stage of the Mekong was more than 1/10 return period. The amount of rainfall in the basins was also much more than the average.

Damage on agriculture was reported as follows:

In Bolikhamsai basin, about 48,000ha was flooded to a depth of 2 - 8m over 2 - 8 weeks. Of the 11,164ha of agricultural land, about 9,097ha was flooded and harvest of 8,088ha was damaged.

In Sebangfai basin, about 41,500ha, including 9,800ha in Xaibouri district, was flooded to a depth of 1 - 6m over 1 - 8 weeks. About 13,000ha of rice field was affected and about 11,000ha was damaged.

In 1996 about 40,000ha in Sebanghiang basin was flooded to a depth of 1.5 - 8m over 2 - 6 weeks. About 10,000ha of rice field was damaged.

2.2 Socio-Economy

2.2.1 General

The study area consists of 4 districts in Bolikhamsai province (Thaphabath, Bolikhan, Paksan, and Pakkading), 4 districts in Khammouane province (Hinboun, Thakhek, Nongbok, and Sebangfai), and 4 districts in Savanakhet province (Xaibouly, Khanthabouly, Xayphouthong, and Songkhon). The total study area is approximately 15,265 ha and extends along the Mekong River, with 6,079 ha in Bolikhamsai province, 5,216 ha in Khammouane province, and 3,970 ha in Savanakhet province.

The economy of the study area is dominated by rice with some other crops such as tobacco, maize, and vegetable along the Mekong River and its tributaries, and some upland crops (pineapple, sugar cane, and tapioca) in areas with low water resource potential. There are also upland rice productions using the traditional slash and burn cultivation in the latter area.

The major roads in the study area are the National roads No. 13, No. 4, No. 8. The road No. 13 that is along the Mekong River from up-stream Bolikhamsai to down stream Savanakhet is considered as the main road. The National Road No.4 joins Bolikhamsai province and Xieng Khouang province is not passable during the wet season. The National Road No.8 joins Bolikhamsai province to the Vietnam border at Laksao is in good condition all year round. Secondary access roads joining district to district in the study area are of poor quality and are flooded or cut during the wet season.

The water resources of the area consist of the Mekong River and its main tributaries. The main tributaries that are providing water and water resource to the rural community in the area are; Nam Mang, Nam Leuk, Nam Giap, Nam San, Nam Sa, Nam Kading, and Nam

Thone in Bolikhamsai province; Nam Hinboun, Nam Don, Nam Sebangfai in Khammouane province, Nam Sebangfai and Nam Sebanghiang in Savanakhet. The plains along those tributaries are considered as the rice bowl of the provinces and play an important role in the development of the provinces. The plains are also subject to constant flooding during the wet season, thus improving constantly the soil conditions. However, these floods have negative effect on the traditional wet season rice production in the area.

2.2.2 Administrative Units

The main government agencies involved in the master plan study are the Ministry of Agriculture and Forestry (MAF) and its related departments, the Bank of the Lao PDR (BOL) and the Agriculture Promotion Bank (APB), the provincial and district authorities of the provinces and districts surveyed. The administrative jurisdiction of the line and administrative agencies are specified below.

(1) Ministry of Agriculture and Forestry (MAF)

The existing structure of MAF consists of one cabinet office and 6 departments. The organizational structure of MAF is specified in Figure 2-7. The MAF's cabinet office is responsible for planning and statistics, finance and budget, international cooperation and investment and legal affairs.

In MAF, the major modification is the establishment of the National Agriculture and Forest Research Institute (NAFRI) which was established at the same level with the other line departments. All the existing research centers belonging to the different departments were re-organized to form NAFRI. The organization structure is shown in Figure 2-8.

(2) Provincial Agriculture and Forestry Service Office (PAFSO) and District Agriculture and Forestry Service Office (DAFSO).

The organization of MAF as a line agency is extended to the province. The PAFSO established under the provincial authority, receives order and directives from MAF. PAFSO's organizational structure is similar to that of MAF.

With a similar function at the district level, DAFSO which is established under the district authority receives order and directives from PAFSO. DAFSO's organizational structure is similar to PAFSO. The existing structure of provincial and district agriculture and forestry services is shown in Figure 2-9.

(3) Bank of the Lao PDR (BOL).

The bank has an Administrative Council headed by the Vice- Prime Minister as chairman, the Governor of the BOL as deputy chairman, the Minister of Finance as deputy chairman

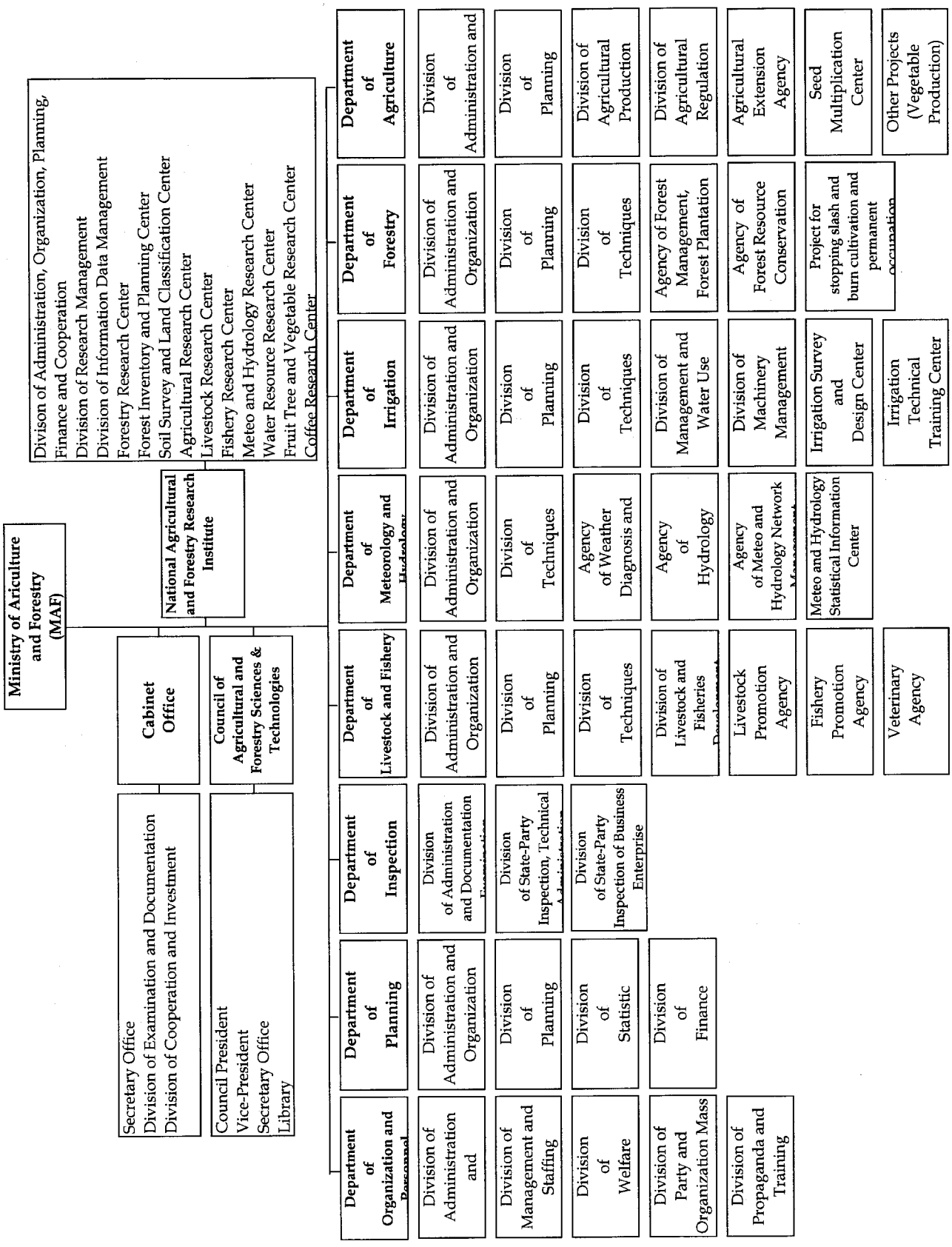
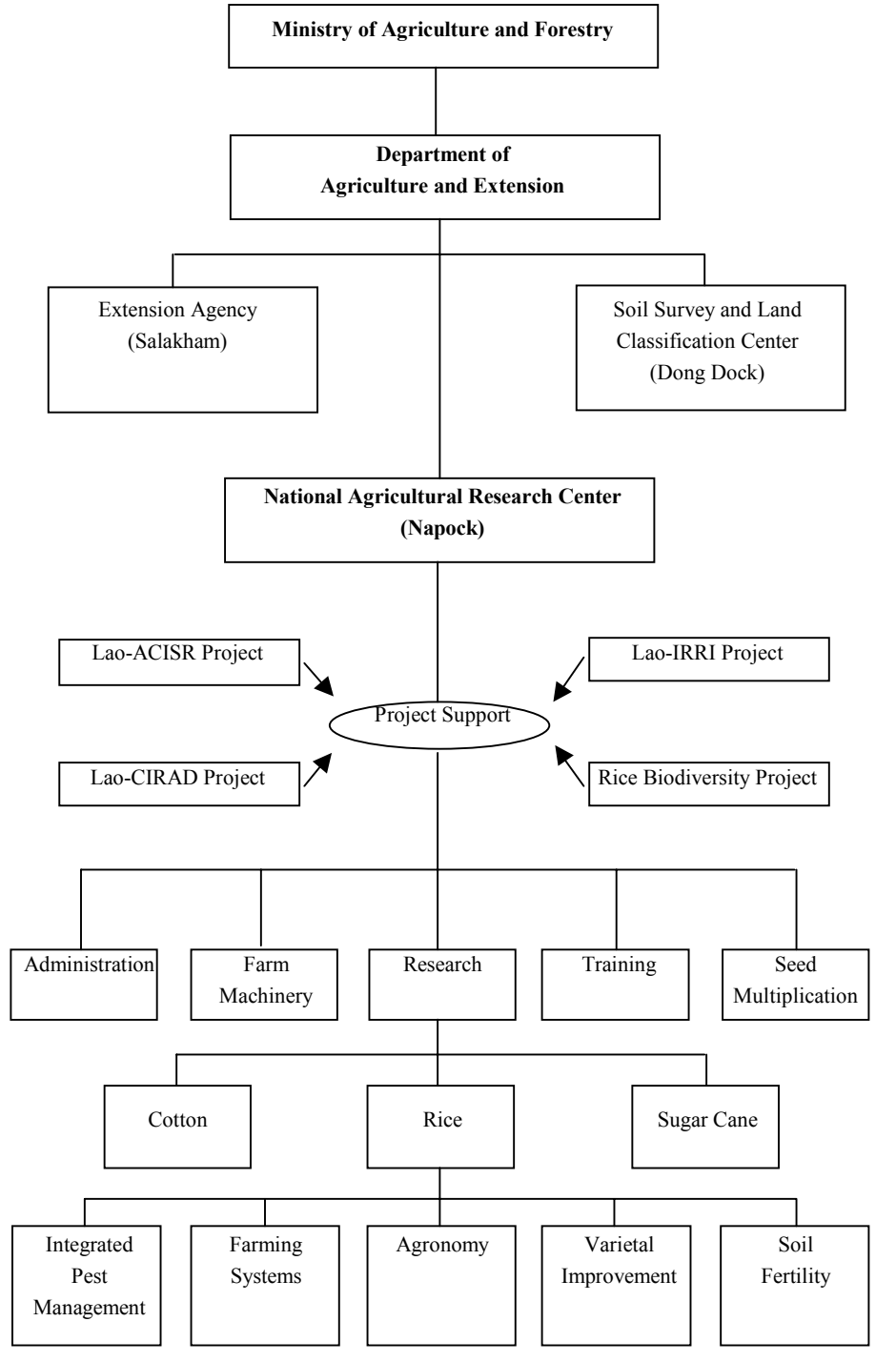


Fig2-7. The Organization of Ministry of Agriculture and Forestry (MAF)



ACIAR: Australian Center for International Aricultural Research
CIRAD: Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement
IRRI: International Rice Research Institute

