waterway. For reservoir fisheries, a good example of reservoir management is to create a large drawn-down zone. This drawn-zone is the area for spawning and nursing young fish. In this study, however, it is proposed to develop a large community fishpond in the low area of the incline land. The recommended size is around 20~30 hectares, depending upon the location, but it must be at least 3 m in depth so that 1 m is allowed for evapotranspiration, 1 m for domestic uses, and 1 m for storing fish in the dry season. These fish shall be served as parent fish in the following wet season.

This pond, together with one or two small nursery ponds for nursing fish before releasing, should be reliable for food security in the target villages, particularly in the dry season. Apart from fishery production, excess water may also be used for irrigation of family food crops in the dry season and/or water source for domestic animals.

(4) Infrastructure Requirement

The role of the public sector in fishery and aquaculture development should go along with the private sector. The “Association of Agriculture and Animal Husbandry” in Savannakhet should be strengthened to be capable of producing at least 5,400 entrepreneurs by 2020 and to produce another few hundred of experienced extension officers for the government.

For production of 27,000 tons of fish production in SKR, the basic infrastructure required is the hatchery, feed mill and ice plant. The hatcheries should be able to produce at least 162,000,000 fingerlings if estimated survival rate is 33%, and fish marketable size is 2 pieces/kg.

The feed mill is also vital for commercial fish production. The mill capacity should be set to produce fish feed of all kind not less than 81,000 tons annually. The feasibility of the feed mill should be investigated in detail. Moreover, in the aquaculture industry, a certain volume of ice is required for short-period preservation, e.g. from farm to cold storage or from farm to market directly.

Like many other agricultural commodities, fish decays rapidly. Cold storages to store fish exceeding immediate consumption is vital for the industry. It may be part of other food cold storage or solely to fish, depending upon production and consumption pattern. Further, cold storage may be required in the future to keep fresh fish for a longer period of time, particularly for consumption in the dry season. Another type of post harvest preservation, such as canning, cooked fish, or fish in oil or another type, may be useful.

(5) Cross National Cooperation.

To achieve a goal in fisheries development in SKR, certain cross-national cooperation between Lao PDR and Thailand is required. In the fields of habitat enhancement, Thailand has possessed thorough experiences in the administration of community fishpond management through the self-effort for food security and poverty alleviation, for at least 25 years.

Further, in 1981, Thailand launched the rehabilitation of small swamps for inland fishery project (SSIFP) by rehabilitation of 200 swamps of about 20 hectares size (under the JBIC loan). Through the villagers' participation and setting up of seven large fish seed centers, the project turned out to be successful.

In the field of aquaculture course in the proposed agriculture college in Savannakhet, numbers of competence faculty can be temporarily recruited either from agricultural colleges or from fisheries station in the Northeastern Thailand. By selecting a staff that can speak Lao fluently (most of northeastern origin can speak Lao), it will guarantee the fulfillment of the objective.

IV-3.6 Agricultural GDP

Based on the projected production towards 2020 and the estimated farmgate price as shownin Table IV3-17, the total value added in the agricultural sector has been

estimated. In view of the high settings of annual increase in major agricultural crops and livestock, the achievement of those projected figures may be tough but is possible. The table shows that the GDP in agriculture will attain the economic framework set for 2020. However, it is understood that more serious efforts are required to achieve this projection.

Table IV3-17 Farmgate Prices of Major Agricultural Products

(Unit: Kip)

	Unit	Market Price, 2000, 1/		Farmgate Price	
		Thakek	Savannakhet	1999, 2/	2000, 3/
Agricultural Products					
1. Paddy					
- Glutinous rice(irrigated)	kg			726	800
- Glutinous rice (rain fed)	kg			792	800
- Ordinary (irrigated)	kg			754	800
- Ordinary (rainfed)	kg			825	800
2. Rice (milled)	kg				
- Glutinous (I)	kg	2,000	1,800		
- Glutinous (II)	kg	1,800	1,700		
- Ordinary	kg	3,000	2,200		
3. Rice (bran)	kg	500	1,600		450
4. Maize	kg	5,000	12,000	559	700
5. Soybean	kg			3,661	3,000
6. Peanut	kg			3,298	3,000
7. Sweet potato	kg	3,000	3,000		700
8. Cassava	kg				450
9. Cabbage	kg	2,000	2,500		
10. Garlic	kg	5,000			
11. Tomato	kg	2,000	5,000		
12. Dry chili	kg	12,00	1,500		
13. Banana	kg	3,000	1,500		
14. Orange	kg	6,000	7,000		1,000
15. Mango	kg	9,500			1,000
16. Coffee	kg				3,900
Livestock					
1. Buffalo meat	kg	16,500	19,000	7,206	8,000
2. Beef	kg	19,000	20,000	7,019	8,000
3. Pork	kg	17,000	15,000	6,570	8,000
4. Broiler Chicken	kg	13,000	13,000		6,500
5. Free range Chicken	kg	20,000	15,000		10,000
6. Live Buffalo (350kg)	head	1,200,000	1,500,000		1,500,000
7. Live Cattle (200kg)	head	500,000	750,000		750,000
8. Live Pig (70kg)	head	300,000			420,000
9. Live Duck	head	35,000		22,684	22,000
10. Broiler Chicken	head			12,076	8,000
11. Free range Chicken	head	20,000		16,264	10,000
12. Chicken egg	piece	400	400		
13. Duck egg	piece	1,000	600		
Fish					
1. Fresh Fish	kg	10,000	12,000		3,000
2. Dried Fish	kg	30,000			

Note: 1/ Interviewed by the SKR Study Team in December 2000.
2/ Yearly Statistics 1999, Planning Department, MAF.
3/ Estimated by the SKR Study Team

Source: Prepared by the SKR Study Team.

Table IV3-18 Estimated Agricultural GDP

(In million Kip at 1999 Price)

Province	Khammouan			Savannakhet		
Year	-2000-	-2010-	-2020-	-2000-	-2010-	-2020-
GDP	**871,000 ,*/**	**1,891,000 ,*/**	**3,330,000 ,*/**	**1,767,000 ,*/**	**4,246,000 ,*/**	**7,417,000 ,*/**
Agriculture in GDP	**492,597 ,**/**	**784,010 ,**/**	**1,178,543 ,**/**	**993,240 ,**/**	**1,538,749 ,**/**	**2,407,552 ,**/**
(I) Crops	**267,132** (54%)	**459,371** (59%)	**723,741** (61%)	**605,321** (61%)	**926,917** (60%)	**1,482,997** (62%)
(II) Livestock & Fish	**112,121** (23%)	**190,082** (24%)	**289,136** (25%)	**333,007** (34%)	**544,817** (35%)	**841,870** (35%)
(III) Forestry	**113,345** (23%)	**134,557** (17%)	**165,666** (14%)	**54,911** (6%)	**67,015** (4%)	**82,685** (3%)

Note: */ Macroeconomic Framework by the Study Team, **/ Target estimated by the Agricultural Sector Study Team