Figure 2-8 Existing Structure of National Agricultural Research Center

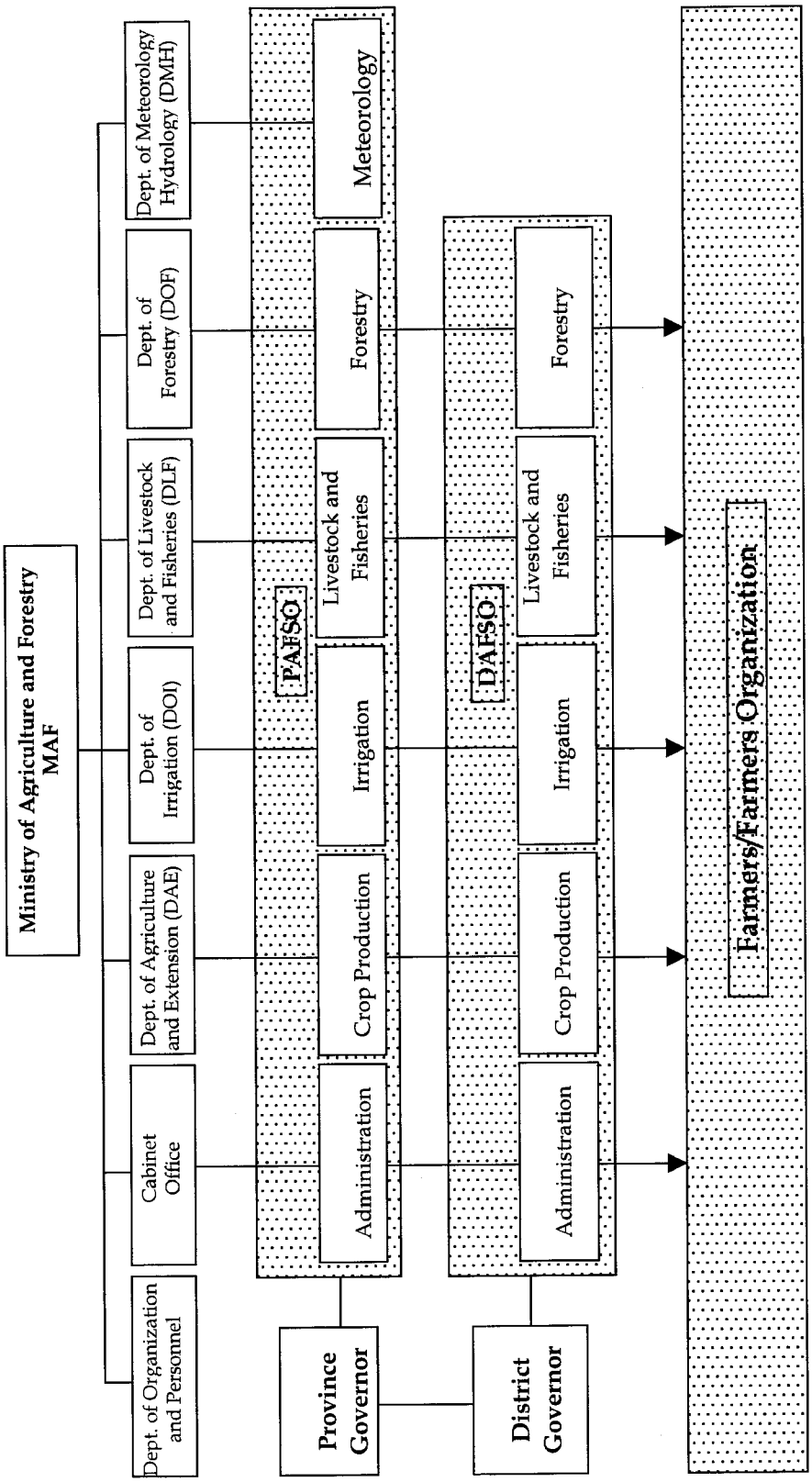


Figure 2-9 Existing Structure of Provincial and District Agriculture and Forestry Services

and members that include the deputy governor of BOL, Chairman of the Committee for Investment and Cooperation (CIC), Minister of MAF and Minister of Ministry of Transport Communication and Construction (MTCC).

The role of the BOL may be outlined as; Issuance of bank note, macro level management of currency, implementation of foreign currency and exchange management policies, supervision of monetary operations, sale of BOL bills, approval of establishment of banks and financial institutions, approval of branch of business bank[1] (BB), management and control of BBs, approval of interest rates of deposits and loans of BBs, management of foreign reserves, and supply liquidity to BBs. The organization structure of BOL is given in Figure 2-10.

(4) Agriculture Promotion Bank (APB)

The General Assembly of the shareholders is the highest organ of APB, although at present , MOF is the major shareholder holding about 80% of APB shares. A Board of Directors is elected by the general assembly administers the APB. The organizational chart of APB is shown in Figure 2-11.

APB has one main office in Vientiane, 3 Branches Offices in Luang Prabang, Savanakhet and Pakse, 15 service units and 47 sub-service units nationwide.

(5) Province and District Authority

The Administrative division in the study area is divided into three provinces (khueng), namely, Bolikhamsai, Khammouane and Savanakhet, and each is an independent prefecture of an administrative parity with the provinces. Below the provinces are the districts (muong), which are in turn divided into zones[2] (khet) and then into villages (ban). In the study area, there are twelve districts, 114 zones and 1021 villages.

In terms of the local administration, the provincial authorities have a fairly high degree of autonomy provided that they adhere to the directives and policy guidelines laid down by the central government. Provincial administration is organized as having similar structure as in the central government and is divided into departments that correspond to respective ministries. A governor with one or two deputies designated by the central government administers the province. Administration at the district level is also organized in the same way as the provincial authorities.

[1] Business banks includes, State Operating Commercial Banks (SOCBs), foreign bank branches and joint venture banks.
[2] The sub-districts were abolished since the beginning of the nineties. The zones were created instead, however, they have political function and no administrative function. The administrative function is with the village authority.

Figure 2-10 Organization Chart of BOL

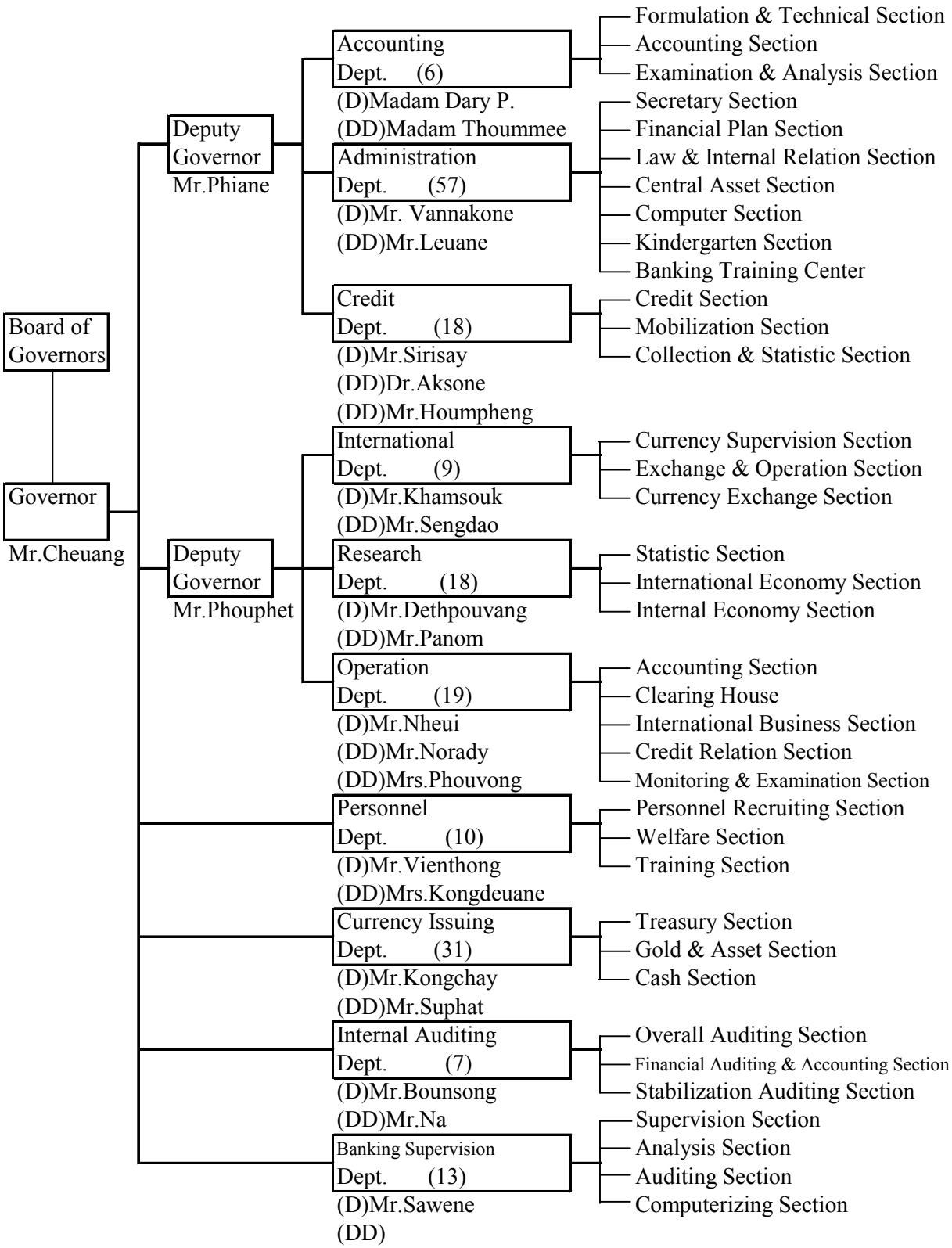
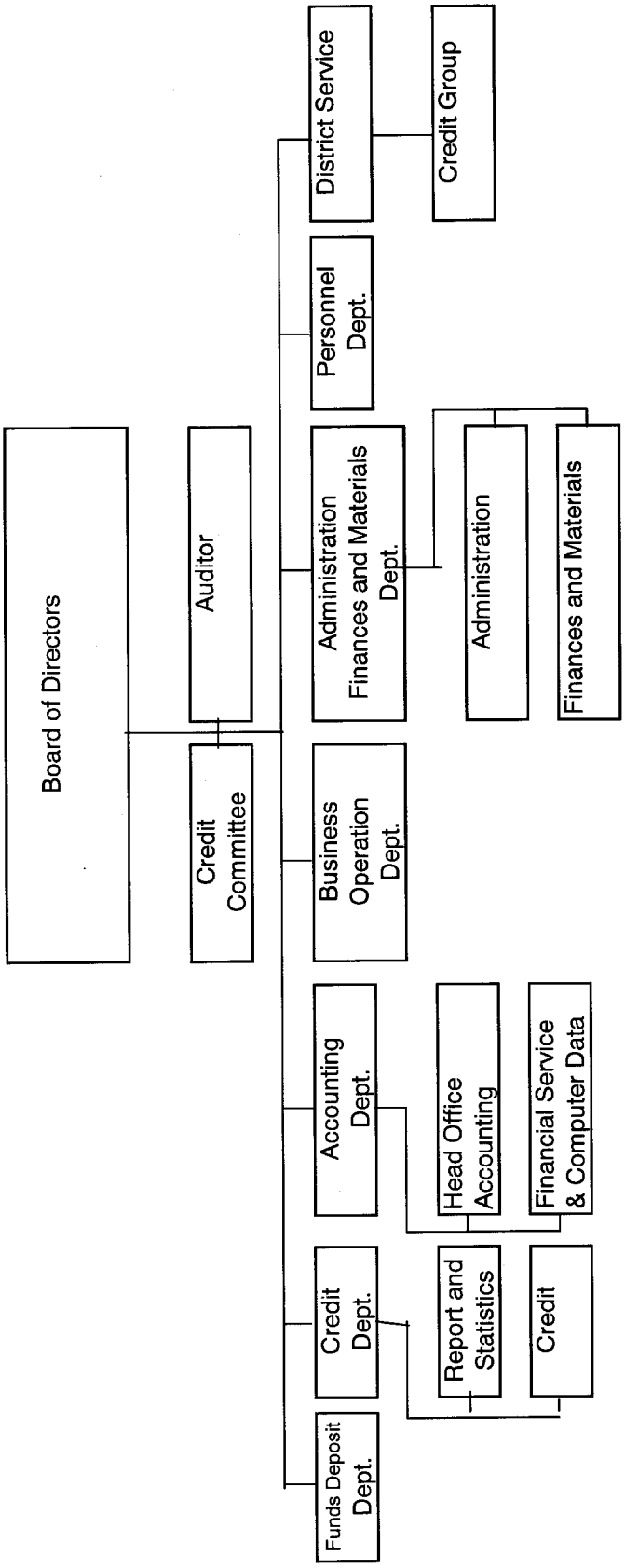


Figure 2-11 Organization Chart of APB



(6) Village Authority

The official organization of the village consists of the Village Public Administration Committee headed by the Nay Ban (chief of village) who is assisted by 1 to 2 deputy chief (s) depending on the size of the village. The Chief of Village reports directly to the district governor office.

The villagers elect all the Village Public Administration Committee members through a village general assembly every 2 years. However, the district authority makes the selection of the candidate for the positions. (7) Formal Mass Organization.

Lao Women Union (LWU): *The Lao Women Union is a formal mass organization which is supported by the government. The organization runs as a non-government organization and has units from central, provincial, district to village level. The LWU at village level is established under the supervision of the village administrative authority and support from the LWU at district level. The role of the LWU is to strengthen the women in all aspects starting from the reproduction and domestic activities to the household production. The LWU started as a female activist movement but lately shifted to consider gender aspects into its development activities.*

Lao Union for National Construction (LUNC): *The LUNC is the second formal mass organization supported by the government to gather solidarity among the different ethnic groups and social groups in the country. The LUNC as the LWU has units from central, provincial, district and village level. At village level the LUNC's roles is to keep solidarity in the village and surrounding community and to assist the village authority in major decision making. The LUNC's committee is used as a council of elder by the village administrative authority because it is composed of local leaders, venerable persons, monks or priest.*

Lao Youth Revolutionary Union (LYRU): *The LYRU is the third formal mass organization supported by the government to take care of the youth condition in the country. Like the two other mass organizations the LYRU has unit from central to village level. At village level, the LYRU is active in mobilizing labor force for the village authority and for the protection of the village.*

2.2.3 Demography

According to the population census 1995 provided by the State Planning Committee, National Statistical Center, the population of the provinces included in the study area is 1,107,810 with 181, 655 households, as presented in the following table.

Population statistics of provinces in study area

Province	population					households				population density	
	total	male	female	urban	rural	number			size	area	
						total	urban	rural	rural	sq. km	density
Bolikhamsai	163,589	81,791	81,798	10,218	153,371	26,434	1,602	24,832	6.1	14,863	11.0
Khammouane	272,463	132,290	140,173	36,605	235,858	49,126	6,194	42,932	5.4	16,315	16.7
Savanakhet	671,758	329,060	342,698	100,278	571,480	106,095	15,687	90,408	6.3	21,774	30.9
total	1,107,810	543,141	564,669	147,101	960,709	181,655	23,483	158,172		52,952	

Source: Lao population census 1995.

The population density in the area ranges from 11 inhabitants per square kilometer in Bolikhamsai to 30.9 in Savanakhet. In the latter province it is assumed that the density of the population in the rural area is less than the average population density.

More specific demographic data were collected for the 12 districts and 1,021 villages located in the study area. The population structure and household size is given in the following table.

Population structure and households size in study area.

Province	District	Number of villages	Population			Households	
			total	male	female	total No.	size
Bolikhamsai	Thaphabath	32	20,404	9,908	10,496	3,640	5.6
	Bolikhan	50	21,268	10,390	10,878	3,464	6.1
	Paksan	75	36,977	18,196	18,781	6,013	6.1
	Pakkading	57	30,525	15,456	15,069	5,719	5.3
	Subtotal	214	109,174	53,950	55,224	18,836	5.8
Khammouane	Hinboun	166	55,231	27,110	28,121	10,993	5.0
	Thakhek	139	68,984	33,334	35,021	12,482	5.5
	Nongbok	71	41,143	20,168	20,975	6,765	6.1
	Sebangfai	49	21,369	10,320	11,049	4,229	5.1
	Subtotal	425	186,727	90,932	95,166	34,469	5.4
Savannakhet	Xaibouly	89	45,405	21,658	23,747	7,259	6.3
	Khanthabouly	93	103,358	50,589	52,769	16,754	6.2
	Xaiphouthong	58	NA	NA	NA	NA	NA
	Songkhone	142	68,099	34,141	33,958	12,465	5.5
	Subtotal	382	216,862	106,388	110,474	36,478	4.5
Total		1,021	512,763	251,270	260,864	89,783	5.7

Source: District statistic book report 1998.

The age group and sex distribution structure of Lao PDR in the 1995 census showed a population pyramid that is broad at the base and narrow at the top. The inventory results made during the field study emphasized that the population is relatively young where a sizeable proportion belongs to the younger age groups. The 1995 census indicated that there is a greater number of females than males. The 1995 sex ratio was 97.7 compared to 96.1 in the 1985 census. This means that the sex distribution has become more even between 1985 and 1995 in Lao PDR. The same trend is also observed in the study area.

The definition of active population given in the 1995 census is the population aged 10

years and above. This portion of the population is divided into two categories. (i.) The economically active population that is calculated to 70% of the active population and (ii.) the economically not active population that is calculated to 30%. In the latter category, students are taking 69% of the proportion. In the rural area, students aged 10 years and above are considered as the main source of labor in the village because they are helping their parents in the household chores and in agricultural farms field after school hours and during summer vacation. In the data gathered from the village inventory, the proportion of active population is higher.

As it appeared in the national census and in the village inventory result, the average size of households varies from the lowest at 3.1 to the highest at 6.4. On the average, the household size in the study area is about 5.7.

2.3 Rural Sociology and Farmers' Organizations

2.3.1 Rural Sociology

(1) General

The population of the Lao PDR is essentially classified to three main ethnic groups, which are referred to as Lao Soung[3] (highland ethnic groups), Lao Theung[4] (midland ethnic groups) and Lao Lum[5] (low land ethnic groups). In the study area, the Lao Lum is the most dominant group, which represents 97% of the total population while the Lao Theung shares 2% of the population. The following table shows the proportion of ethnic groups in each province.

Ethnic groups proportion of study area

Study area	Lao Lum		Lao Theung		Lao Soung & Foreigner		Total	
	persons	%	persons	%	persons	%	persons	%
Bolikhamsai	95,370	93	3,370	3	3,440	3	102,180	100
Khammouane	174,960	95	8,160	3	1,160	1	184,280	100
Savanakhet	251,040	100	920	0	170	0	252,130	100
Study area	521,370	97	12,450	2	4,770	1	538,590	100

Source: Planning and Cooperation Division in three provinces

In the inventory of 108 villages for the study, only 2 villages are of the Lao Theung ethnic groups. The Tai Phouan, Tai Phouthai, Tai Meuy and Tai Kaleung dominate the Lao Lum minorities.

[3] Ethnic groups (Hmong, Yao) that migrated from southern China. This group is dispersed throughout the northern region and some inhabit portion of the central highland.
[4] Ethnic groups belonging to the Austro-Asiatic or Mon-Khmer ethno-linguistic group. There are the inhabitants of Laos in the pre-historic times.
[5] Ethnic groups belonging to the Tai related to northern and northeastern Thailand, the Shan States in Myanmar, and Yunnan province in China.

The dominant religion in the area is Buddhism[6]. About 99 % of the villages are Buddhist. Buddhism plays a big role in the Lao Lum society. In the ancient practice, the pagoda that also takes the name of the village, provided education and medical knowledge to the people. This practice is still present in the area and the venerable monk is always consulted about important decisions in the village.

Due to traditional social practice, the Lao rural society is expanding slowly within it surrounding and is not progressing out side its physical and ethnical boundary. One of the main reasons is due to the poor condition of the road and the accessibility of the progress (culture, information etc.). Despite the development of the Lao society in the urban area, the Lao rural area is still a close society where the people and community live in a close circle having limited contact with the other communities that are remote or have different ethnic source. In the study area most of the villages are formed into one ethnic group and one religion group. The village size in the study area varies from 20 households to 486 households or an average size of village is 88 households for Bolikhamsai, 81 households for Khammouane and 95 households for Savanakhet.

Since the last decade, the Lao rural society has changed due to the impact of economic reforms undertaken by the government. However, the living conditions in the area remain weak due to social conditions such as poverty, low income, and lack of funds/money, health, water and sanitation, education and work opportunity. In recent years, the Asian crisis had enormous effects to the economy and financial stability of the country. The effects may have no direct implication in the rural area because of the auto-subsistence conditions related to subsistence agriculture practices and un-developed monetary exchange practices. However, this crisis had implications on the price of commodities including fertilizer and pesticides and also to the price of rice. Due to the devaluation of the kip, the price of paddy in Lao PDR is now cheaper than in Thailand which was not the case before the crisis.

(2) Living Conditions

Almost 86% of the households depend on agricultural production. The cash income of the family is mainly derived from selling farm products such as paddy and vegetables. Additional sources of income come from sale of animals (cows, pigs) and poultry followed by fishing and by home handicrafts. In some areas, the collection of non-timber forest products (bamboo shoots, rattan shoots, wild cardamom, resin etc.) is one of the main source of income. According to the village inventory, about 5 percent of the farmers derive additional income from non-farm labor and small business (village shop, soup shop, transport etc.). Seasonal labor migration to towns is common especially when flood and drought occurs during the dry season.

[6] The Buddhism practices is the Buddhism Theravada also found in Thailand, Cambodia, Myanmar and Sri Lanka.

In terms of farm economy, the annual income per capita of the poorest household is 126,800 Kips[7] per person/year or about 29.48 US Dollars[8] per year. The average income per capita of the richest household is 1,944,200 Kips per person/year or about 452 US Dollars per year. The estimated average income per capita in the study area is 557,940 Kips per person/year or about 129.75 US Dollars per person/year.

In the Lao rural area, livestock possession is considered as one of the criteria to define the wealth of a family. Cows and water buffaloes are not only raised for consumption and crop production but are also considered as tradable assets and family investment. The more cattle the family has, the wealthier the family is. In the survey area, 47% of the households possess cows, 54% possess water buffaloes and about 37.7% possess 2 wheel tractors. The degree of mechanization has increased as well as the percentage of households owning agriculture machinery.

The result from the socio-economic survey showed that there are limited credit activities in the study area. Very few farmers obtained loan from the APB. For buying food and medical expenses, some families borrow money from neighbors and siblings. There are savings and mutual funds but these are mostly related to the religious affairs and to school improvement activities of the village. Revolving funds and rice banks have been introduced in some villages by the district authorities and NGOs, particularly in the villages experiencing shortage of rice due to severe flood.

(3) Living Environment

In terms of housing conditions, all houses in the study area are owned and used by individual households. The type of housing materials varies from poor to rich. However, most of the houses have roof made of thatch or wood or iron sheet, walls are made of concrete bricks or bamboo and/or wood; floor is made of concrete/bricks or bamboo and/or wood.

Electricity is limited to very few places in the area specifically in areas located next to the provincial and district town. In the survey, 47 villages (43.5%) of the villages have electricity. . Some villages profited from the installation of electrical pumps. In areas where there is no electricity, most households use kerosene lamps or simple diesel lamps for illuminating their homes. In terms of fuel for cooking, firewood is collected from the communal forests surrounding the villages. The average distance to collect the wood is 1.1 kilometers.

[7] average income of poor household divided by the average number of family. In this calculation the case of Xaiphouthong was calculated.
[8] 1 US$ equal to 4300 kips at the time of the interview. At the time of the report 1 US$ equal to 9 400 Kips.

(4) Gender

The division of labor between male and female was assessed during the household survey. The gender responsibility and structure of duty of the family members in the productive and non-productive household activities were identified during the interview. A preliminary gender analysis is given in the following table.

Gender division of labor

Household activity	Who take decision	Who is leading	Who is doing the work
Productive household activity			
Preparing land for crop production	Male	Male	Male & Female
Preparing seed bed	Male	Male	Male
Transplanting plants	Male	Female	Female & Male
Weeding	Male	Male	Male
Fertilizer Application	Male	Male	Male
Threshing	Male	Male	Male & Female
Transporting and storing crops	Male	Male	Male & Female
Grazing cows/buffalo	Male	Male or Female	Female & Male
Feeding pigs and poultry	Female	Female or Male	Female & Male
Handicraft processing	Female	Female	Female & Male
Processing of farm product (i.e. lao Lao)	Female	Female	Female & Male
Selling home commodity to local market	Female	Female	Female
Selling paddy and rice	Male	Male or Female	Male & Female
Non-productive household activity			
Going to village meeting	Male	Male	Male
Going to credit group meeting	Male	Male	Male
Going to pagoda/temple meeting	Male	Male or Female	Male & Female
Participation in training	Male	Male	Male
Fetching water	Female	Female	Female & Male
Fetching fuel wood	Female	Male or Female	Female & Male
Cooking	Female	Female	Female & Male
Cleaning household	Female	Female	Female & Male
Taking care of children and baby	Female	Female	Female
Keeping money	Female	Female	Female
Borrowing money with village people	Female	Male or Female	Female & Male
Borrowing money from APB	Male	Male or Female	Male & Female
Repair house	Male	Male	Male & Female
Repair tool and equipment	Male	Male	Male & Female

Source: Household survey.

In productive household activities the decision of the husband head of family is dominant. However, in livestock raising and in selling farm products, the women take the decision. Women are involved in almost all production activities and are working as much as the men.

In non-productive activities, the reproduction[9] responsibilities are given to the housewife. Responsibility in fetching water and fuel wood relies on the women as well. The long tradition in ethnic Lao Lum housewife is for keeping the money and to procure funds for the household expenses.

(5) Access to water

In the study area, the accessibility to water source is slightly better than the situation at national level. The water source situation is specified in the table below.

Water source situation in study area

Study area	Deep well	Dug well	spring/ tap water	Jar	coverage to population (%)
Bolikhamsai	253	103	15	84	65
Khammouane	356	700	5	1768	57
Savanakhet	624	202		56	79
Study area	1233	1005	20	1908	69

Source: Public Health Service Office of three provinces

However, from the villages surveyed, the main sources of drinking water during the dry season are from river/stream and wells. During the rainy season, all households harvest rainwater in addition to the water in the wells. In general, the quality of water is acceptable. However, 33 villages (30%) inventoried claimed some problems in water supply.

(6) Health

According to the Public Health Service Office in the provinces, malaria disease is common in the study area, but other vector-borne diseases such as schistosomiasis, filariasis, and encephalitis are not found. The tendency of malaria disease differs among the provinces. In Bolikhamsai, the incidence is high during the wet season. On the contrary, an epidemic is also observed during dry season in Savanakhet area. In the case of Khammouane, the incidence is basically higher during the wet season, however, small peaks can be seen in the beginning of the dry season from December to January. These tendencies might be associated to the water bodies such as swamps, reservoir, irrigation

[9] reproduction activities refers to maternity care and house care activities

fields etc. near the residential area. To date, no clear relations have been established.