Main Crops/Items in Agriculture Sector			Khammouan												Savannakhet											
	-1999-	-1999-	-2000-				-2010-				-2020-				-2000-				-2010-				-2020-			
(I) Crops	Farmgate Price, 1/ (Kip/kg)	Unit Price ,2/ (Kip/kg)	Cropped Area (ha), 3/	Yield ,3/ (ton/ha)	Produc-tion (ton)	Value (GDP) (mill. Kip)	Cropped Area (ha)	Yield ,4/ (ton/ha)	Produc-tion (ton)	Value (GDP) (mill. Kip)	Cropped Area (ha)	Yield ,4/ (ton/ha)	Produc-tion (ton)	Value (GDP) (mill. Kip)	Cropped Area (ha), 3/	Yield ,3/ (ton/ha)	Produc-tion (ton)	Value (GDP) (mill. Kip)	Cropped Area (ha)	Yield ,4/ (ton/ha)	Produc-tion (ton)	Value (GDP) (mill. Kip)	Cropped Area (ha)	Yield ,4/ (ton/ha)	Produc-tion (ton)	Value (GDP) (mill. Kip)
1. Rice																										
- Lowland rice	808	679	49,000	3.3	161,700	109,749	54,100 ,7/	3.6	194,760	132,188	66,000 ,7/	4.0	264,000	179,182	106,000	3.3	349,800	237,416	117,100 ,7/	3.6	421,560	286,121	142,700 ,7/	4.0	570,800	387,413
- Dry season rice	754	633	11,000	4.1	45,100	28,565	12,200 ,7/	4.6	56,120	35,544	14,800 ,7/	5.0	74,000	46,869	21,000	4.3	90,300	57,192	23,200 ,7/	4.6	106,720	67,592	28,300 ,7/	5.0	141,500	89,620
- Upland rice	816	685	500	1.6	800	548	100 ,7/	1.6	160	110	0 ,7/	1.6	0	0	1,000	1.6	1,600	1,097	500 ,7/	1.6	800	548	0 ,7/	1.6	0	0
2. Maize	559	470	700	2.5	1,750	822	1,816 ,8/	2.8	5,084	2,387	4,709 ,8/	3.0	14,128	6,634	3,100	2.5	7,750	3,639	8,041 ,8/	2.8	22,514	10,572	20,855 ,8/	3.0	62,566	29,378
3. Starchy Root crops	600 ,4/	504	250	6.0	1,500	756	648 ,8/	6.5	4,215	2,124	1,682 ,8/	7.0	11,773	5,934	1,200	6.0	7,200	3,629	3,112 ,8/	6.5	20,231	10,197	8,073 ,8/	7.0	56,511	28,482
4. Mungbean	6,244	5,245	5	0.8	4	21	8 ,9/	0.9	7	38	13 ,9/	1.0	13	70	35	0.8	28	147	57 ,9/	0.9	51	269	93 ,9/	1.0	93	487
5. Soybean	3,661	3,075	50	0.8	40	123	130 ,8/	0.9	117	359	336 ,8/	1.0	336	1,034	0	0.8	0	0	50 ,8/	0.9	45	138	130 ,8/	1.0	130	399
6. Peanut	3,298	2,770	35	1.0	35	97	91 ,8/	1.2	109	302	235 ,8/	1.5	353	978	1,070	1.0	1,070	2,964	2,775 ,8/	1.2	3,330	9,226	7,198 ,8/	1.5	10,798	29,913
7. Tobacco	8,000 ,4/	6,720	850	5.0	4,250	28,560	1,142 ,10/	5.5	6,283	42,220	1,535 ,10/	6.0	9,211	61,899	950	5.0	4,750	31,920	1,277 ,10/	5.5	7,022	47,188	1,716 ,10/	6.0	10,295	69,181
8. Cotton	7,000 ,4/	5,880	50	1.0	50	294	130 ,8/	1.2	156	915	336 ,8/	1.5	505	2,967	900	1.0	900	5,292	1,466 ,9/	1.2	1,759	10,344	2,388 ,9/	1.5	3,582	21,062
9. Sugar cane	700 ,4/	588	150	25.0	3,750	2,205	1,244 ,11/	28.0	34,841	20,487	3,027 ,11/	30.0	90,807	53,394	60	25.0	1,500	882	2,098 ,11/	28.0	58,737	34,537	5,417 ,11/	30.0	162,510	95,556
10. Coffee	3,625	3,045	15	0.7	11	32	2,024 ,11/	0.7	1,417	5,178	5,298 ,11/	0.8	4,238	15,486	15	0.5	8	23	2,024 ,11/	0.6	1,215	3,699	5,298 ,11/	0.7	3,708	11,292
11. Vegetable	2,000 ,4/	1,680	1,900 ,6/	5.0	9,500	15,960	2,100 ,6/	5.5	11,550	23,285	2,500 ,6/	6.0	15,000	30,240	4,300 ,6/	5.0	21,500	36,120	5,100 ,6/	5.5	28,050	47,124	6,200 ,6/	6.0	37,200	62,496
12. Fruits	2,500 ,4/	2,100	1,400 ,6/	10.0	14,000	29,400	4,100 ,12/	13.0	53,300	134,316	6,700 ,12/	15.0	100,500	253,260	3,000 ,6/	10.0	30,000	63,000	10,200 ,12/	13.0	132,600	278,460	16,600 ,12/	15.0	249,000	522,900
13. Others, 5/						50,000				59,918				65,795				162,000				120,902				134,818
Sub-total of (I)						**267,132**				**459,371**				**723,741**				**605,321**				**926,917**				**1,482,997**
(II) Livestock & Fishery	Farmgate Price, 1/ (Kip/kg)	Unit Price ,2/ (Kip/kg)	Popula-tion ('000 heads)		Produc--tion (tons)	Value (GDP) (mill. Kip)	Popula-tion ('000 heads)		Produc--tion (tons)	Value (GDP) (mill. Kip)	Popula-tion ('000 heads)		Produc--tion (tons)	Value (GDP) (mill. Kip)	Popula-tion ('000 heads)		Produc--tion (tons)	Value (GDP) (mill. Kip)	Popula-tion ('000 heads)		Produc--tion (tons)	Value (GDP) (mill. Kip)	Popula-tion ('000 heads)		Produc--tion (tons)	Value (GDP) (mill. Kip)
1. Buffalo	7,206	6,053	81		3,240	19,612	94 ,14/		3,760	22,759	106 ,14/		4,240	25,665	188		7,520	45,519	206 ,14/		8,240	49,877	250 ,14/		10,000	60,530
2. Cattle	7,018	5,895	50		2,050	12,085	202 ,15/		8,293	48,891	329 ,9/		13,509	79,638	214		8,774	51,724	793 ,15/		32,527	191,752	1,292 ,9/		52,983	312,343
3. Pig	6,570	5,519	90		4,590	25,331	119 ,16/		6,069	33,494	157 ,16/		8,007	44,189	224		11,424	63,047	295 ,16/		15,045	83,030	390 ,16/		19,890	109,769
4. Goat & Sheep	6,500 ,4/	5,460	2		24	131	3		36	197	4		48	262	20		240	1,310	27		324	1,769	36		432	2,359
5. Poultry	7,000	5,880	471		1,931	11,355	706 ,17/		2,895	17,020	1,412 ,17/		5,789	34,040	1,118		4,584	26,953	1,706 ,17/		6,995	41,128	3,529 ,17/		14,469	85,077
6. Fish	7,000 ,4/	5,880			3,100	18,228		,18/	6,300	37,044		,18/	12,100	71,148			7,600	44,688		,18/	15,600	91,728		,18/	29,900	175,812
7. Chicken eggs	9,710	8,156			457	3,727			614	5,009			825	6,732			1,123	9,160			1,509	12,310			2,028	16,543
8. Duck eggs	12,505	10,504			62	651			83	875			112	1,176			153	1,607			206	2,160			276	2,903
9. Others, 13/						21,000				24,793				26,295				89,000				71,063				76,534
Sub-total of (II)						**112,121**				**190,082**				**289,136**				**333,007**				**544,817**				**841,870**
(III) Forestry, 19/																										
1. Saw logs						42,889				42,889				42,889				12,807				12,807				12,807
2. Sawn wood						61,585				80,457				108,932				19,866				25,826				34,766
3. Home consumption						9,071				11,411				14,045				22,238				28,382				35,112
Sub-total of (III)						**113,345**				**134,557**				**165,666**				**54,911**				**67,015**				**82,685**
Grand Total						**492,597**				**784,010**				**1,178,543**				**993,240**				**1,538,749**				**2,407,552**

Source: Estimated by the SKR Study Team.

Note:
1/ Yearly statistic 1999, Ministry Agriculture and Forestry.
2/ Value added price = Estimated 16% of production costs were excluded. (estimated by the Study team)
3/ Basic Statistics of Lao PDR 1975-2000.
4/ Estimated by the Study team based on the field survey.
5/ Bamboo shoots, mushrooms, cardamone, tea, sesame, and other various kinds of miscellaneous crops, the amount of which was estimated to be 15% of total value in 2010, 10% in 2020.
6/ Requirement for food balance.
7/ Table of Projected Rice Banalnce Sheet estimated by the Study team.
8/ 10% of annual increase.
9/ 5% of annual increase.
10/ 3% of annual increase.
11/ 5% of annual increase plus additional increase by commercial basis.
12/ Requirement for food balance plus additional increase by commercial basis.
13/ Milk, hunted wild animals, and other various kinds of misscellaneous small animals, the amount of which was estimated to be 15% of total value in 2010, 10% in 2020.
14/ 1.0~2% of annual increase for local consumption.
15/ 14% ~15% of annual increase for local consumption plus export.
16/ 2%~3% of annual increase for local consumption.
17/ 4%~8% of annual increase for local consumption plus export.
18/ 6%~7% of annual increase for local consumption.
19/ Microeconomic Framework by the Study Team

IV-4 ACTION PROGRAM

IV-4.1 Settings for Programming

1) Profitability of Rice Cultivation

In the lowland region along the Mekong, the average holding size of paddy field is about 0.9 hectares, and about 20% can be irrigated for the dry season cultivation. Thus, farmers in this region totally have surplus rice, even though the holding size and rice sufficiency level of each household vary in the region. At present, due to inbalance of rice supply within the provinces, rice is one of the cash crops. However, this situation may not continue long in the future if rice transportation and delivery systems are improved and surplus rice is increased. In this context, as well as in view of crop profitability, “Crop Diversification” should be further promoted. As discussed previously (see Section 2.1.3), the household survey result shows that farmer’s income from livestock is 1.0 to 3.0 times the income from rice. The following comparison also shows that peanut is more profitable than rice.

Table IV4-1 Crop Profitability (Rice & Peanut)

Crop	Wet season Rainfed Rice	Dry season Irrigated Rice	Wet season Rainfed Peanut	Dry season Irrigated Peanut
(1) Present				
Net Income (Kip/ha)	1,522,000	1,682,000	1,530,000	1,800,000
Net Income ($/ha)	(184)	(204)	(185)	(218)
(2) Potential				
Net Income (Kip/ha)	2,282,000	2,442,000	2,670,000	2,940,000
Net Income ($/ha)	(276)	(296)	(324)	(356)

Source: Estimated by the Study Team.
Note: US$ 1.0 = 8,240 Kip as of 01 November 2000.

In the eastern region, the average holding size of paddy field is about 0.4 ha and no irrigated paddy land in the dry season due to limited plain areas. Farmers in this region generally face deficit in rice, even though the holding size and rice sufficiency level of each household vary in the region. Therefore, farmers are more forced to depend on subsistence farming and, the poverty gap between in the lowland Mekong region and in the eastern region is becoming bigger and bigger. The government is making efforts to solve this issue, though immediate effective measures are not easily found due to limited staff and budget, as well as poor accessibility to the remote areas.