Other facilities in terms of primary health care including latrine, hospital, health post, etc. are also lacking in the whole country. The situation of primary health care in the study area is shown in the table as follows.

Primary health care situation in study area

Study area	Latrine		Hospital		Health post		
	number	coverage (%)	number	number of bed	number	number of bed	number of staff
Bolikhamsai	3,478	22	4	124	12	48	26
Khammouane	6,533	19	5	212	40	80	n.d.
Savanakhet	14,756	37	5	240	36	72	47
Study area	24,767	28	14	576	88	200	n.d.

Source: Puplic Health Service Office of three provinces

From the village inventory, very few houses in the area have a latrine. In Bolikhamsai 91 %, in Khammouane 96%, and in Savanakhet 70% of the households[10] in the village surveyed have no toilet. The low population density in the majority of the area permits the villagers to continue doing their things in the surrounding brush areas.

(7) Education

In the study area, 90.75% of the total villages have primary schools. However, the building conditions of the schools are poor and there is lack of school materials and teachers. In most of the villages primary schools classes are up to grade 3 only, because of insufficient classrooms and due to remote location of the secondary school, the children have the tendency to drop school in their early years. When they finish school they tend to migrate to other villages or to town to work as hired agriculture labor or to work in other sector. The villagers consider the insufficient classroom and primary school offering up to grade 5 only as a major constraint that implicate the labor force of the village.

Secondary schools cover only 20.37% of the total villages inventoried. The secondary school children have to travel an average of 5 kms to reach school. Considering the present conditions of access roads, this is very far for the children. Some of them have to go by foot. In both primary and secondary school, there is low enrolment of children to school especially among the girls.

[10] Bolikhamsai 3844 HH to 4221 HH, Khammouane 3416 HH to 3528, and Savanakhet 3617 HH to 5201 HH in the 108 villages inventoried.

2.3.2 Farmers' Organizations

(1) Water Users Association (WUA)

In the study area there are four (4) Water User Associations[11] officially registered with the district authority and the Department of Administration of the Office of the Prime Minister. The irrigation schemes are; Muong Kao scheme of Thakhek district in Khammouane province, Ban Veun Tonhen scheme of Xaibouri district, Thasano and Nakae schemes of Khanthabouri district in Savanakhet province.

The WUA is a formal farmers' organization, which has as a juridical personality. Despite their legal independent entity, the WUA is also a communal organization. Therefore, it is governed by a steering committee representing the village administrative authority of all the villages located in the irrigation scheme. The WUA management committee is elected by the WUA's General Assembly and operates the irrigation scheme.

The WUA is not only responsible for the operation and maintenance of the scheme but also responsible for the procurement of input supplies and credit for agriculture production of the members and for the marketing of farm products. With their legal entity, the WUAs have the right to undertake business venture with the APB and trading companies.

Irrigation public assets (pump, headwork, canals and structures) were fully transferred to the association[12]. The irrigation system is presently under the full responsibility of the farmer organization. Irrigation Service Fee (ISF) system has been introduced and in order to recover the cost for future investment, the WUA are in the process of increasing their Irrigation Service Fee (ISF) to cover all O & M costs, and to include a Village Development Funds (VDF). In the dry season of 1997-98 the 4 WUAs located in the study area were able to collect all the ISF and VDF as planned. However, the actual ISF and VDF collected do not cover the full cost to recover the investment of those schemes.

Despite the establishment of WUA through the stepwise process developed by SIRAP, the associations are still young and need to be further strengthened. The balance sheet and financial reports of those WUAs have not been properly audited yet and there has been very limited support from PAFSO and DAFSO. APB is also hesitant to provide medium-term and long-term loans to the associations. Firstly, due to the precocious legal entity and the financial transparency of these organizations, and secondly, because APB is lacking funds to provide the credit they require.

[11] The establishment of the 5 WUAs were done according the irrigation management transfer (IMT) process developed by the Sustainable Irrigated Agriculture Project (SIRAP), the MAF decree no 153 and prime minister order No. 26/PM.
[12] The IMT transfer was designed by the Sustainable Irrigated Agriculture Project (SIRAP) of the Mekong River Commission (MRC).

(2) Water Users Group (WUG)

In all the irrigation schemes formulated by DOI and PAFSO, there is a Water User Group (WUG) established by the village authority. The WUGs[13] are established under the directive of DOI for operation and maintenance of the irrigation scheme. The organization is a village driven organization headed by the chief or deputy chief of village. The size of the organization varies depending on the size and complexity of the irrigation scheme. In irrigation schemes covering more than one village, the WUG committee is set to include members of all villages. The village that has the most land/members is taking the lead and WUG's chairman position. The By laws and article of association of the WUGs are drafted by the PAFSO of each province. The organizational chart of WUG is similar to the WUA but with less function depending on the size of the scheme.

In the case of WUGs, the responsibility for the operation and maintenance of the irrigation scheme had been transferred to the farmer organization. The WUGs are operating and collecting water charges with the farmers. Water charge in most of the schemes is structured to cover electricity or fuel expenses (in case of pump scheme), cost for mechanical operation and maintenance and fee for the pump operator. In some of the schemes, fee for water masters and premium for the WUG committee members are also included.

However, the public irrigation assets still belong to the government. For major repairs, the WUGs get assistance from PAFSO. In Savanakhet and Khammouane, WUGs took the initiative to borrow money from the bank to construct main canal and secondary canals[14]. This only proves that there is a developing sense of ownership among the farmers and a tendency for strong WUGs to be upgrades their status to WUA.

In the long run, WUGs that are relying on the village legal entity to manage and operate irrigation system would not be reliable to undertake any legal obligation i.e. to loan from APB as an organization. Because the function of the village authority is as a social administration and not conform to do business. The previous process as practiced by the WUGs in Savanakhet and Khammouane does not guaranty the payback of the loan from the APB and SOCB which that have provided medium term loan to the farmers. The loans were approved based on a petition and guaranteed by the village and district authorities. Hence, in the concept of the master plan, the development of the legal framework of WUG would be an important component.

(3) APB Credit Groups

The credit policy of APB is to provide credit to group of farmers (5 to 10 families). In the

[13] Non formal water user organization are called water user group
[14] Case of Lahanam and Boua Khai, in Savanakhet, and Hinkhan scheme in Khammouane.

study area, especially in the irrigated fields, there are established APB credit groups. The practice to group the farmers for the credit program is done differently in the 3 provinces. In Bolikhamsai credit are provided to the WUG's production groups[15] (water blocks group). But in Savanakhet the grouping of farmers is done independently from the water user organization.

The APB credit groups are formed for seasonal loan (short term). They are heterogeneous, therefore will not be composed of the same persons when the groups are reformed for the next season. The APB credit groups have no production function. They rule as a credit group with the sole aim to return the money back to the APB at the end of each production season. After payment has been made to the bank, the groups vanish.

Because the only reason for the farmers to group themselves is to get credit support (in kind as well as in cash), there is no production function. No support is provided from APB to the credit groups in terms of knowledge about the utilization of the supplies (fertilizer) and equipment. On the other hand, PAFSO and DAFSO neither provide the technical knowledge concerning the appropriate use of fertilizer and equipment. However, the model developed by APB to provide credit to the farmers grouped into blocks and called production group under WUG in Bolikhamsai could be a good starting point.

(4) Production Group

In the organization of WUG, the water block groups are called production groups. However, their function is mainly for water management. The function of "production grouping" is very limited. Farmers are not sharing resources to buy fertilizer and other inputs for the production and are still selling the farm products individually.

Grouping of farmers for the production of specific crops or livestock is not practiced in the study area. The reason is that rice is the dominant crop and there is limited contract venture in the area.

(5) Contract Farming Group

The only crop under contract farming activity in the study area is tobacco. In the Sebangfai plain of Khammouane province particularly, the Lao Tobacco Company engaged in contracts with groups of farmers to produce tobacco. The contract-farming group also gets credit support from APB.

[15] Case of Hadsaykhoune, Thana, Sivilay and Nongkeun in Bolikhamsai.

(6) DAFSO Demonstration Group

In some areas, DAFSO organizes farmers into production groups for growing some particular crops or for doing irrigated agriculture practice. It is a kind of group dynamic before initiating the farmers to form WUG. It is, however, observed that these demonstration groups are not viable and disappear as soon as the support of DAFSO is stopped, Khanthabouri district, Savanakhet.

2.4 Present Condition of Agriculture

2.4.1 Paddy production in the study area

Paddy is the dominant crop in the study area. Lowland fields are being used for paddy cultivation during wet season. Only a single crop of rice is grown and the land is not used for other purposes after the harvest of the rice crop apart from being grazing grounds buffaloes and cows. The areas planted with paddy for the past 9 years are shown in Table 2-3. The annual cultivated paddy area in the study area for 1998-99 season is estimated at 98,200 ha comprising about 77,500 ha in the wet season and 20,700 ha in the dry season, respectively, which is about 10 % of the total cultivated paddy area in Lao PDR. The majority of rice produced in the study area came from lowland wet paddy fields during the wet season, but recently, irrigated paddy production during the dry season is increasing rapidly.

Unit yields and annual production of paddy are presented in the Table 2-4. The average unit and production are unstable and varies season by season. According to data collected from three PAFSO, the average yield of study area ranged between 2.2 to 3.0 ton/ha in the wet season and 2.1 to 4.3 ton/ha in dry season, respectively. The paddy production fluctuated according to the paddy varieties and planting methods used. The production of paddy in the study area for 1997-98 season was about 240,000 tons or about 15% of national production.

Rice fields in the plains along the major rivers are subjected to serious over-bank floods, on average once every three or four years. The study area is prone to occasional droughts that can reduce production of rice, particularly in the areas where water supply is already marginal. The following figures show the summary of recent trend of flood damage in the three provinces.

2.4.2 Paddy varieties and their features

Rice is the staple food crop of the Lao people. The very unique feature of paddy cultivation in Lao PDR is the occurrence of predominantly glutinous paddy varieties throughout the country. Glutinous varieties have high amylopectin and low amylose content.

Table 2-3 (1/2) Paddy Planted Area, Flood Affected area and Harvested area (1990-1999)

	Wet season								
	1990	1991	1992	1993	1994	1995	1996	1997	1998
Bolikhamsai									
Planted	ND	ND	ND	ND	13,489	15,712	14,811	15,973	18,077
F Affected	ND	ND	ND	ND	0	8,906	1,770	5,001	0
Harvested	ND	ND	ND	ND	13,489	6,806	13,041	10,972	18,077
1 Thaphabath									
Planted	ND	ND	ND	ND	1,644	4,121	2,776	3,048	3,464
F Affected	ND	ND	ND	ND	0	1,250	529	1,801	0
Harvested	ND	ND	ND	ND	1,644	2,871	2,247	1,247	3,464
2 Bolikham									
Planted	ND	ND	ND	ND	2,121	1,651	1,600	1,911	2,023
F Affected	ND	ND	ND	ND	0	692	294	230	0
Harvested	ND	ND	ND	ND	2,121	959	1,306	1,681	2,023
3 Paksan									
Planted	ND	ND	ND	ND	5,882	6,340	6,341	6,640	7,528
F Affected	ND	ND	ND	ND	0	3,454	470	1,874	0
Harvested	ND	ND	ND	ND	5,882	2,886	5,871	4,766	7,528
4 Pakkadin									
Planted	ND	ND	ND	ND	3,842	3,600	4,094	4,374	5,062
F Affected	ND	ND	ND	ND	0	3,510	477	1,096	0
Harvested	ND	ND	ND	ND	3,842	90	3,617	3,278	5,062
Khammouane									
Planted	25,250	24,785	24,912	24,636	24,519	28,734	26,391	26,950	23,911
F Affected	1,148	10,470	0	1,032	10,270	12,264	13,547	5,335	0
Harvested	24,102	14,315	24,912	22,381	15,645	17,258	13,394	21,615	23,911
5 Hinboun									
Planted	6,145	5,932	5,951	5,566	6,623	7,769	6,951	6,808	4,100
F Affected	10	2,870	0	887	3,481	3,870	2,032	1,789	0
Harvested	6,135	3,062	5,951	4,402	3,142	3,899	4,919	5,019	4,100
6 Thakhek									
Planted	7,383	5,755	6,060	6,168	6,359	6,290	6,316	6,752	6,742
F Affected	118	582	0	70	813	2,474	1,865	982	0
Harvested	7,265	5,173	6,060	5,793	5,546	3,816	4,451	5,770	6,742
7 Nongbok									
Planted	11,723	9,333	9,125	9,234	9,137	10,777	9,555	9,775	9,556
F Affected	1,020	4,362	0	0	4,331	4,120	6,940	2,297	0
Harvested	10,703	4,971	9,125	8,772	4,807	6,657	2,615	7,478	9,556
8 Sebangfai									
Planted	—	3,766	3,776	3,668	2,400	3,898	3,569	3,615	3,513
F Affected	—	2,657	0	75	1,645	1,800	2,710	267	0
Harvested	—	1,109	3,776	3,414	2,150	2,886	1,409	3,348	3,513
Savanakhet									
Planted	ND	ND	ND	ND	ND	36,571	33,122	40,701	37,538
F Affected	ND	ND	ND	ND	ND	4,973	10,894	3,611	1,924
Harvested	26,872	21,711	29,644	16,724	29,718	31,598	22,228	37,090	35,559
9 Xaibouri									
Planted	ND	ND	ND	ND	ND	8,487	7,575	7,662	7,214
F Affected	ND	ND	ND	ND	ND	4,206	6,059	1,088	226
Harvested	7,003	2,942	8,098	2,597	3,903	4,281	1,516	6,574	6,988
10 Khanthabouri									
Planted	ND	ND	ND	ND	ND	11,236	10,384	5,730	5,515
F Affected	ND	ND	ND	ND	ND	447	929	310	0
Harvested	10,129	9,033	9,716	6,623	10,040	10,789	9,455	5,420	5,460
11 Songkhaon									
Planted	ND	ND	ND	ND	ND	16,848	15,163	21,069	19,052
F Affected	ND	ND	ND	ND	ND	320	3,906	1,857	1,641
Harvested	9,740	9,736	11,830	7,504	15,775	16,528	11,257	19,212	17,411
12 Xaibouathong									
Planted	-	-	-	-	-	-	-	6,240	5,757
F Affected	-	-	-	-	-	-	-	356	57
Harvested	-	-	-	-	-	-	-	5,884	5,700
Study area									
Planted	25,250	24,785	24,912	24,636	38,008	81,017	74,324	83,624	79,526
F Affected	1,148	10,470	0	1,032	10,270	26,143	26,211	13,947	1,924
Harvested	50,974	36,026	54,556	39,105	58,852	55,662	48,663	69,677	77,547