2) Farm Income

The results of the socio-economic household survey by the Study Team in May 2000 indicate that the annual household incomes vary from $54 to $362, with an

average of $192. This income level is low, even though some allowance is considered.

These days, TV sets have become popular in each household, particularly in the urban areas, and people are enjoying various kinds of information about the present economic momentum in the world. However, the real living conditions in the rural area differ much from those seen on TV. Many farmers are still dependent on subsistence farming. Thus, no extra money is available for farmers to try any new agricultural activities, even though the required amount is small. Insufficient technical support and information from the government is another reason for the little progress of “diversification” or “market economy”.

On the other hand, the good news is that a farmer’s group in Savannakhet was voluntarily established in March 1999 to solve the issues among producers, to cooperate with other organizations, and to strengthen their power. After their long efforts, the association has successfully obtained an APB loan in the amount of 600 million Kip in January 2000, which is now used for the initial investments in livestock/farming activities.

In the eastern area, the poverty situation is more serious than the lowland region, due mainly to (i) some limitations to extend paddy fields; (ii) poor accessibility due to lack of road network; and (iii) lack of support and information by the government.

3) Integrated Farming Enhancement Program

It is clear from the above settings that increase in income at the household level is definitely needed to encourage the farmer’s motivation for their challenges. The challenges are directed towards diversified and integrated farming, which will provide the younger generations with a dream of a promising farming life in the future, and will finally stimulate the regional economy. Thus, the proposed program is named, and its objective and target are simply set as follows:

- Program : “Integrated Farming Enhancement Program”
- Objective : Improving and stabilizing the people’s living standard, as well as stimulating the regional economy.
- Target : To attain double income at the household level by 2010.

IV-4.2 Program to Double Household Income

1) General

There are a lot of agricultural and rural development programs prepared by the government and external organizations. However, a bottleneck always exists in the lack of fund to implement the program. This situation is the same at both the government and household levels. Thus, the proposed action program should be challenging so as to improve the present situation with a minimal fund. In other words, the key point is to effectively utilize available resources in a sustainable manner. In this context, appropriate knowledge, technique and idea to the real regional situations are needed to realize the program.

2) Diversification

"Diversification" does not mean only "crop diversification", but it includes (i) integrated farming management, (ii) cooperation with local industry or handicraft business such as sericulture and agro-processing of farm/forestry products, and (iii) other ideas how to add values to the resources which have not been used effectively before. The essential points for diversification are discussed below.

(1) Intensification

Gradual change or modification of the current extensive farming to the semi-intensive farming should be encouraged to improve the productivity and sustainability of crop production. Semi-intensive farming must be appropriate to the practical situation of the region, and there still remain a lot of things to do for improvement of crop production without large investments. Some of them are cited below.

(i) Improvement of water management in the irrigated paddy field:
- more accurate land leveling during land preparation in every season for more effective control of irrigation water; and
- strengthening of Water User's Group (WUG) on O&M, including collection of Irrigation Service Fee (ISF);

(ii) Improvement of farm management of paddy field under rainfed conditions
- transplantation of rice seedlings in line with more effective field management of fertilizing, weeding and pest & disease control; and
- effective cleaning/weeding of the surrounding areas to protect the field from rodent attack;

(iii) Introduction of enclosure system for cattle grazing:
- Change of the existing extensive system to the semi-intensive system by grazing in the enclosure pasture for more effective disease control and collecting cattle manure; and

- Improvement of pasture (grassland) for both grazing cattle and cut & carry feeding.

(2) Diversified, Integrated & Re-cycled Farming

As discussed previously, the profitability of rice cultivation is normally lower than other cash crops. The profitability of crops mainly depends on the yield and market price. The crop yield under the rainfed condition depends on the climate, and the damage of insect and disease may also affects the yield. The income of crop is normally seasonal, i.e., income from the wet season crops in December to January, and income from the dry season crops in April to May. The shipments of products are generally concentrated in such periods. The farmgate prices in the harvest season are lower than those in the off-season.

Livestock farming is rather stable and less affected by unseasonal weather and seasonal prices. However, too much intensive raising of animals will bring about risks of animal diseases. In this connection, an integrated farming system combined with crop cultivation and livestock raising is recommended. Their balanced combination will improve the unstable situation of the present farming system and to avoid risks. Further, the proposed integrated farming system also includes the following ideas of re-cycling to minimize the production costs and maximize the use of unutilized resources.

" Re-cycled Farming"

- "Cattle manure": (i) making compost with rice straw (saving cost for chemical fertilizer) and (ii) returning to the fields to improve the soil structures and maintain the humus of the soil for sustainable use of farm land;
- "Chicken manure": the products are used to feed fish, to fertilize aqua plants in the fishponds as well as farm lands;
- "Rice straw and maize stalk": (i) possible to feed cattle in the critical period of the dry season, (ii) making compost with cattle manures (saving cost for chemical fertilizer), and (iii) mulching to keep soil moisture in the dry season and to protect the soil from erosion;
- "Rotation of cassava, maize and peanut": From the view of crop profitability, peanut is the most profitable among the three crops. However, mono-cropping in upland faming may bring unbalanced composition of the soil nutrition and decline the soil fertility and may lead to the occurrence of pest and diseases of crops. Thus, the rotation of the field crops with legume is proposed in upland field crop farming, for example a combination with maize, cassava and peanut. Legume crop of peanut is useful because of its capability to fix nitrogen from the air into the soil through their root nodules. Cassava and maize are used for feeding poultry and pig. The leaves of cassava are also utilized for Eri-silk worm feeding.

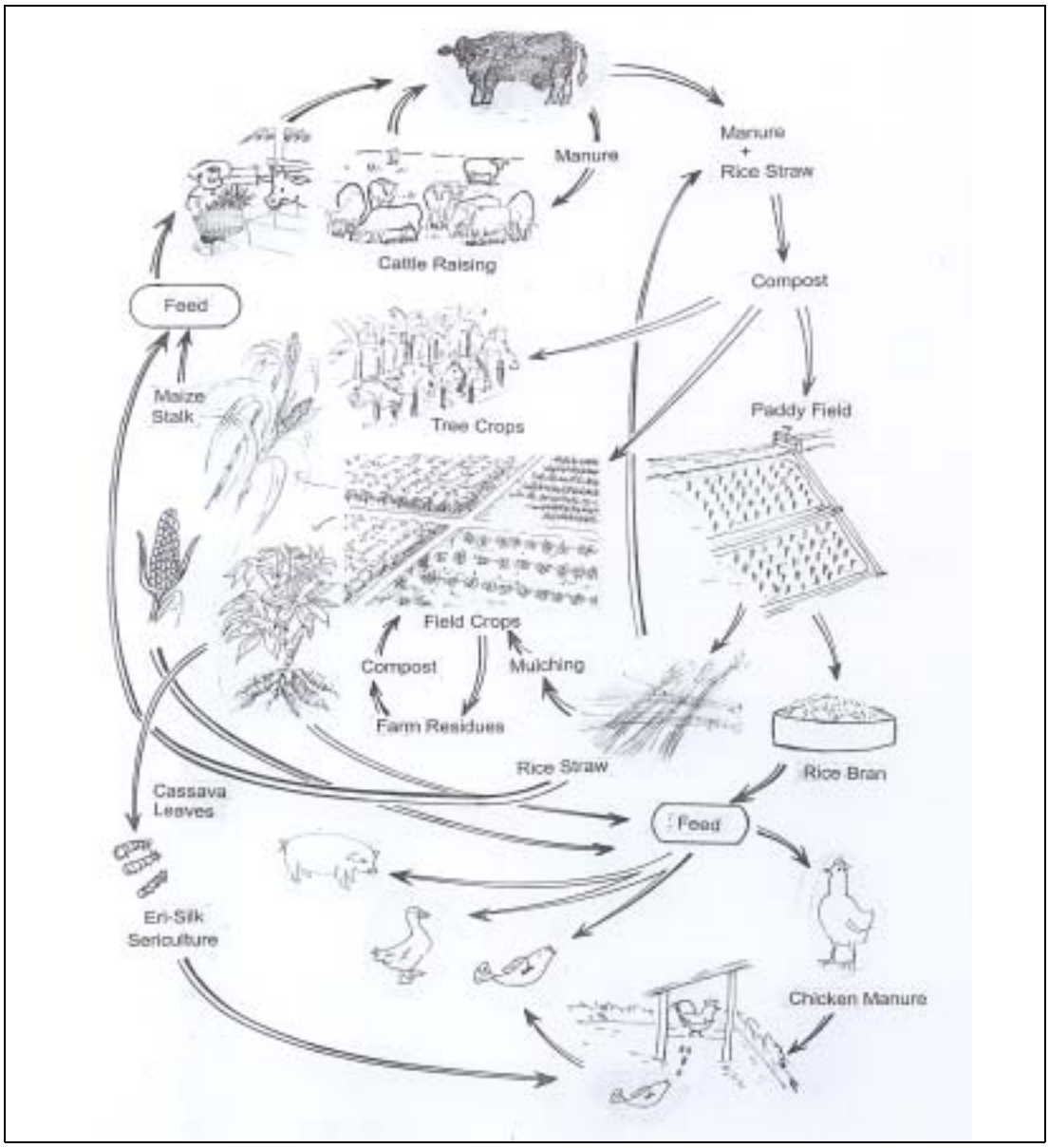


Figure IV4-1 Re-cycled Farming with Farm By-Products and Residues

(3) Organic farming

Minimal Use of Chemical Fertilizer

All chemical fertilizers are imported in Lao PDR, and their importation and distribution are handled by both the government and the private sector. The single largest supplier of fertilizer is APB under the close cooperation with PAFO/DAFO. Since, chemical fertilizers are expensive, costing about 520,000 Kip/ha (14%~18% of the gross income) in case of rice cultivation, many farmers face difficulty to prepare such amount of cash by themselves before the planting

season begins. The availability of credits for purchasing fertilizers is also limited. Further, farmers often face problems of untimely supply.