Source: PAFSO

Table 2-3(2/2) Paddy Planted Area, Flood affected area and Harvested area (1990-1999)

	Dry season								
	1990	1991	1992	1993	1994	1995	1996	1997	1998
Bolikhamsai									
Planted	ND	ND	ND	ND	4	11	21	222	4,739
F Affected	ND	ND	ND	ND	0	0	0	0	126
Harvested	ND	ND	ND	ND	4	11	21	215	4,613
1 Thaphabath									
Planted	ND	ND	ND	ND	0	0	0	122	1,102
F Affected	ND	ND	ND	ND	0	0	0	0	12
Harvested	ND	ND	ND	ND	0	0	0	114	1,090
2 Bolikham									
Planted	ND	ND	ND	ND	0	0	0	4	124
F Affected	ND	ND	ND	ND	0	0	0	0	12
Harvested	ND	ND	ND	ND	0	0	0	4	112
3 Paksan									
Planted	ND	ND	ND	ND	4	8	17	93	3,088
F Affected	ND	ND	ND	ND	0	0	0	0	7
Harvested	ND	ND	ND	ND	4	8	17	93	3,081
4 Pakkadin									
Planted	ND	ND	ND	ND	0	3	4	4	425
F Affected	ND	ND	ND	ND	0	0	0	0	95
Harvested	ND	ND	ND	ND	0	3	4	4	330
Khammouane									
Planted	693	314	1,306	797	338	689	922	3,247	5,511
F Affected	0	0	0	0	0	0	0	0	0
Harvested	693	314	1,306	797	338	689	922	3,241	5,511
5 Hinboun									
Planted	4	0	5	0	0	0	3	593	1,050
F Affected	0	0	0	0	0	0	0	0	0
Harvested	4	0	5	0	0	0	3	593	1,050
6 Thakhek									
Planted	505	174	307	247	208	279	349	756	1,350
F Affected	0	0	0	0	0	0	0	0	0
Harvested	505	174	307	247	208	279	349	750	1,350
7 Nongbok									
Planted	185	140	650	350	50	179	264	1,303	2,111
F Affected	0	0	0	0	0	0	0	0	0
Harvested	185	140	650	350	50	179	264	1,303	2,111
8 Sebangfai									
Planted	-	-	344	200	80	231	306	595	1,000
F Affected	-	-	0	0	0	0	0	0	0
Harvested	-	-	344	200	80	231	306	595	1,000
Savanakhet									
Planted	0	0	0	0	1,199	1,486	2,361	6,239	10,668
F Affected	0	0	0	0	5	29	20	28	54
Harvested	468	399	1,897	1,051	1,194	1,457	2,341	6,112	10,614
9 Xaibouri									
Planted	0	0	0	0	782	910	1,511	4,066	6,330
F Affected	0	0	0	0	5	0	0	0	8
Harvested	196	206	862	703	777	910	1,511	4,066	6,322
10 Khanthabouri									
Planted	0	0	0	0	125	182	300	399	674
F Affected	0	0	0	0	0	29	20	0	16
Harvested	132	143	205	180	125	153	300	300	658
11 Songkhaon									
Planted	0	0	0	0	292	394	550	1,734	3,083
F Affected	0	0	0	0	0	0	0	20	0
Harvested	140	50	830	168	292	394	530	1,714	3,083
12 Xaibouathong									
Planted	-	-	-	-	-	-	-	40	581
F Affected	-	-	-	-	-	-	-	8	30
Harvested	-	-	-	-	-	-	-	32	551
Study Area									
Planted	693	314	1,306	797	1,541	2,186	3,304	9,708	20,918
F Affected	0	0	0	0	5	29	20	28	180
Harvested	1,161	713	3,203	1,848	1,536	2,157	3,284	9,568	20,738

Source: PAFSO

Table 2-4 (1/2) Paddy Production and Yield (1990-1999)

	Rain season								
	1990	1991	1992	1993	1994	1995	1996	1997	1998
Bolikhamsai									
Production	ND	ND	ND	ND	24,281	10,669	29,596	19,133	54,097
Yield	ND	ND	ND	ND	1.80	1.57	2.27	1.74	2.99
1 Thaphabath									
Production	ND	ND	ND	ND	2,959	4,464	5,123	2,669	11,778
Yield	ND	ND	ND	ND	1.80	1.55	2.28	2.14	3.40
2 Bolikham									
Production	ND	ND	ND	ND	3,818	2,502	2,977	1,681	5,260
Yield	ND	ND	ND	ND	1.80	2.61	2.28	1.00	2.60
3 Paksan									
Production	ND	ND	ND	ND	10,588	3,581	13,248	7,244	22,885
Yield	ND	ND	ND	ND	1.80	1.24	2.26	1.52	3.04
4 Pakkadin									
Production	ND	ND	ND	ND	6,916	122	8,248	7,539	14,174
Yield	ND	ND	ND	ND	1.80	1.36	2.28	2.30	2.80
Khammouane									
Production	65,151	28,470	63,689	48,318	44,102	46,526	21,917	52,167	63,791
Yield	2.70	1.99	2.56	2.16	2.82	2.82	1.64	2.41	2.67
5 Hinboun									
Production	15,640	6,026	14,281	9,024	6,692	7,118	5,706	7,328	6,150
Yield	2.55	1.97	2.40	2.05	2.13	1.83	1.16	1.46	1.50
6 Thakhek									
Production	19,977	10,347	14,301	12,281	13,810	10,189	9,925	15,925	19,080
Yield	2.75	2.00	2.36	2.12	2.49	2.67	2.23	2.76	2.83
7 Nongbok									
Production	29,534	10,190	24,912	20,526	16,343	22,967	4,680	23,256	31,535
Yield	2.76	2.05	2.73	2.34	3.40	3.45	1.79	3.11	3.30
8 Sebangfai									
Production	0	1,908	10,195	6,486	7,257	6,252	1,606	5,658	7,026
Yield	#DIV/0!	1.72	2.70	1.90	3.38	2.98	1.14	1.69	2.00
Savanakhet									
Production	79,938	66,514	91,168	47,087	100,368	97,448	60,207	125,853	117,593
Yield	2.97	3.06	3.08	2.82	3.38	3.08	2.71	3.39	3.31
9 Xaibouri									
Production	18,913	7,357	23,970	12,453	11,319	12,843	4,700	21,037	23,060
Yield	2.70	2.50	2.96	4.80	2.90	3.00	3.10	3.20	3.30
10 Khanthabouri									
Production	31,805	28,002	29,342	16,624	32,128	34,525	28,265	18,157	16,380
Yield	3.14	3.10	3.02	2.51	3.20	3.20	2.99	3.35	3.00
11 Songkhaon									
Production	29,220	31,155	37,856	18,010	56,921	50,080	27,242	67,242	60,939
Yield	3.00	3.20	3.20	2.40	3.61	3.03	2.42	3.50	3.50
12 Xaibouathong									
Production	-	-	-	-	-	-	-	19,417	17,214
Yield	-	-	-	-	-	-	-	3.30	3.02
Study area									
Production	145,089	94,984	154,857	95,405	168,751	154,643	111,720	197,153	235,481
Yield	2.85	2.64	2.84	2.44	2.87	2.78	2.30	2.83	3.04

Source: PAFSO

Table 2-4(2/2) Paddy Production and Yield (1990-1999)

	Dry season								
	1990	1991	1992	1993	1994	1995	1996	1997	1998
Bolikhamsai									
Productio	ND	ND	ND	ND	13	25	63	879	19,330
Yield	ND	ND	ND	ND	3.40	2.30	3.02	4.10	4.19
1 Thaphabath									
Productio	ND	ND	ND	ND	0	0	0	442	4,731
Yield	ND	ND	ND	ND	0.00	0.00	0.00	3.89	4.34
2 Bolikham									
Productio	ND	ND	ND	ND	0	0	0	14	526
Yield	ND	ND	ND	ND	0.00	0.00	0.00	3.50	4.70
3 Paksan									
Productio	ND	ND	ND	ND	13	19	51	410	13,248
Yield	ND	ND	ND	ND	3.40	2.43	3.00	4.41	4.30
4 Pakkadin									
Productio	ND	ND	ND	ND	0	6	12	12	825
Yield	ND	ND	ND	ND	0.00	1.95	3.10	3.20	2.50
Khammouane									
Productio	2,671	1,099	5,284	3,438	1,391	3,132	4,476	13,872	27,405
Yield	3.85	3.50	4.05	4.31	4.12	4.55	4.85	4.28	4.97
5 Hinboun									
Productio	12	0	20	0	0	0	13	1,601	4,200
Yield	3.50	0.00	4.06		0.00	0.00	4.33	2.70	4.00
6 Thakhek									
Productio	1,818	609	1,246	1,156	976	1,256	1,678	3,468	7,831
Yield	3.60	3.50	4.06	4.68	4.70	4.50	4.81	4.62	5.80
7 Nongbok									
Productio	841	490	2,639	1,470	176	836	1,270	6,619	11,294
Yield	4.55	3.50	4.06	4.20	3.50	4.67	4.81	5.08	5.35
8 Sebangfai									
Productio	-	-	1,379	812	240	1,040	1,515	2,184	4,080
Yield	-	-	4.01	4.06	3.00	4.50	4.95	3.67	4.08
Savanakhet									
Productio	1,386	685	1,465	3,309	4,456	5,269	9,560	25,475	47,916
Yield	0.00	1.72	0.77	3.15	3.73	3.62	4.08	4.17	4.51
9 Xaibouri									
Productio	735	210	342	2,229	2,789	3,340	5,999	16,305	29,713
Yield	0.00	1.02	0.40	3.17	3.59	3.67	3.97	4.01	4.70
10 Khanthabouri									
Productio	301	376	657	576	438	570	1,176	1,660	2,797
Yield	0.00	2.63	3.20	3.20	3.50	3.73	3.92	5.53	4.25
11 Songkhaon									
Productio	350	99	466	504	1,229	1,359	2,385	7,370	13,257
Yield	0.00	1.98	0.56	3.00	4.21	3.45	4.50	4.30	4.30
12 Xaibouathong									
Productio	ND	ND	ND	ND	ND	ND	ND	140	2,149
Yield	ND	ND	ND	ND	ND	ND	ND	4.38	3.90
Study Area									
Productio	4,057	1,784	6,749	6,747	5,860	8,426	14,099	40,226	94,651
Yield	3.49	2.50	2.11	3.65	3.82	3.91	4.29	4.20	4.56

Source: PAFSO

1998 Dry season: Projection

Non-glutinous varieties are also grown by both upland and lowland farmers but to a lesser extent in the uplands of the northern region.

In the study area, traditional rice varieties predominate during the wet season. At present, some farmers plant improved varieties during the wet season because of the high productivity. The level of adoption of modern varieties was greater in some districts, where more than of 50 % of varieties being grown were improved varieties. The most popular improved varieties are TDK-01, -02, -03, RD-6, -8, -10, CR203 and Mali 105. Improved varieties are usually grown in association with traditional varieties. On the average, farmers in the study area grow two to three different varieties which have different growing periods. Farmers believe that a mixture of varieties reduces the labor requirement during the peak field operations of transplanting and harvesting.

Traditional, low input requirement rice varieties are photosensitive and cannot be grown during the dry season. During the dry season, high yielding varieties can be grown. Farmers grow glutinous types in both seasons, exclusively.