In addition, the government has been promoting the use of bio-fertilizer to minimize the use of chemical fertilizers. Thus, it is considered that the crop budget with only chemical fertilizers inputs may not be realistic. Consequently, in the proposed crop budgets, chemical fertilizer inputs are only recommended for the irrigated dry season cultivation. As for the wet season cultivation, such as rainfed paddy, field crops and fruit/tree crops, no (or minimal) chemical fertilizer but input of about 1,000 kg/ha of organic manure is recommended aiming at more sustainable and practical farming system.

The demand for organic food products is rising in this region, and the Food and Agriculture Organization of the United Nations (FAO) is emphasizing the significant role of organic agriculture in securing future food production and improving the income situation of farmers in developing countries. The current development of generically modified crops will further increase the awareness of consumers and promote the demand for organically produced food and other products. Producer groups in this market segment need to protect their interests and worldwide regulations have been implemented with strict control and inspection systems. These control and inspection systems must be recognized and supported by the government, and the process must be transparent to the consumer. Without strict application of regulations, market development for organic food and other organic products is not possible even at the local or national level, and definitely not for export markets.

Consequently, the fertilizer application proposed in this study is a minimal chemical fertilizer input in combination with maximum organic manures available in each farm.

Requirement for Organic Manures

A lot of long-term comparisons and researches have been carried out in various countries to verify the benefits of soil organic matter for chemical-free agriculture. They pointed out the following:

- Organic matter supplies most of the nitrogen and sulfur and half of the phosphorus taken up by unfertilized crops. The slow-release pattern of nitrogen and sulfur mineralizaion offers a definite advantage over soluble fertilizer;
- Organic matter supplies most of the cation exchange capacity (CEC) of acid, highly weathered soils. Rapid decreases in organic matter result in sharp reduction in CEC;

- By forming complex with organic matter, amorphous oxides do not crystallize. Phosphorus fixation by these oxides is decreased by organic radicals blocking the fixation charges;
- Organic matter contributes to soil aggregation and thus improves physical properties and reduces susceptibility to erosion in sandy soils;
- Organic matter modifies water retention properties, particularly sandy soil;
- Organic matter may form complexes with micronutrients which prevent their leaching.

In spite of all these valid reasons, soil organic matter is of minor concern in management schemes where fertilizers are effectively and economically used. In fact, adequate fertilizer practices increase the soil organic matter contents because of increased root decomposition. In short, the choice between animal manures and inorganic fertilizers is a matter of nutrient content, economics, transportation, and accessibility. Again, the long-term organic manure applications improve physical soil properties and mulching conserves organic matter by decreasing soil temperatures.

With the above in view, the use of organic manure should be more strongly promoted for future farming in Lao PDR in order to achieve a sustainable farming system. In this proposed program, a gradual introduction of cattle grazing in enclosed pasture lands is proposed as one of the key points for promotion of diversified, integrated and organic farming. It is reported that the annual volume of fresh matter produced by a well-fed, adult dairy cow is 10 tons (30% of dry matter). For local cattle kept for social purposes or as draught animals, this quantity is reduced to 2~3 tons, usually with somewhat higher dry matter contents. Compost consists of partially decomposed materials of plant, animal or human origin, or their combination. Crop residues are important suppliers of organic matter to the soil. The quantities and composition vary considerably. Growing of local maize varieties, for instance, may result in 2~3 tons of straw/ha. Green manure crops, mostly Leguminosae, produce 20~50 tons of fresh matter, depending on the type of crops, the growing season and the inputs. Another important factor is the fixation of nitrogen from the air by bacteria. The composition of several organic fertilizer is given below.

Table IV4-2 Composition of Natural Organic Manures

(Unit: %)

Material	Total Nitrogen (N)	Total Phosphorus Pentoxide (P_2O_2)	Total Potash (K_2O)	Total Lime (CaO)
1) Cattle manures (dried)	2.0	1.5	2.0	4.0
2) Poultry manures (dried)	5.0	3.0	1.5	4.0
3) Animal by-products (bone meal, raw)	4.0	22.5	*/	31.5
4) Ash, wood	*/	2.0	5.0	32.5

Note: The organic fertilizer material usually vary widely in composition. The figures given are average or typical analyses.
*/ None, or less than 0.5%.
Source: Agricultural Compendium for Rural Development in the Tropics and Subtropics, Elsevier, 1981

To maintain the humus level of the soil, 5~10 tons/ha of organic manure (30% dry matter) are required. With the field crops, particularly cash crops, these quantities are supplied once in every 4~6 years, provided that farmyard manure is available.

3) Household Land Use Plan

(1) Household Land Use Plan by Region

In order to set the land use and livestock holding plan at the household level, the statistics figures have been examined and the "Household Land Use & Livestock Holding Plan" is proposed as summarized below.

Table IV4-3 Proposed Land Use and Livestock Holding Plan

(ha/HH)

Region	Lowland Region			Central Region			Eastern Region		
Year	2000	2010	2020	2000	2010	2020	2000	2010	2020
A. Land Use (ha)									
1) Rice (wet season)	0.9	0.9	0.9	0.7	0.7	0.7	0.4	0.4	0.5
2) Rice (dry, irrigated), 1/	0.2	0.3	0.5	0.0	0.1	0.2	0.0	0.0	0.0
3) Field crops, 2/	0.1	0.2	0.3	0.1	0.2	0.35	0.1	0.3	0.4
4) Pasture (cattle grazing)	0.0	1.0	1.5	0.0	1.0	1.5	0.0	1.0	1.5
5) Fruit/ tree crops	0.0	0.1	0.2	0.0	0.3	0.6	0.0	0.5	1.0
6) Fish pond, 3/	0.0	0.3	0.4	0.0	0.2	0.3	0.0	0.06	0.1
7) Forestry, 4/	3.1	1.2	0.8	4.3	3.1	2.8	3.6	3.2	2.8
(sub-total of A), 5/	(1.1)	(2.4)	(3.3)	(0.7)	(2.3)	(3.3)	(0.5)	(2.2)	(3.4)
B. Livestock (heads)									
1) Cattle + Buffalo	3.5	5.7	7.4	4.6	7.5	9.2	3.8	7.5	9.1
2) Pig	1.4	2.3	3.7	1.3	2.1	4.6	2.0	3.3	5.3
3) Poultry	12.0	19.5	31.8	9.0	14.7	23.9	9.5	15.5	25.2

Note: 1/ includes some cash crops in dry season irrigated paddy field.
2/ mixed with peanut, maize, cassava, soybean, etc.
3/ includes communal ponds.
4/ Forest/natural grass land, which are normally for communal use by the villagers.
5/ excludes fish ponds and forest/natural grass land being used as communal land.
Source: Estimated by the Study Team

The main points of the proposed plan are:

- Rice cultivation area in the wet season will not be increased drastically;
- Irrigated rice cultivation area in the dry season will be gradually increased particularly in lowland region;
- Field crop cultivation is promoted with integrated proper upland farming system, for sustainable use of farmland (estimated to be extended by about 6~7% of annual increase);
- Improved pasture land for cattle raising is to be promoted with a semi-intensive enclosure system to use limited land resource effectively and in a sustainable manner (estimated to be extended by about 8% of annual increase);
- Fruit tree /tree crops are to be promoted, since there must be some potential for local marketing as well as for export in the future. Particularly in the mountainous area, fruit tree/tree crops must be alternatives for upland rice which is grown by slash and burn cultivation. (estimated to be extended by about 11% of annual increase);
- Cattle raising is the most promising farming in the region. However, the increase of the numbers of cattle by household level may be about 4% annually and a drastic increase will be made by commercial level.
- Pig and Poultry raising will be increased by about 5% annually.
- Fish culture is promising due to big local demand. The plan for fish culture development was prepared by household level in this Table, some of which can be developed by community level depending on the physical condition of each village. (estimated to be extended by about 5% of annual increase);

(2) Carrying Capacity for Cattle Raising

The basic strategy of the proposed cattle increase plan at the village level is:

- Effective land use at the village level;
- Provision of a uniform and year-round supply of forage for a maximum number of stock;
- Maintenance of the grassland in its most productive condition by encouraging its best species and by promoting as full ground cover as possible for erosion control;
- Adjustment of stocking rate to carrying capacity with proper pasture management such as controlled use of fire practices and controlled- or rotational grazing practice;
- Periodic resting of the grassland from grazing during the critical growth periods;
- Bush control;
- Special provision for dry-season feeding with effective use of crop residues such as rice straw, maize leaves and stalks, etc,; and

- Preventive disease control.

Under such considerations, the carrying capacity is examined if the increase in the number of cattle is possible or not. As mentioned above, rice straw, maize leaves and stalks, and the leaves of some kind of trees in the forest can be fed for cattle raising particularly in the critical dry season. The carrying capacity for each land use category is estimated on the basis of the feed requirement (dry matter) of 8 kg/day for 200 kg weigh cattle as summarized below.