2.4.3 Farming practices

Common farming practices adopted in the study area are the following:

(1) Seedbed Preparation and Management

The usual wet-bed method is used to raise rice seedlings. Seedbed preparation commences with the first wet season rain (around mid-May) and usually involves a double plowing and single harrowing. Seeding rates of about 45 kg/ha in wet season and 80 kg/ha in dry season are being used, respectively. Majority of the farmers apply farmyard manure to the seedbed.

The dry-bed method and traditional unique dry-bed method are also observed in some districts.

(2) Land Preparation

Land preparation is related to the onset of the wet season rain and commences when sufficient water has accumulated to facilitate plowing. Buffaloes are used to pull wooden-frame plows and harrows and two plowings and one harrowing are usually undertaken. Recently, the number of hand tractors is rapidly increasing in most of the study area. Gradually, the land preparation done by buffaloes is being replaced by hand tractors.

(3) Transplanting

Transplanting is determined by rainfall distribution and therefore related to the timing of

land cultivation. Usually, manual transplanting is done during late June - early July. seedling age at transplanting ranges between 30 - 35 days. Transplanting is undertaken using family labour rather than a communal activity. The average number of seedlings per hill is about 3, and hill spacing of 20 cm x 20 cm (wet season) or 15 cm x 15 cm (dry season) is usual. Some farmers in Paksan district have introduced wet direct seeding method for dry season paddy cultivation.

(4) Fertilizer application

Few farmers apply chemical fertilizer for the wet season paddy. Urea (46:0:0) and ammophos (16:20:0) are common. However, application rates are very low and the fertilizer, when used, is usually applied as a single top dressing.

For dry season cropping, the recommended fertilizer rate in paddy rice cultivation is 100-150 kg ammonium phosphate (N:P:K=16:20:0) as basal dressing and 100-150 kg urea (N:P:K=46:0:0) as top dressing per hectare. The high yielding varieties that can be grown during the dry season need fertilization to give a satisfactory yield. Although the fertilizer rates are not high, farmers do not always apply the recommended rates, as fertilizer prices are high and most of the time cannot be found at in the market when needed. Farmyard manure is applied by some farmers, but mostly for seedbed preparation.

(5) Crop Management

During wet season rice cropping, no serious pest incidences have been reported. As such, pesticide use for wet season rice cropping is virtually nil.

Pest incidence in rice is greater during dry season cropping than the wet season. Stem borer outbreaks and to a lesser extent of brown plant hopper can reduce the yields. Therefore some form of pest control might be necessary during the dry season. Most of farmers however, do not apply prophylactic insecticides but apply them when the pest population threatens to affect the crop yield.

Manual weeding is done by household members, with weeding activities undertaken 1 - 3 times within the cropping period. However, weed infestation and weeding are not regarded as serious problems in the study area.

Harvesting, threshing and winnowing are undertaken manually using family labor. Harvesting of short maturing varieties planted higher in the terrace can take place up to 30 days before harvesting of late maturing varieties grown in the lower part. In Bolikhamsai and Khammouane, majority farmers use machine for threshing on contract basis.

2.4.4 Vegetables and Other crops

Generally, farmers grow vegetables along riverbanks or upland fields and plant fruit trees in the home garden in order to supplement their diets and to generate cash income. Almost all farmers along major rivers grow vegetables on riverbanks during the dry season. Individual plots are very small and farmers use river water for irrigation. Vegetable production in the study area is recognized as an important agricultural activity during the dry season.

2.4.5 Livestock

Almost all farmers maintain a variety of livestock. Most of the animals raised are for domestic use, food, draught power, transport or savings. Buffaloes are used for land preparation. Cows are not used for land preparation, but they are mainly used as draft animals for pulling carts and, occasionally for meat. Pigs, poultry and ducks are important sources of protein in the study area. However, buffaloes, cattle and pigs are sold to domestic markets and some are also exported to other provinces and Thailand.

The most problematic matter for livestock raising is disease control. The main diseases in the study area are hemorrhagic septicemia, cholera for chicken, swine fever for pigs, foot and mouth infection for cattle. The Veterinary Division of the Department of Livestock and Fisheries gives priority for training the village veterinary volunteers to vaccinate the animals. The veterinary services regularly receive vaccines from Vientiane. The areas in the low land do not have severe diseases problems due to their accessibility to the services.

2.4.6 Fisheries and Fish Culture

Indigenous fishing exists in the rural areas where rivers provide a good source of fish. The river fish are mainly for domestic use, but it was also found out that some farmers sell fish to the domestic market. The demand for fish is high and it is easily sold at the markets. Fish is also dried and salted at the household level and forms as important part of the diet for farmers in the study area. The subsistence fishery is probably the most important source of fish.

In most irrigation schemes, new fishponds have been developed, and some existing fishponds have been improved because of assured enough water supply. Many fishponds are located in the study area especially in Savanakhet province. Some farmers seem successful at fish culture and have changed their extensive fish culture to the intensive fish culture system. Savanakhet and Khammouane provinces have production centers of fingerlings. These centers produce approximately 2,721,000 fingerlings annually in Savanakhet and 500,000 fingerlings in Khammouane (big head, common carp, silver carp, Indian carps, pontias, tilapia). In the future the both centers plan to produce more

fingerlings.

Fish culture has a very high potential in the study area, and it is recently on the upward trend. However, the lack of capital and technical experience, and supply of fingerlings has limited the expansion of this potential.

2.5 Finance System and Agricultural Finance

2.5.1. Finance System

(1) Present situation of SOCB

On 16 December 1998 two banks in the north, the Alounmay Bank and Banque Setthathirath, merged with Lane Xang Bank, and two banks in the south, the Nakhornluang Bank and the Phak Tai Bank, were consolidated with Lao May Bank. The Bank of the Lao PDR (hereafter "BOL") officially approved the consolidation on 1 July 1999. The consolidation officially commenced on 1 July and 22 respectively, with 12 branches and service units each, under the new names of Lane Xang Bank Limited and Lao May Bank Limited.

As a result, the State-owned Commercial Banks (hereafter "SOCBs") consist of three banks; Banque Pour le Commerce Exterieur Lao (BCEL), Lane Xang Bank Ltd. and Lao May Bank Ltd. The purpose of restructuring the SOCBs was to expedite and to streamline the staff for the bigger stages, as more experienced human resources are needed in the fields of international trade and foreign exchange since 1997. The "Two-tier System of BOL" remained unchanged. Agricultural Promotion Bank (APB) is not classified as SOCB, but was called as the State-owned Specialized Bank (SOSB).

Lao-Viet Bank, a joint-venture bank owned by BCEL and BIDV on a fifty-fifty basis, was opened in Vientiane on 22 June 1999. As a result, there are three joint-venture banks in Laos, including the Vientiane Commercial Bank-the only private bank. The banking system of Lao P.D.R. now consists of three SOCBs, a SOSB, three joint-venture banks, seven branches of foreign banks and a representative office (Standard Chartered Bank). At the end of 1998, the main financial accounts of commercial banks are shown in Table 2-5 and foreign currency loans/deposits and overall positions for the same period are shown in Table 2-6.

(2) Present Situation of Auditing

With the exception of APB, three SOCBs are subject to auditing since 1997 by an external auditing company, KPMG, in addition to supervision of BOL. The KPMG, based in Australia and under contract with World Bank submits the audited reports to BOL every April, with assistance of KPMG Vietnam, KPMG Lao and KPMG Thailand.

Table 2-5 Major Financial Indicator of Commercial Banks (at end of 1998)

Unit : million Kip

	Loan	Deposit	Profit before tax	Paid-in capital
BCEL	197,922	399,231	-14,822	1,933
Lancexange Ltd.	42,330	88,274	-115	910
Lao May Ltd.	68,960	108,494	306	1,157
Total of 3 SOCB	309,212	595,999	-14,631	4,000
APB	47,010	17,721	1,188	800
State-owned Special Bank	47,010	17,721	1,188	800
Vientiane Commercial Bank	10,979	19,219	860	3,712*
Joint Development Bank	41,340	54,428	-7,427	21,631*
Total of 2 JV Banks	52,319	73,647	-6,567	25,343
Bangkok Bank	77,895	11,049	-359	25,215*
Siam Commercial Bnak	2,167	29,917	-1,281	21,203*
Krungthai Bank	41,729	5,704	-1,215	24,781*
Thai Farmers Bank	10,192	11,632	10,096	21,195*
Thai Military Bank	13,514	33,418	-3,599	21,261*
Bank of Ayoudhya	9,445	9,136	236	22,764*
Public Bank	7,673	14,544	184	21,195*
Total of 7 Foreign Bank	162,615	115,400	4,062	157,614
Grand Total	571,156	802,767	-15,948	187,757

(*) including reserves. (Source : BOL)

Table 2-6 Foreign Currency Position of Commercial Banks (at end of 1998)

Unit : million Kip

	Loan in F/C	Deposit in F/C	Other Assets in	Other Liabilities	Overall Position*
BCEL	174,442	307,957	256,362	70,369	+52,478
Lancexange Ltd.	5,867	36,601	16,130	196	-14,800
Lao May Ltd.	37,825	62,998	20,675	3	-4,501
Total of 3 SOCBs	218,144	407,556	293,167	70,568	+33,177
APB	0	2,456	1,124	0	-1,332
State-owned Special Bank	0	2,456	1,124	0	-1,332
Vientiane Commercial Bank	9,664	17,233	8,638	489	+580
Joint Development Bank	38,331	47,849	9,049	4,445	-4,914
Total of 2 JV Banks	47,995	65,082	17,687	4,934	-4,334
Bangkok Bank	77,895	9,637	1,767	50,379	+19,646
Siam Commercial Bnak	1,733	28,354	34,445	0	+7,824
Krungthai Bank	41,729	5,272	10,578	24,694	+22,341
Thai Farmers Bank	10,192	11,632	23,872	4,860	+17,933
Thai Military Bank	13,168	30,705	31,348	3,984	+9,827
Bank of Ayoudhya	9,445	9,136	9,285	576	+10,976
Public Bank	7,293	13,912	28,754	9,311	+12,824
Total of 7 Foreign Bank	160,802	105,676	140,049	93,804	+101,371
Grand Total	426,941	580,770	452,027	169,306	+128,882

(*) "+" in overall position means "long"in foreign currencies, while "-" means "short".

(Source : BOL)

According to their balance sheets as at the end of September,1999, the non-performing loan（NPL） totals 14.6 billion Kip and accounts for 3.6 times of their paid-up capital (4 billion Kip). Further, the KPMG auditor's report submitted in April, 1999 claims that out of total loans for 164.4 billion Kip, 72.5% or 119.2 billion Kip is ought to be classified to NPL at the end of 1997.

On the other hand, APB is subject only to the auditing by BOL. NPL of APB reported only 0.6 billion Kip out of a loan balance for 91.9 billion Kip. Further, APB has appropriated 0.35 billion Kip out of the NPL as a loan loss by means of business profit of the fiscal year 1999 for 8.1 billion Kip. At the end of 1999 its equity balance was 9.3 billion Kip and the owned capital ratio was 6.3%.

(3) Monetary operation of central bank and interest rate system

(a) Monetary operation

Traditionally the central bank (BOL) has three measures in monetary operation: official interest rate, reserve requirements and open market operation. BOL does not decide the specific official interest rate at which money is lent to commercial banks, while the rate of reserve requirements remained unchanged recently and the balance of central bank bills (BOL bills) is now comparatively small. Under these circumstances, the traditional operations of BOL could not operate and perform effectively.

The rate of reserve requirements has been changed from 10% and subjected to 12 % since July 1995. Above all, as the SOCBs are not allowed to lend more than 80 % of their deposits and there is always more than 20 % of surplus money, which prevent reserve requirements from working effectively.

BOL bills are discount bills with maturity of 6 months and 1 year to be sold by SOCBs. In 1999 about 12 billion Kip was sold with maturity of 6 months at 60 % p.a. The outstanding balance of BOL bills as of end of September 1999 was placed at 43,169 million Kip. In addition to BOL bills, there is an outstanding balance of 5,126 million Kip: Lottery Savings Bonds with maturity of 5 years at 1 % p.a. The total bills held by the commercial banks are 520 million Kip of BOL bills and 12,608 million Kip of TB (Treasury Bills or MOF bills), totaling in 13,128 million Kip, which accounts for only 1.6 % of total deposits of commercial banks. As such, monetary adjustments through bills operation are quite limited.

Recent Issuance of BOL bill & TB

Unit : billion Kip

Scale	Issued Amount (billion Kip)	Duration (months)	Interest Rate (% p.a.)	Initial date of issuance	Balance (Sept.30,1999)
BOL bill					
1. 20 billion	20	6	24%	Sept.13, 1996	3.25
2. 15 billion	15	12	26%	Jan. 29, 1998	8.88
3. 20 billion	20	6	30%	Nov.16, 1998	18.80
4. 50 billion	12 .44	6	60%	April 1, 1999	12.44
Total	67.44				43.17
T B					
1. 13 billion	13	6	22－24%	Oct. 24, 1996	7.90
2. Auction	20	Various	Various		1.00
3. 55 billion	25.08	6	30%	Jan. 11, 1999	26.08
Total	58.08				33.98

（Source : BOL）

In view of these, the monetary operation of BOL has to depend on direct financial maneuver by means of increase/decrease of loans or supply/absorption of deposits, accounting for 28% of total balance of loans of commercial banks. Actually the financial squeeze in September 1999, was triggered by the government's decision to enforce severe tax collection by MOF, followed by BOL's absorption of loans and deposits, causing all commercial banks to decrease their lending balance and finally the credit. The commercial loan balance was slashed by 23 % at the end of October, as compared with the previous month.