- Rice field = 0.4 heads/ha (with 1,200 kg of dry material of rice straw);
- Upland field crops (maize) = 0.3 heads/ha (with 880 kg of dry material of maize stalk, leaves, other crop residue);
- Natural grass land/ Forest = 1.0 head/ha (with 3.0 tons of dry matter); and
- Improved pasture land = 4.0 heads/ha (with 12 tons of dry matter).

With the above assumptions, the carrying capacity for cattle raising per household has been examined as shown below.

Table IV4-4 Carrying Capacity for Cattle Raising

Region	Lowland Region			Central Region			Eastern Region		
Year	2000	2010	2020	2000	2010	2020	2000	2010	2020
A. Land Use (ha)									
Rice (wet season): (ha)	0.9	0.9	0.9	0.7	0.7	0.7	0.4	0.4	0.5
-Carrying capacity: (heads)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.3)	(0.2)	(0.2)	(0.2)
Rice(dry, irrigated): (ha)	0.2	0.3	0.5	0.0	0.1	0.2	0.0	0.0	0.0
-Carrying capacity: (heads)	(0.1)	(0.1)	(0.2)	(0.0)	(0.0)	(0.1)	(0.0)	(0.0)	(0.0)
Field crops (ha): (ha)	0.1	0.2	0.3	0.1	0.2	0.35	0.1	0.3	0.4
-Carrying capacity: (heads)	(0.0)	(0.1)	(0.1)	(0.0)	(0.1)	(0.1)	(0.0)	(0.1)	(0.1)
Pasture: (ha)	0.0	1.0	1.5	0.0	1.0	1.5	0.0	1.0	1.5
-Carrying capacity: (heads)	(0.0)	(4.0)	(6.0)	(0.0)	(4.0)	(6.0)	(0.0)	(4.0)	(6.0)
Forest: (ha)	3.1	1.2	0.8	4.3	3.1	2.8	3.6	3.2	2.8
-Carrying capacity: (heads)	(3.1)	(1.2)	(0.8)	(4.3)	(3.1)	(2.8)	(3.6)	(3.2)	(2.8)
(sub-total of A), */	(3.5)	(5.7)	(7.4)	(4.6)	(7.5)	(9.2)	(3.8)	(7.5)	(9.1)
B. Livestock (heads)									
Cattle + Buffalo, 3/	3.5	5.7	7.4	4.6	7.5	9.2	3.8	7.5	9.1

Note: 1/ Forest/natural grass land, which are normally for communal use by the villagers.
2/ Total Carrying Capacity (heads/HH).
3/ Targeted Cattle & Buffalo's holding plan per HH.
Source: Estimated by the Study Team

The above table indicates that increase in cattle raising per household will be possible from 3.5 heads/HH to 7.4 heads/HH in the lowland region, from 4.6 heads/HH to 9.2 heads/HH in the central region and from 3.8 heads/HH to 9.1 heads/HH in the eastern region. The table also suggests that 1.5 ha of improved pasture land is required to attain the target.

(3) Labor Requirement

Labor requirement and its availability as family labor have been examined on the basis that the available labor unit per family is 2.4 and annual available labor per family is 576 man-days with 20 days-working days per month. Based on this setting, the labor requirement for the proposed household land use and agricultural activities have been examined, with the result that the labor requirement is increased from 226~275 man-days in 2000 to 377~425 man-days in 2020. The figures of 226~275 man-days in 2000 appear to be too small, which may suggest that farmers use the other times for various economic activities, such as collecting forest products, hunting wild animals, and so forth to compensate shortage in agricultural products. The figures of 377~425 in 2020 show to be reasonable and within the availability of family labor, even though intensive farming activities are increased. These figures may suggest that, if promising agricultural activities (job opportunities) are found, farmers can shift some of their daily economic activities to specific agricultural activities. Detailed examination of the labor requirement is presented below.

Table IV4-5 Labor Requirement per HH

Region		Lowland Region			Central Region			Eastern Region		
Year		2000	2010	2020	2000	2010	2020	2000	2010	2020
A. Land Use (ha)	m.d.1/									
1) Rice (wet season): (ha)	120	0.9	0.9	0.9	0.7	0.7	0.7	0.4	0.4	0.5
-Labor require.: (man-day)		(102)	(102)	(102)	(78)	(78)	(78)	(48)	(48)	(54)
2) Rice(dry, irrigated): (ha)	120	0.2	0.3	0.5	0.0	0.1	0.2	0.0	0.0	0.0
-Labor require.: (man-day)		(18)	(30)	(54)	(0)	(12)	(24)	(0)	(0)	(0)
3) Field crops (ha): (ha)	120	0.1	0.2	0.3	0.1	0.2	0.35	0.1	0.3	0.4
-Labor require.: (man-day)		(6)	(24)	(36)	(6)	(24)	(42)	(12)	(36)	(48)
4) Pasture: (ha)	70	0.0	1.0	1.5	0.0	1.0	1.5	0.0	1.0	1.5
-Labor require.: (man-day)		(0)	(70)	(105)	(0)	(70)	(105)	(0)	(70)	(105)
5) Fruit/tree crops: (ha)	30	0.0	0.1	0.2	0.0	0.3	0.6	0.0	0.5	1.0
-Labor require.: (man-day)		(0)	(3)	(5)	(0)	(9)	(18)	(0)	(15)	(30)
6) Fishpond: (ha)	20	0.0	0.3	0.4	0.0	0.2	0.2	0.0	0.06	0.1
-Labor require.: (man-day)		(0)	(20)	(20)	(0)	(20)	(20)	(0)	(1)	(2)
7) Forest: (ha)	35	3.1	1.2	0.8	4.3	3.1	2.8	3.6	3.2	2.8
-Labor require.: (man-day)		(109)	(42)	(28)	(151)	(109)	(98)	(126)	(112)	(98)
B. Livestock (heads)	m.d.									
1) Cattle + Buffalo:(heads)	-	3.5	5.7	7.4	4.6	7.5	9.2	3.8	7.5	9.1
-Labor require.: (man-day)	,2/	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
2) Pig: (heads)	20	1.4	2.3	3.7	1.3	2.1	4.6	2.0	3.3	5.3
-Labor require.: (man-day)	,3/	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)
3) Poultry: (heads)	20	12.0	19.5	31.8	9.0	14.7	23.9	9.5	15.5	25.2
-Labor require.: (man-day)	,3/	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)
(Total Labor Requirement)		275	331	390	275	362	425	226	322	377

Note: 1/ Labor requirement per ha.
2/ Applied for the management in the pasture and forest.
3/ Average requirement of 20 man-days was applied for both pig and poultry raising.
Source: Estimated by the Study Team

4) Crop Budget

In order to examine the farm level income generation in 2005, 2010 and 2020, the crop budgets for rice, main field crops and fruit tree, as well as the farm budgets for animal raising have been prepared for respective crops. The net incomes are summarized below.

Table IV4-6 Annual Net Incomes by Crop/Livestock

Crop/Livestock	Annual net income	Remarks
1) Rice	2,282,000 Kip/ha	Wet season rainfed
2) Rice	2,442,000 Kip/ha	Dry season irrigated
3) Peanut	2,670,000 Kip/ha	Wet season rainfed
4) Peanut	2,940,000 Kip/ha	Dry season irrigated
5) Fruits tree / Tree crop	2,485,000 Kip/ha	Rambutan, Mango, Coffee, etc.
6) Cattle	255,000 Kip/head	Gross income/head/year
7) Pig	278,000 Kip/head	9 months to be adult
8) Chicken	20,000 Kip/head	4.5 months to be adult
9) Fishculture	2,625,000 Kip/ha	

Note: */ All the projected products are estimated to be at the full developed stage.
Source: Estimated by the Study Team.

(1) Rice

Annual net income of rice cultivation is estimated to be 2.3 million Kip/ha for the wet season rainfed condition and 2.4 million Kip/ha for the dry season under irrigated condition. There seems to be little difference of net incomes between the wet season rainfed rice and the dry season irrigated rice. It is because that:

- Estimated yields are very realistic, 3.5 ton/ha for the wet season rice and 4.5 ton/ha for the dry season irrigated rice;
- Chemical fertilizer inputs are proposed only for the dry season rice cultivation with a minimal input rate; and
- Costs for the chemical fertilizers and irrigation service fee are required for the dry season cultivation, which are about double compared with that of the wet season rainfed cultivation.

The projected crop budgets of rice and peanut in the paddy field are presented in the following.

Table IV4-7 Crop Budget for Paddy Field: Rice and Cash Crops

Description	Year	2000			2020		
	Crop	W.Rice 1/	D.Rice 2/	D.Pea.,3/	W.Rice 1/	D.Rice 2/	D.Pea.,3/
(I) Output	(unit)						
- Yield, 4/	ton/ha	2.5	3.5	0.8	3.5	4.5	1.2
- Production	tons	2.5	3.5	0.8	3.5	4.5	1.2
- Farmgate price	T.Kip/kg	0.8	0.8	3.0	0.8	0.8	3.0
- Gross income	T.Kip/ha	2,000	2,800	2,400	2,800	3,600	3,600
(II) Input	(unit)						
a) Seed, 5/	T. Kip	90	90	180	90	90	180
b) Chemical fertilizer, 6/	T. Kip	0	520	260	0	520	260
c) Mech./Labor input, 7/	T. Kip	288	288	0	288	288	0
d) Agrochemicals, 8/	T. Kip	0	0	0	0	0	0
e) Organic manures, 9/	T. Kip	0	0	0	0	0	0
f) Irrigation Fee, 10/	T. Kip	0	80	40	0	80	40
g) Others (5%), 11/	T. Kip	100	140	120	140	180	180
Total Input Costs	T. Kip	478	1,118	600	518	1,158	660
(III) Net Income	T.Kip/ha	1,522	1,682	1,800	2,282	2,442	2,940

Note: 1/ Wet Season Rainfed Rice, 2/ Dry Season Irrigated Rice, 3/ Dry Season Irrigated Peanut
4/ Estimated with minimal inputs of chemical fertilizer and higher inputs of organic manures, such as farmyard manure, compost and animal droppings.
5/ The use of improved seed is estimated as 40% in the wet season and 90% in the dry season in 2000, and 100% in both the wet and dry season in 2020.
6/ Chemical fertilizer inputs are proposed for only the dry season rice cultivation with a minimal input rate.
7/ For land preparation, estimated based on rental basis, the cost of which was calculated in the form of paddy.
8/ Minimal inputs of agro-chemicals are recommended with the application of the IPM system by FAO.
9/ Organic manures of 5 tons/ha in every 5 years are at least required to maintain the humus level of the soil.
10/ ISF (Irrigation Service Fee): The costs of ISF were calculated in the form of paddy, 100 kg-paddy for dry season paddy and 50 kg-paddy for dry season cash crops.
11/ 5% of the gross income, for tools, fencing materials and transportation, etc.
Source: Estimated by the Study Team.

(2) Peanut

Annual net income of peanut cultivation is estimated to be 2.7 million Kip/ha for the wet season rainfed condition and 2.9 million Kip/ha for the dry season irrigated condition. Peanut growing seems to be a little more profitable than rice growing due to a higher farmgate price of peanut. Estimated yield of peanut seems to be conservative, 1.0 ton/ha for rainfed condition and 1.2 ton/ha for irrigated condition, due to limited experience by farmers. However, it will be gradually increased according to their experiences. For field crop cultivation in upland areas, maintenance of soil fertility and protection of soil erosion are promoted for sustainable upland farming. In this connection, application of at least 1,000 kg/ha inputs of organic manures is recommended. A rotated mixed cropping with maize, peanut and cassava is also effective to maintain the soil fertility. The projected crop budgets of field crops are presented in the following.

Table IV4-8 Crop Budget for Field Crop

Description	Year	2000			2020		
	Crop	Cass. 1/	Maize,2/	Peanut,3/	Cass. 1/	Maize,2/	Peanut,3/
(I) Output	(unit)						
- Yield, 4/	ton/ha	3.0	1.2	0.6	4.0	1.6	1.0
- Production	tons	3.0	1.2	0.6	4.0	1.6	1.0
- Farmgate price	T.Kip/kg	0.45	0.7	3.0	0.45	0.7	3.0
- Gross income	T.Kip/ha	1,350	840	1,800	1,800	1,120	3,000
(II) Input	(unit)						
a) Seed/seedlings	T. Kip	300	21	180	300	21	180
b) Chemical fertilizer, 5/	T. Kip	0	0	0	0	0	0
c) Mech./Labor input, 6/	T. Kip	0	0	0	0	0	0
d) Agrochemicals, 7/	T. Kip	0	0	0	0	0	0
e) Organic manures, 8/	T. Kip	0	0	0	0	0	0
f) Others (5%), 9/	T. Kip	68	42	90	90	56	150
Total Input Costs	T. Kip	368	63	270	390	77	330
(III) Net Income	T.Kip/ha	982	777	1,530	1,410	1,043	2,670

Note: 1/ Wet Season Rainfed Cassava, 2/ Wet Season Rainfed Maize, 3/ Wet Season Rainfed Peanut
4/ Estimated with minimal inputs of chemical fertilizer and higher inputs of organic manures, such as farmyard manure, compost and animal manures.
5/ Minimal inputs of chemical fertilizer are basically recommended.
6/ All activities are assumed to be done by manual labor.
7/ Minimal inputs of agro-chemicals are recommended with the application of the IPM system by FAO.
8/ Organic manures of 5 tons/ha in every 5 years are at least required to maintain the humus level of the soil.
9/ 5% of the gross income for tools, fencing materials and transportation, etc.

Source: Estimated by the Study Team.

(3) Fruit Tree and Tree Crop

Annual net incomes for fruit trees such as rambutan, orange and mango are estimated to be about 2.6 million Kip/ha and that for coffee about 2.1 million Kip/ha. Estimated yield of 3.0 tons/ha for fruit trees seems to be conservative under practical application of organic manures such as farmyard manure, animal manures and legume cover crops. Organic manures of 5 tons in every 5 years are required to maintain the humus level of the soil. Such fruit tree planting seems to be profitable, but it needs 3 to 4 years until their first production and 7 to 10 years for their full production. Thus, such counter measures as intercropping of annual crops between trees are proposed to compensate no harvest period in the initial stage. The projected crop budgets for fruit tree and coffee planting are presented in the following.

Table IV4-9 Projected Crop Budget for Fruit Tree and Tree Crop

		Rambutan	Orange	Mango	Coffee
(I) Output	(unit)				
1) Full production, 1/	Year	10	12	10	7
2) Productive period	Year	30	30	30	20
3) Yield, 2/	tons/ha	3.0	3.0	3.0	0.6
4) Farmgate price	T.Kip/kg	1.0	1.0	1.0	3.9
4) Gross income	T.Kip/ha	3,000	3,000	3,000	2,340
(II) Input	(unit)				
a) Seedlings, 3/	T. Kip	50	100	83	33
b) Chemical fertilizer, 4/	T. Kip	0	0	0	0
c) Mech./Labor input, 5/	T. Kip	0	0	0	0
d) Agrochemicals, 6/	T. Kip	0	0	0	0
e) Organic manures, 7/	T. Kip	0	0	0	0
f) Others (10%), 8/	T. Kip	300	300	300	234
Total Input Costs	T. Kip	350	400	383	267
(III) Net Income, 9/	T.Kip/ha	2,650	2,600	2,617	2,073

Note: 1/ The year reached to the full production after plantation.
2/ Estimated with minimal inputs of chemical fertilizer and higher inputs of organic manures, such as farmyard manure, compost and animal manures.
3/ Annual cost for seedlings for productive period.
4/ Minimal inputs of chemical fertilizer are basically recommended.
5/ All activities are assumed to be done by manual labor.
6/ Minimal inputs of agro-chemicals are recommended with the application of the IPM system by FAO.
7/ Organic manures of 5 tons/ha in every 5 years are at least required to maintain the humus level of the soil.
8/ 10% of the gross income for tools, fencing materials and transportation, etc.
9/ Estimated 20% of full income in 5th year and the full income form 10th year after planted.

Source: Estimated by the Study Team.

(4) Cattle Raising

Farmers have raised cattle and buffalo in an extensive manner until now, benefited from natural resources in the forest and by using such farm by-products as rice straw and maize stalk. Thus the actual costs for cattle and buffalo raising are currently small. However, in the long run, semi-intensive raising system with improved pasture should be applied to increase the number of cattle. Pasture is to be maintained applying organic manures. Grazing land for cattle will be a combination with natural forest and improved pasture, though it is expected that the area of improved pasture is extended step by step. The annual cost of pasture is estimated to be 0.3 million Kip/ha, under the carrying capacity of 4 heads per ha. On the other hand, the annual gross income for cattle raising is estimated to be 0.26 million Kip per head. A farm budget of cattle raising is presented in Table IV4-10.

Table IV4-10 Farm Budget for Cattle Raising

	Unit	Amount	Remarks
(I) Farm Budget for Cattle Raising			
1) Adult live weight	kg	200	
2) Period to be adult	year	2.5	
3) Mortality/Loss	%	15	
4) Annual selling	head	0.34	per raising population
5) Farmgate price	'000Kip	750	per head of 200 kg live cattle
6) Annual gross income	'000Kip	255	per raising population
7) Cost for Cattle raising			per raising population
- Farm residues	'000Kip	0	Rice straw, maize stalk, etc.
- Forest/Natural grass land	'000Kip	0	Communal use
- Improved pasture	'000Kip	352	Refer to (II)
(II) Cost for Pasture			
- Annual seed cost	'000Kip	40	Every 5 years to be renewed
- Chemical fertilizer	'000Kip	0	Minimal inputs of chemical
- Mechanical/Hired labor	'000Kip	0	All activities by manual
- Organic manures	'000Kip	0	Animal manures during pasturing
- Fencing materials	'000Kip	300	Annual cost
- Others (5%)	'000Kip	13	5% of annual gross income
(Total Annual Cost for Pasture)	'000Kip	352	
(III) Grass Production			Gamba, Guinea, Napier, Stylo, etc.
- Yield	tons/ha	48	12 tons of dry matter
- Carrying capacity	heads/ha	4.0	Feed requirement: 8 kg-dry matter /day for 200 kg weight cattle

Source: Estimated by the Study Team

(5) Pig Raising

Pig raising is a promising farm activity in view of the increase in local demand for pork. Integrated animal raising with the self farm products of maize, rice bran, cassava and other farm by-products is proposed to minimize the raising cost and to maximize the use of farm by-products. A pig needs 9 months to become an adult (70 kg live-weight). Feed requirement for 9 months is estimated to be about 510 kg of agricultural products, the cost of which will be 0.17 million Kip/head. It is estimated that the farmgate price of live pig (70 kg live-weight) will be 0.42 million Kip/head and the annual net income by pig raising will be 0.28 million Kip/head. Farm budget for pig raising is presented as summarized on the following page.