(b) Interest rate system

The interest rates of deposits with commercial banks are decided freely. However, as the ceiling of loan interest rate is fixed at 30 % p.a. by BOL, recent interest rates of deposits are almost fixed under 30 %, like the table of APB as below, which remained unchanged since September 1998.

Deposit interest rate of APB (as at November 30,1999)

Savings Account		12 % p.a.
Time Deposit	3 months	15% p.a.
	6 months	18% p.a.
	1 year	24% p.a.
	18 months	25% p.a.
	2 years	26% p.a.
	over 2 years	28% p.a.

The main loans extended by APB are farm-operation loans to farmers. Despite the recent hyper inflation, the interest rates for farm-operation loans funded by governmental subsidies remain unchanged at low of 7% to 10% p.a., including 5 % of spread for APB, as per the table shown below:

Interest System of Farm Operation Loans

(as at November 30,1999)

	Loan interest of BOL to APB	Loan interest of APB to farmers	Spread for APB
Within 1 year	5% p.a.	10% p.a.	5% p.a..
Within 3 years	3% p.a.	8% p.a.	5% p.a.
Over 3 years	2% p.a.	7% p.a.	5% p.a.

Interest rates for other agriculture-related loans are the general loan interest rates, subject to 30% ceiling, based on rates of customers' deposit and BOL deposit as fund resources.

2.5.2. Agricultural Finance

(1) Growth of APB

APB is the sole SOCB permitted to operate banking business in the rural areas of Lao PDR. APB is the major player in the agricultural finance as it is endowed with various privileges by GOL including the concessional loan from BOL. However, its service reached only 20% of total farm households in the country. Under the hyperinflation that prevailed in the country, the nominal amount of APB loan and deposits are increasing. However, if adjusted by CPI deflator (Dec.1995=100), real value of the loan has decreased in 1997 and 1998 F / Y as are shown in the table below.

Growth of APB Unit: Kip million

	Dec 1995	1996	1997	1998	1999
Deposit					
Amount	2,850	5,358	9,372	27,309	46,375
Adjusted	2,850	4,993	6,565	7,906	7,220
Net Amount Index (%)	100	175	230	277	253
Loans					
Amount	17,302	20,690	29,515	46,992	91,438
Adjusted	17,302	19,282	20,676	13,605	14,236
Net Amount Index (%)	100	111	120	79	82.3

(2) Loan repayment at APB

The loan repayment ratio at APB in 1997 was 44% for loans over one year period and 80% for the loans less than one year. The same ratio was 59% and 69%, respectively. In 1998 the repayment performance was specifically bad for the loans less than one-year period. This is due to the increased loans to rural enterprises and the incidence of moral hazards capitalizing on the concessional loans under hyperinflation.

(3) Borrower of APB

The details of APB loan are shown in the table below. The majority borrowers are the farmers and rural enterprises. The share of the SOE is not large. The rural enterprises are the rice mills and farm products traders or the village level middlemen. The loan to rural enterprises has been increasing yearly. Its share in the total lending of APB in 1997 was 25.6% and 28.1 in 1998. However, the repayment has decreased from 85.3% in 1997 to 72.4% in 1998. The repayment of the farmers remain almost unchanged at 69.5% in 1997 and 69.7% in 1998.

According to the APB Act, APB may grant loans solely to individuals and corporate entities in the agriculture sector. The number of borrower farm households is not known to APB considering that the primary borrowers are the farmers groups, not the individual farmers. The numbers of farmers belonging to the borrower groups are not reported to the head office of APB, although in most of the APB offices, specifically at the field offices, the data is available. This is a problem related to the conduct of loan classification. APB must develop its MIS system and at the same time APB must develop a system to collect and enter the data on the status of the loans by each individual farmers in the computer.

The following are the comments on the data of borrowers of APB.

i) SOE

Unlike other SOCBs, the amount of loan to SOE is small. This may be an advantage of APB to other SOCBs.

ii) Government and private sectors' joint venture

The government includes provincial governments and the loan amount is not small. Further study is necessary.

iii) Community enterprise

This category includes the entities established by the provincial governments like Food Supply Companies. However, the details of this category of borrowers are not known to APB head office. Further study is necessary.

iv) Rural enterprises

The loans to rural enterprises are increasing fast. The interest rate under this category of borrowers is the market rate of 30% and/or lower. As the BOL's low interest concessional loan to APB is limiting these years and the spread for the concessional loan is not enough to pay the rising cost of APB's operation, the loans under this category of

borrowers are becoming more and more important for APB. However, the loan fund for this category is to be financed by the deposits of the lending APB office which is a limiting factor for the loan activities.

v) Individual farmers (individuals living in Lao PDR)

The loans to individual farmers are granted through the farmer groups. In exceptional cases where there are needs for non-seasonal fund, farm machinery and livestock fund, APB loans are granted based on the mortgage of Individual's assets like land and farm machinery. The ceiling of the loan under this category is the amount of deposits received by the lending office of APB.

APB loan borrowers number & amount by category Unit: Kip million

Category	No.	Amount Oct.1999	Amount (%)
Central gov. SOE	2	12	0.0
Joint Venture of SOE & private sector	54	14,481	15.8
Community enterprise	1,528	7,847	8.6
Rural enterprise	2,022	14,868	16.2
Farmer (No. of group & individual)	13,622	54,564	59.4
Total	17,228	91,771	100.0

(4) Bad loans

At the end of December 1998, the data presented by APB on bad loan amounted to Kip 538 million or 1.1% of total amount of loan. It seemed it was customary for APB to roll over the loans that are already due and the borrowers have no fund to make repayment. The amount calculated in the bad loan is the amount which is equal to loss. On the part of APB, the number of field officers is not enough to monitor the economic performance of each borrower to prevent the incidence of default in repayment.

Based on the BOL Regulation No.07 / BOL (dated 15th Jan.1996) Regulation on the Classification of Loans at commercial banks and other financial institutions (Article 1), all banking institutions must conduct a loan classification at every quarter. Within APB head office, there is an Inspector's Office and the inspection of all APB branch and sub-service units is conducted every month and the result is reported to the Board meeting. The criteria for the classification as described in the Regulation and the Provision for the Possible Loan Loss must be used. The set of criteria for Loan Classification is shown as below.

Category	Criteria
Not classified	Normal loans
I Category (below standard)	Non repayment of principal and nonpayment of interest due.
II (Doubtful)	No collaterals, business suspended、liquidated.
III (Loss)	Borrower's death, disappearance.

Reserve for the Possible Loan Loss (Ratio to the Classified Loan Amount)

Unit: Kip million

Category	I	II	III	Total
Ratio	5%	50%	100%	---
Applicable Amount for APB	116	587	12	715

The above calculation was made based on the data prepared by APB. Under the existing system of APB, the total amount of classified loan ratio of 7.5% must be much lower than the actual conditions. At BAAC of Thailand where the loan administration system is much better organized than at APB, the classified loan ratio is 16.2% (March 1999). It should be noted that in the balance sheet and income statement of APB, it is not clear how the provision has been made.

It is also noted that the classified loan amount is rather concentrated in particular offices of APB. Vientiane Metropolis and Vientiane Special District, together has an amount of classified loan amounting to Kip 1,195 Million which is one-third of the total classified loan at APB, followed by Pakse, Muang Khong and others.

Total Loan and Classified Loan Amount by APB Office Dec. 1998

Unit: Kip million

No.	APB office	Total Loan (A)	Classified Loan (B)	B / A %
1	Vientiane Metropolis	10,590	487	4.6
2	Luangprabang	1,633	15	0.9
3	Savannaket	3,334	213	6.4
4	Pakse	7,968	725	9.1
5	Phongsari	334	0.2	0.0
6	Luangnamtha	1,265	5	0.4
7	Udomsai	1,198	17	1.4
8	Huaphan	500	13	2.6
9	Sayaburi	1,590	117	7.4
10	Bokeo	1,048	---	---
11	Siangkwang	1,241	33	2.7
12	Vientiane Sp.District	3,281	708	21.6
13	Saisonbun	459	10	2.2
14	Borikamsai	2,802	348	12.4
15	Kammuang	2,920	77	2.6
16	Salawan	2,367	95	4.0
17	Sekhong	1,107	96	8.7
18	Attapu	1,157	81	6.9
19	Muangkhong	2,213	468	21.1
	Total	47,008	3,508	7.5

Detail of Classified Loan Unit: Kip million

Category	Total Loan	I	II	III
Amount	3,508	2,322	1,174	12
Ratio	100.0%	66.2	33.5	0.3
No. of Office	18	17	10	0

(5) Lending Regulation, Handbook for Loan

Regulations on the lending and loan administration went into effect in November 1993. The contents have been revised with the change in financial environment. However, it still is serves as the basis of the loan processing at APB. The contents of the Regulation are as shown below. It could be noted that while some parts of the Regulation are strictly observed, some parts are neglected due to insufficient fund and staffing.

I Purpose of APB

1. Short-term loan
2. Medium-term loan
3. Long-term loan

II Lending Procedure

1. Principle of group lending
2. Credit group

3. Formation of credit group
4. Lending Plan
5. Processing by APB
6. Disbursement
7. Administration
8. Notification of Repayment
9. Loan in Arrears
10. Prevention of Arrears
11. Processing loan in arrears
12. Loan restructuring
13. Prepayment
14. Responsibility of guarantor

There is also the Handbook for Loan. The topics are the almost the same, however more detailed loan terms and conditions are described.

(6) Concessional Loan of APB

In compliance with APB Act and Law on Agriculture, APB is granting concessional loans to farming sectors at lower interest than the market rates. The concessional fund is funded by the Central bank of the country at highly concessional conditions. The present state of the concessional loans is shown in the tables below. It should be noted that the short-term loans are still increasing, however, the medium and long-term loans are not increasing as fast as the short term loans.

a. Loan amount by interest rate

Unit: Kip million

	10%&lower		Over 10%		Total	
	No.	Amount	No.	Amount	No.	Amount
1998	28,070	25,721	7,122	20,880	35,192	46,601
1997	20,652	17,499	13,600	11,507	34,252	29,006

Note: Number of loan is the number of account / credit groups and individuals, not the number of beneficiary farmers.

b. Share of Concessional Loan at APB

Unit:%

	10%& lower		Over 10%		Total	
	No.	Amount	No.	Amount	No.	Amount
1998	79.8	55.2	20.2	44.8	100.0	100.0
1997	60.3	60.3	39.7	39.7	100.0	100.0

c. Average Amount per A/C (at end of the F/Y)

Unit: Kip thousand

	10% & lower	Over 10%	Total
1998	916	2,932	1,324
1997	847	846	847

Note: The above tables were prepared based on the number of accounts. For most of the loans at 10% and lower, farmers credit groups are organized comprising 7-15 farmers. The number of farmers belonging to these groups is not available for the moment. There are also individual farmers receiving loans from APB based on the collaterals. A small part of the loans over 10% is granted through the credit group system. However, majority is the loans to individual farmers, rural enterprises, community enterprises based on the collaterals and loans to SOEs.

d. Concessional Loans by Interest Rate

The interest rate structure for the concessional loans is based on the reversed yield system. APB charges 10% for loans over 3 years, 8 % for over 1 year and 7% for one year and less.

Concessional Loan Number & Amount by Interest Rate

Unit: Kip million

	7%		8%		10%		Total	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
1998	2,945	7,881	8,012	7,296	17,113	10,544	28,070	25,721
1997	4,616	6,950	6,294	6,881	9,742	3,668	20,652	17,499

f. Increase of Concessional Loan (F/Y 1998)

Unit: %

	7%		8%		10%		Total	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount
Total	△36.2	13.4	27.3	6.0	75.7	239.5	35.9	47.0

Note, △ is the minus sign.

(7) Loans over 10%

The number and amount of APB loans granted at interest rates over 10% are shown in the table below. In terms of the funding structure of APB, it must be difficult for APB to grant loans at the interest rate of 11 – 15% without external support. Loans at 16 – 20% are maintained at Kip 3 billion levels although its number has decreased sharply. Loans at 21 – 25% have decreased both in number and amount. Loans over 25% have increased significantly. At the moment APB has a policy of placing its emphasis in lending activities on loans over 25%. In 1998, the total loan amount of APB increased by Kip 17,595 million. The concessional loan has increased by Kip 8,222 million. The loans over 10% increased by Kip 9,373 million where as the loan over 25% amount increased by Kip 13,629 million and other loan amount decreased by Kip 4,256 million.