Table IV4-11 Farm Budget for Pig Raising

	Unit	Amount	Remarks
(I) Farm Budget for Pig Raising			
1) Adult live weight	kg	70-75	
2) Period to be adult	year	0.75	9 months
3) Mortality/Loss	%	15	
4) Annual selling	head	1.13	per raising population
5) Farmgate price	'000Kip	420	per head of 70 kg live cattle
6) Annual gross income	'000Kip	476	per raising population
7) Feeding cost for pig raising	'000Kip	173	per head to be adult
8) Other materials (5%)	'000Kip	24	per head (vaccination, etc.)
9) Net Income	'000Kip	278	per raising population
(II) Feeding Cost per Head			
- Maize	'000Kip	36	51 kg
- Rice bran	'000Kip	92	204 kg
- Cassava	'000Kip	45	102 kg
- Others	'000Kip	0	153 kg with farm by-product
(Total Feeding Cost)	'000Kip	173	
(III) Feed Requirement			
- from birth to 3 months			Milk for 180 days
- to 9 months (180 days)	kg	510	Average feed : 2.5~3.0 kg/day

Source: Estimated by the Study Team

(6) Chicken Raising

It is expected that native chicken (free range chicken) is a promising animal not only for domestic market but for exports. Integrated animal raising system described above is also proposed. Chicken manure is effective for feeding fish as well as fertilizing aqua plants in fishponds. A native chicken needs 4 to 5 months to become an adult (1.2 kg live-weight). Feed requirement for 5 months is estimated to about 7.4 kg of agricultural products such as maize, rice bran and other farm by-products, and the cost will be 1,850 Kip/head. It is estimated that the farmgate price of free range live chicken (1.2 kg live-weight) will be 10,000 Kip/head and the annual net income by chicken raising will be 20,000 Kip/head. Farm budget for chicken raising is presented as summarized in the following.

Table IV4-12 Farm Budget for Chicken Raising

	Unit	Amount	Remarks
(I) Farm Budget for Chicken Raising			
1) Adult live weight	kg	1.2-1.5	
2) Period to be adult	year	0.37	135 days
3) Mortality/Loss	%	15	
4) Annual selling	head	2.30	per raising population
5) Farmgate price	'000Kip	10	per head of 1.2 kg live chicken
6) Annual gross income	'000Kip	23	per raising population
7) Feeding cost for chicken raising	'000Kip	1.8	per head to be adult
8) Other materials (5%)	'000Kip	1.1	per head (vaccination, etc.)
9) Net Income	'000Kip	20	per raising population
(II) Feeding Cost per Head			
- Maize	Kip	518	0.7 kg
- Rice bran	Kip	1,332	3.0 kg
- Others	Kip	0	3.7 kg with farm by-product
(Total Feeding Cost)	Kip	(1,850)	
(III) Feed Requirement			
- 135 days	kg	7.4	Average feed : 0.02~0.1 kg/day

Source: Estimated by the Study Team.

(7) Fishculture

Fishculture is a promising farm activity in view of the increase in local demand for fish. Integrated system using self farm products of maize, rice bran and chicken manures for fertilizing aqua plants is proposed to minimize raising cost and to maximize the use of farm by-products. Low cost inputs are proposed so that farmers can realize this program by themselves. Feeding fish is normally done by providing chicken manure, which also fertilizes aqua plants in the fishpond. Supplemental feeding is only necessary for two weeks before harvest to fatten the stock and to improve its taste. A total of 10,000 fingerlings with a size of 5 to 10 cm, about 1 month age is required for 1.0 ha of fishpond. It is estimated that the live-weight of each fish will be increased to 500 kg per fish with about 65% of mortality. Thus, the total annual production of fish per ha is estimated to be 3,250 kg. Requirement for supplemental feeding for 6,500 fishes is estimated to be 320 kg. It is also estimated that the annual net income by the proposed fishculture program will be 2.6 million Kip/ha, based on 3,000 Kip/kg of the fresh fish farmgate price. Farm budget for the proposed fishculture is presented as shown in the following.

Table IV4-13 Farm Budget for Fishculture

	Unit	Amount	Remarks
(I) Farm Budget for Fishculture			Per Ha per Year
1) Adult live fish weight	g	510~530	
2) Period to be adult	year	1.0	
3) Mortality/Loss	%	35	
4) Number of fingerlings per Ha	fingerlings	10,000	
5) Number of fish for selling per year	fish	6,500	
6) Increase of weight for 1 year	g	500	per fish
7) Total increase of weight for 1 year	kg	3,250	
8) Farmgate price	Kip/kg	3,000	
9) Annual gross income	'000Kip	9,750	per Ha
10) Total amount of cost	'000Kip	7,124	Feeding and other cost
11) Net Income	'000Kip/ha	2,625	
(II) Feeding and Other Cost per Ha			
- Maize	'000Kip/ha	67	96 kg
- Rice bran	'000Kip/ha	57	128 kg
- Others	'000Kip/ha	0	96kg with chicken manures
(Total Feeding Cost)	'000Kip/ha	(125)	
- Fingerling	'000Kip/ha	4,000	10,000 fingerlings
- Construction of fishpond	'000Kip/ha	1,000	Depreciation for 30 years
- Maintenance of fishpond	'000Kip/ha	2,000	Routine management
Total Annual Cost of (II)	'000Kip/ha	7,124	
(III) Feed Requirement			
- Supplement feed	kg	320	2 weeks before harvest

Source: Estimated by the Study Team based on the data from DLF.

5) Projected Income Generation

Household income generation is estimated by region as presented in Table IV4-14, based on the proposed household land use plan, the crop budgets for recommended crops, as well as the farm budgets for animal raising.

The table shows that the annual household income can be doubled within 10 years, if the government support to the farmers is properly provided. The required public support is: (i) technical support, (ii) financial support, and (iii) marketing support.

Table IV4-14 Income Generation by Agricultural Activities

I. Lowland Region	2000			2005			2010			2020		
	Unit Income	Area (ha)	Income ('000Kip)	Unit Income	Area (ha)	Income ('000Kip)	Unit Income	Area (ha)	Income ('000Kip)	Unit Income	Area (ha)	Income ('000Kip)
A. Land Use	('000 Kip/ha)			('000 Kip/ha)			('000 Kip/ha)			('000 Kip/ha)		
1) Rice (wet season), 1/	1,522	0.9	1,294	1,712	0.9	1,455	1,902	0.9	1,617	2,282	0.9	1,940
2) Rice (dry season irrigated), 1/	1,682	0.2	252	1,872	0.1	187	2,062	0.15	309	2,442	0.25	611
3) Cash crop (dry season irrigated), 2/	1,800	0.0	0	2,085	0.1	209	2,370	0.15	356	2,940	0.25	735
4) Field crops (mixed), 1/	1,096	0.1	55	1,249	0.20	250	1,402	0.25	350	1,707	0.30	512
5) Pasture (cattle grazing), 3/	-352	0.0	0	-352	0.5	-176	-352	1.0	-352	-352	1.5	-528
6) Fruit tree/ tree crops, 4/	0	0.0	0	1,243	0.1	62	1,988	0.1	199	2,485	0.2	373
7) Fish pond/Rice field, 5/	2,100	0.0	0	2,363	0.2	473	2,494	0.3	748	2,625	0.4	1,050
B. Livestock	('000 Kip/head)	(Nos.)		('000 Kip/head)	(Nos.)		('000 Kip/head)	(Nos.)		('000 Kip/head)	(Nos.)	
1) Cattle+Buffalo, 6/	204	3.5	714	230	4.5	1,025	242	5.7	1,381	255	7.4	1,887
2) Pig, 7/	222	1.4	311	250	1.8	447	264	2.3	602	278	3.7	1,033
3) Poultry, 8/	16	12.0	192	18	15.3	276	19	19.5	371	20	31.8	637
Total Income per HH			**2,818**			**4,207**			**5,582**			**8,249**
(Total Income per HH in $), 9/			($342)			($511)			($677)			($1,001)
II. Central Region												
A. Land Use	('000 Kip/ha)			('000 Kip/ha)			('000 Kip/ha)			('000 Kip/ha)		
1) Rice (wet season), 1/	1,522	0.7	989	1,683	0.7	1,094	1,845	0.7	1,199	2,168	0.7	1,409
2) Rice (dry season irrigated), 1/	1,682	0.0	0	1,841	0.0	0	2,001	0.05	100	2,320	0.1	232
3) Cash crop (dry season irrigated), 2/	1,800	0.0	0	2,048	0.0	0	2,297	0.05	115	2,793	0.1	279
4) Field crops (mixed), 1/	1,096	0.1	55	1,227	0.15	184	1,359	0.20	272	1,622	0.30	486
5) Pasture (cattle grazing), 3/	-352	0.0	0	-352	0.5	-176	-352	1.0	-352	-352	1.5	-528
6) Fruit tree/ tree crops, 4/	0	0.0	0	1,180	0.1	118	1,889	0.3	567	2,361	0.6	1,416
7) Fish pond/Rice field, 5/	1,995	0.0	0	2,244	0.1	224	2,369	0.2	474	2,494	0.3	748
B. Livestock	('000 Kip/head)	(Nos.)		('000 Kip/head)	(Nos.)		('000 Kip/head)	(Nos.)		('000 Kip/head)	(Nos.)	
1) Cattle+Buffalo, 6/	194	4.6	891	218	5.9	1,280	230	7.5	1,724	242	9.2	2,229
2) Pig, 7/	211	1.3	275	238	1.7	394	251	2.1	531	264	4.6	1,207
3) Poultry, 8/	15	9.0	137	17	11.5	196	18	14.7	265	19	23.9	454
Total Income per HH			**2,347**			**3,316**			**4,895**			**7,933**
(Total Income per HH in $), 9/			($285)			($402)			($594)			($963)
III. Mountainous Region												
A. Land Use	('000 Kip/ha)			('000 Kip/ha)			('000 Kip/ha)			('000 Kip/ha)		
1) Rice (wet season), 1/	1,522	0.4	609	1,655	0.4	662	1,788	0.4	715	2,054	0.5	924
2) Rice (dry season irrigated), 1/	1,682	0.0	0	1,811	0.0	0	1,940	0.0	0	2,198	0.0	0
3) Cash crop (dry season irrigated), 2/	1,800	0.0	0	2,012	0.0	0	2,223	0.0	0	2,646	0.0	0
4) Field crops (mixed), 1/	1,096	0.1	110	1,206	0.20	241	1,316	0.30	395	1,536	0.40	615
5) Pasture (cattle grazing), 3/	-352	0.0	0	-352	0.5	-176	-352	1.0	-352	-352	1.5	-528
6) Fruit tree/ tree crops, 4/	0	0.0	0	1,118	0.2	168	1,789	0.5	895	2,237	1.0	2,237
7) Fish pond/Rice field, 5/	1,890	0.0	0	2,126	0.03	64	2,244	0.06	135	2,363	0.1	236
B. Livestock	('000 Kip/head)	(Nos.)		('000 Kip/head)	(Nos.)		('000 Kip/head)	(Nos.)		('000 Kip/head)	(Nos.)	
1) Cattle+Buffalo, 6/	184	3.8	698	207	5.6	1,157	218	7.5	1,635	230	9.1	2,088
2) Pig, 7/	200	2.0	400	225	2.6	575	238	3.3	774	250	5.3	1,328
3) Poultry, 8/	14	9.5	137	16	12.1	196	17	15.5	265	18	25.2	454
Total Income per HH			**1,953**			**2,887**			**4,461**			**7,353**
(Total Income per HH in $), 9/			($237)			($350)			($541)			($892)

Note: 1/ Unit net incomes are estimated to be increased according to the increasing productivities year by year. (Table IV4-7 and IV4-8 Projected Crop Budget of Rice and Field Crops).
Due to transportation cost for marketing, all the unit net incomes are estimated that 100% for the lowland region, 95% for the central region and 90% for the mountainous region.
2/ The crop budget of peanut was applied to this item. (Table IV-4-5) The area for cash crops was estimated to be 50% of the total dry season irrigated paddy field.
3/ Only the cost for pasture are applied to this item and the net incomes from cattle raising are applied in the item B. 1) Cattle+Buffalo.
4/ 0% of the net income of the crop budget in 2000, 50% in 2005, 80% in 2010, and the full net income in 2020 were applied to this item due to the required period for their full production. (Table IV4-9 Projected Crop Budget of Fruit Tree and Tree Crop).
5/ Table IV4-13 Farm Budget for Fishculture. 80% of the net income of the farm budget in 2000, 90% in 2005, 95% in 2010, and the full net income in 2020 were applied considering the present situation of the technical supporting availability by the government.
6/ Table IV4-10 Farm Budget for Cattle Raising. 80% of the net income of the farm budget in 2000, 90% in 2005, 95% in 2010, and the full net income in 2020 were applied.
7/ Table IV4-11 Farm Budget for Pig Raising. 80% of the net income of the farm budget in 2000, 90% in 2005, 95% in 2010, and the full net income in 2020 were applied.
8/ Table IV4-12 Farm Budget for Chicken Raising. 80% of the net income of the farm budget in 2000, 90% in 2005, 95% in 2010, and the full net income in 2020 were applied.
9/ US$ 1.0 = 8,240 Kip as of 01 November 2000.
Source: Estimated by the Study Team.

(1) Technical Support

Technical support will be extended by the staff of concerned departments in both provincial and district offices, in cooperation with external support as the need arises.

As previously discussed, the prime constraint on agricultural development in Lao PDR is the shortage of skilled manpower. Accelerated agricultural growth requires more skilled people. In this context, the Agricultural College proposed under the Human Resource Development Initiative in this study will respond to the requirement of skilled manpower not only for SKR development but for agricultural development of Lao PDR.

The government is restructuring itself to enhance its capacity to respond to farmer needs in the evolving market economy. Community and farmer's needs are communicated to the Farming System Extension Workers (FSEWs) in district. What district cannot solve, is sent to Subject Matter Specialist (SMS) in province, and what province cannot solve is sent to the central level for resolution. Consequently, each government level above the district functions is a supportive role.

However, it is important to note that the current incentive structure is inconsistent with the new demands for the agricultural institutions, which may be one of the major reasons for the insufficient performance by extension workers. In the future, it should be taken into account that some technical support services in various areas of the agricultural sector should be put in the private sector. Anyhow, improvement in remuneration and working conditions is indispensable, together with staff training and career development.

In this program practically, it is proposed that all the concerned FSEWs in the district office and SMSs in the provincial office should be involved as responsible technical supporting staff for each activities, as well as on-the-Job training with some reasonable petty expenses.

(2) Financial Support

The required amount of the fund for each activity is relatively small compared with the construction costs of irrigation facilities and roads. The funds will be used for purchasing seeds of cash crops, seedlings of fruit trees, calves, piglets, chicks, fingerlings and some materials for fencing and fishpond, which will be revolved to support those activities one after another.

Normally, those loans for farm-operation are granted through APB. However, due to limited fund and staff at APB, as well as time consuming process for the loan

approval, it may propose to establish another specific financial support system specifically focusing on this program in each province.

(3) Marketing Support

For farmers, access to markets is essential and it has been a major impediment to successful agricultural development. Poor road network curtails any increase in trade within the region. However, all production areas have informal but established marketing chain. This involves farmers taking their produce to village markets, where it is procured by middlemen and taken to either a district or provincial market and in the case of tradable commodities, they end up in the export market.

Thus, the formation of the farmer's production group without any big investment may be one of the practical and effective countermeasures to improve the marketing system. It may be possible for the groups to exchange marketing information and to have some power to negotiate the prices with traders.

IV-4.3 Priority Programs

1) New Village Initiative: A Pilot Program in SKR

The simplified target for agricultural development is income generation through an integrated farming system, and the proposed action program has been discussed mainly focused on increase in agricultural productivity. However, three (3) more issues should be addressed in order to ensure and sustain income generation in the rural areas. They are:

(i) Who will be responsible for future agriculture? Do younger generations have the ambition of succeed agricultural activities? Are there sufficient skilled staff to support farmers?
(ii) Are there any possibilities of the present farming system proceeding to high value added agro-processing or agro-industry in the market economy?
(iii) How to improve social services/infrastructure in the rural areas in accordance with increase in income?

The first question is to be responded by the proposal to promote human resource development by setting up an Agricultural College. The second and third questions are incorporated into the program for the New Village Initiative (NVI). It is therefore planned that NVI will be implemented as a pilot program in Savannakhet and Khammouan with the following sub-programs:

(i) Promotion of integrated farming, with specific attention to promotion of crop diversification, livestock, fishculture, and tree crops.
(ii) Promotion of local industries, making use of available local resources and unused/waste materials (to be discussed in Chapter V-2), and
(iii) Improvement of social services/infrastructure at the village level (e.g., improvement of water supply, roads and access roads/bridges)

The plan for promotion of NVI as a pilot program in Savannakhet and Khammouan is further elaborated and presented in Part 3: Priority Program Study Report, Chapter I.

2) Savannakhet Agricultural Collage

The success of the proposed program depends on development of human resource in terms of farmers, as well as development of DAFO and PAFO staff. For training of younger farmers and community leaders, as well as government staff of FSEW level, it is proposed to establish an Agricultural College in Savannakhet. The objective of the college is to encourage younger generations of farmers and government staff at FSEW levels, who have ambition to future agriculture in Lao PDR. The subjects to be learnt in the college are to be practical for acquiring more practical farming skills, as well as a sense of farm management through actual farming activities in the fields. The subjects also cover all the major farming/cultivating systems of including diversified crops, fruits, vegetables and tree crops, as well as livestock and fishery management.

The proposed agricultural college will promote self-sufficiency from its agricultural products. The students should be recruited from the lower secondary school and from village leaders. Most of expenditures will be covered by commercial revenue of commodities produced in the college.

In the first year, the courses are designed to cover basic theory of each subject of crop, livestock and aquaculture and basic commercial farm management, while in the second year the course will confine to practical experience thoroughly. The third year will concentrate more on the commercial production. The revenue from selling products, after taken out of operational cost, will be treated as a bonus to the graduates so that they can go back home not only with knowledge and diploma but also with some capital to start ventures in their home village.

The plan for establishment of the Savannakhet Agricultural Collage is proposed as shown in Part 3: Priority Program Study Report, Chapter III.