Loans over 10% Number & Amount Unit: Kip million

	11 – 15%		16 – 20%		21 – 25%		Over 25%		Total	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount
1998	1,174	416	1,678	3,369	2,182	3,460	2,088	13,635	7,122	20,880
1997	4,553	2,120	4,478	3,895	4,558	5,486	11	6	13,600	11,507

Change in Number & Amount of Loans over 10% (1998 F / Y)

Unit: %

	11 – 15%		16 – 20%		21 – 25%		Over 25%		T o t a l	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount
1998	- 24.2	- 80.4	- 63.5	- 13.5	-52.1	- 36.9	190 times	2,228 times	- 47.6	81.5%

(8) KR2 Fund to APB

Since FY 1995/96 APB has made use of farm inputs and machinery for its credit in kind loan scheme that were granted to GOL under the KR2 program of the GOJ.

Some part of KR2 assistance involving the grant for heavy farm machinery, was delivered to the Ministry of Agriculture of GOL. However, most part of KR2 assistance was delivered to APB for its lending program. The assistance is granted to APB as a loan from MOF of GOL and must be repaid to MOF. In 1998 / 99F / Y the amount of KR2 assistance delivered to APB amounted to Kip 10,993 million which is 20.5% of the total amount of lending in the F / Y. The KR2 assistance is a kind of grant from GOJ. GOL lends it to APB as a loan without interest. The unit price of KR2 fertilizer and farm machinery is calculated at 65% of market price in Lao PDR. APB may add a margin of 15% for its handling costs. The farmers can receive fertilizer and farm machinery at 20% lower than the market price when they get it through the APB credit in kind. The interest rates charged to farmers are the normal interest rate of 7%, 8% and 10% according to the lending term.

The loan to APB for fertilizer can be recovered within a year. In the past, APB has made repayments to MOF for the loan of 1995 / 96 and 1996 / 97 totaling to Kip 4,493 million. As for the farm machinery loans, APB has made the repayment for the 1995 / 96 loan amounting to Kip 348 million. In total, APB has received Kip 20,830 million and made repayment of Kip 4,841 million. The outstanding amount of the loan to MOF is Kip 15,989 million which is 11.0% of total value asset at the end of December 1999.

The accounting system for the KR2 assistance has not been fully clarified and the inventory control of the KR2 items should be strengthened. KR2 assistance has an important impact on the operation of APB. APB is requested to make the operation more transparent.

Irrigation equipment like pumps and diesel engines are not included in the items of KR2. It will be desirable to include small pumps and engines in addition to the existing items

to assist the GOL in its efforts to improve dry season irrigation.

KR2 Assistance to APB U nit: Kip million

F / Y	Item	Amount	Repaid to MOF	Outstanding
1995 / 96	F. machinery	348	348	---
	Fertilizer	1,058	1,058	---
	T o t a l	1,406	1,406	---
1996 / 97	F.machinery	241	---	241
	Fertilizer	1,935	1,935	---
	T o t a l	2,176	1,935	241
1997 / 98	F. machinery	1,856	---	1,856
	Fertilizer	4,399	1,500	2,899
	T o t a l	6,255	1,500	4,755
1998 / 99	F. machinery	2,183	---	2,183
	Fertilizer	8,810	---	8,810
	T o t a l	10,993	---	10,993
T o t a l	F. machinery	4,628	348	4,280
	Fertilizer	16,202	4,493	11,709
	T o t a l	20,830	4,841	15,989

(9) Present Situation of Screening Ability and Management Ability

About 55% of the present credit balance of APB is accounted by seasonal loans by means of governmental fund. And the beneficiaries of the seasonal loans are almost APB's Credit Groups.

"Loan Screening System" is almost fixed in order to finish allocation of fund one month before the rainy season (from April to October) and dry season (from November to March). All staff of APB exert efforts to furnish funds to farmers as scheduled.

Due to limited of government funds, applications for fund allocation by province and by district are submitted from branches, and approved by the head office.

Within the approved limit, branch credit committees screen and approve each loan to Credit Groups in their respective areas of operations.

When the approved limit falls short, the branch has to submit an additional loan application for approval by of the head office. The head office has to request BOL for the additional fund of the government, in case its loan amounts exceeded the limit set by the government.

For loans other than the seasonal loans (3 months), the branch manager can approve under the authorized limit (Table "Authorized Limits" below) within the balance of deposits mobilized by the branch. As regards the loans over 3 months and within one year, the branch credit committee can approve. For medium and long-term loans over one year, the credit committee of the head office will be asked to screen for approval.

Authorized Limits

	Credit Group For Seasonal Loan	Individual Loan
H.O.(Credit Committee) With attendance of Managing	Within limit of Governmental Fund	No Limit
H.O.(Credit Committee) Without attendance of	Within limit of Governmental Fund	100 Million Kip
3 Branches(Credit Committee)	Within limit of allocated Fund	15－10 Million Kip
15 Service Units(Credit Committee)	Within limit of allocated Fund	10－3 Million Kip

For quick screening and promote efficiency, the branch credit committee is allowed to open attendance of only three members out of five regular members. Also the deputy officers are allowed to attend and decide in place of absent officers. The credit committee of the head office can be opened in attendance of only four members out of five regular members.

(2) Present situation of accounting system

(a) "Bank Accounting System"

On December 16, 1996 BOL approved the Version #4 of "Bank Accounting System" (hereafter "BAS"). Since January 1, 1997 BAS has been used as the accounting manual of all commercial banks in this country.

According to International Accounting Standards, the BAS was prepared by Biotechnology Consultants Limited in France by order of BOL.

(b) Financial control

There are three measures of financial control of central banks, these are; official discount rate, reserve requirement and open market operation.

In Lao P.D.R., BOL has not decided the discount rate because the distribution market of commercial bills is not yet well developed.

As regards to open market operation, the Ministry of Finance issues Treasury Bills in order to raise funds and BOL issues Central Bank Bills in order to absorb excessive money from the market.

In April 1999, BOL issued Central Bank Discount Bills for 12 billion dollars at 5% per month to mature in October, 1999. These were allocated to SOCBs to sell to their customers.

On the other hand, the rate of reserve requirement is set high, at 12% for deposits of both local and foreign currencies. At the end of April, 1999, 153.1 billion Kip was deposited as reserve requirements at BOL, eventually absorbing big money to BOL from the market.

In this connection, the outstanding balance of bank note end of April amounts to 91.0 billion Kip, out of which 73.1 billion Kip circulated as bank notes outside banks.

For commercial banks, BOL's regulations prohibit SOCBs to lend over 80% of their deposits. Therefore, SOCBs can hold only about 8% of deposit balance as cash or deposits to BOL as surplus money keeping 12% of deposit balance at BOL as reserve requirement. In the developed countries, such surplus money can be borrowed by other banks through the call money market. But in this country, SOCBs keep surplus money as just extra money which does not yield any interest.

From the point of view of fund management, SOCBs need not manipulate the daily fund by lending and borrowing. This is the reason why in APB there are no fund operation sheets. It is enough to control the surplus fund that the accountants just watch the balances of own deposit with BOL and other banks and cash at hand.

However, in the period of seasonal loan repayment, APB can afford repayment to BOL for the borrowed money. First, by repaying the borrowed money in the manner of Savings Lottery deposit (13%p.a.) in the name of BOL with APB with a limit of 3 billion Kip and second, by repaying the borrowed money subsidized by the government (5%p.a.).

(c) Present mechanization

At present, 32 computers, 45 typewriters and no copier are used in the branches and service units (hereafter "S.U."). Every branch and sub-unit has a Fax machine each.

As regards to allocation of 32 computers, three branches in Luang Phrabang, Savanakhet and Champasack have 3, 3 and 4 computers respectively, while among 15 S.U., only 11 S.U. has only a computer each, and the other 4 S.U. have 4 (Vientiane), 3 (Khammouane) and 2 each (Bolikhamsai & Saravanh).

A total of 16 computers in head office are used in Banking & Accounting Div.(5), Administrative Div.(2), Credit Div.(2), Head Office Service Div.(5), Internal Audit Div.(1) and Foreign Relation & Projects Div.(1). 3 fax machines are also used in Banking & Accounting Div., Credit Div. and H.O. Service Div.

(d) Management of accounting ledgers & documents

Main ledgers, slips and evidences are kept in responsibility of Banking & Accounting Div. for one year and then stored in the safes of the warehouse for 10 years including one year's storage in Banking & Accounting Div. Some regulations for SOCBs are prepared by BOL.

2.5.3 PCM Workshop on Agricultural Finance

(1) Theme and Participants

The workshop on " Agriculture Finance" was held at the Ministry of Agriculture and Forestry (MAF) in Vientiane, Lao PDR, on January 25-26, 1999. In total, 32 participants from the MAF, the Bank of Lao PDR (BOL), the Agricultural Promotion Bank (APB), Farmer Organizations, and JICA Study Team attended the two-day workshop. Using the participatory planning methods of the PCM, the participants identified the problems and put them on a problem tree. The problem tree elaborated during the session is presented in Figure 2-12. On the basis of the problem tree, the participants were randomly divided into four groups in which further discussion was carried out to construct the objective tree.

(2) Objective Analysis by Group Discussion

The discussion topics in each group were as follows:

- Group A: Strengthening the Agricultural Promotion Bank.
- Group B: Policy for the mobilization of resources and funds for agriculture investment and credit.
- Group C: Improving the coordination between the finance institutions and other government agencies in support of agriculture production.
- Group D: Mobilization of farmers' funds for agriculture development.

In Group A, the discussion focused on (a) relation between APB's field offices and farmers, (b) capability of APB's staff and (c) agricultural finance by other finance institutions. In Group B, (a) institutional loan system by BOL, (b) loan evaluation system and (c) capability of loan officers were discussed. In Group C, discussion was made on (a) collaboration of APB and PAFSO, (b) priority allocation of government budget and (c) effective utilization of the said budget. In Group D, (a) problems in farmers' organizations, (b) upgrading farmers' knowledge on agricultural finance and (c) farmers' participation in development projects, were also discussed. On the basis of the outcomes from the group discussions, the objective tree was constructed as shown in Figure 2-13.

(3) PDM

After the workshop, the issues and problems identified using the PCM process were reviewed and analyzed. The main focus on financial institutions were:

Figure 2-12 Problem Tree (Agricultural Finance)

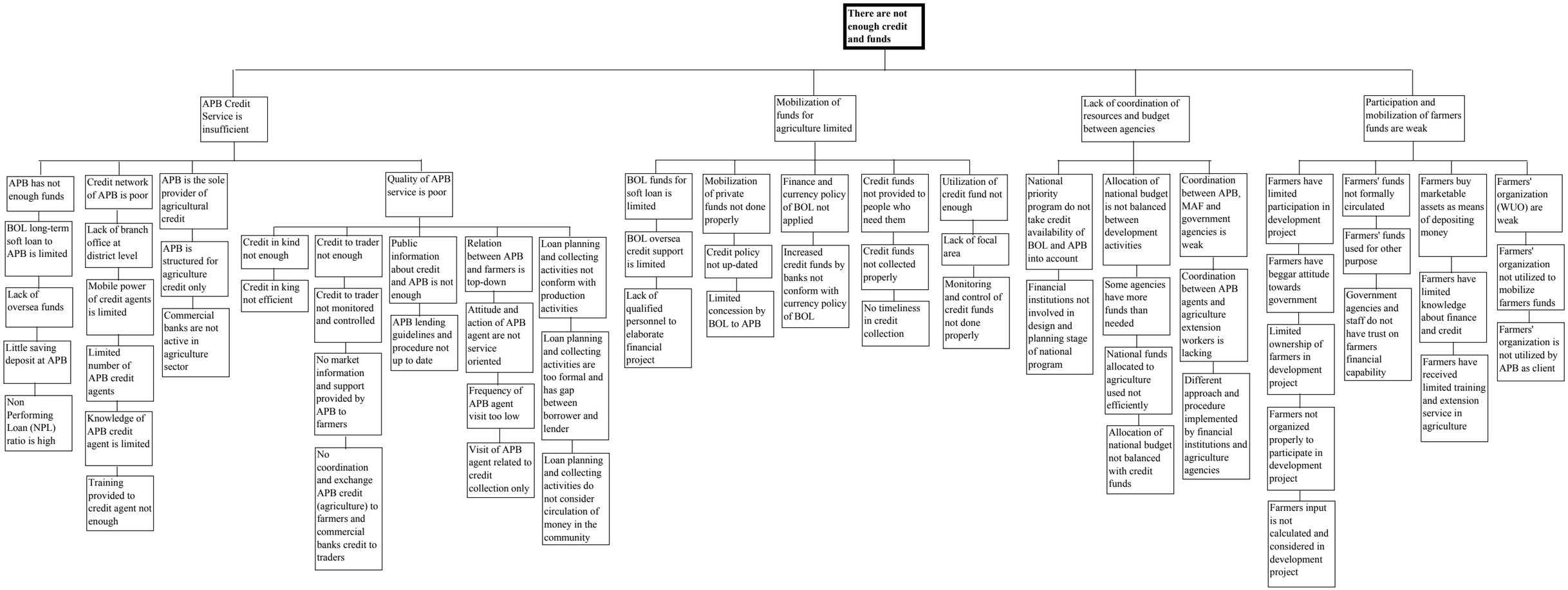
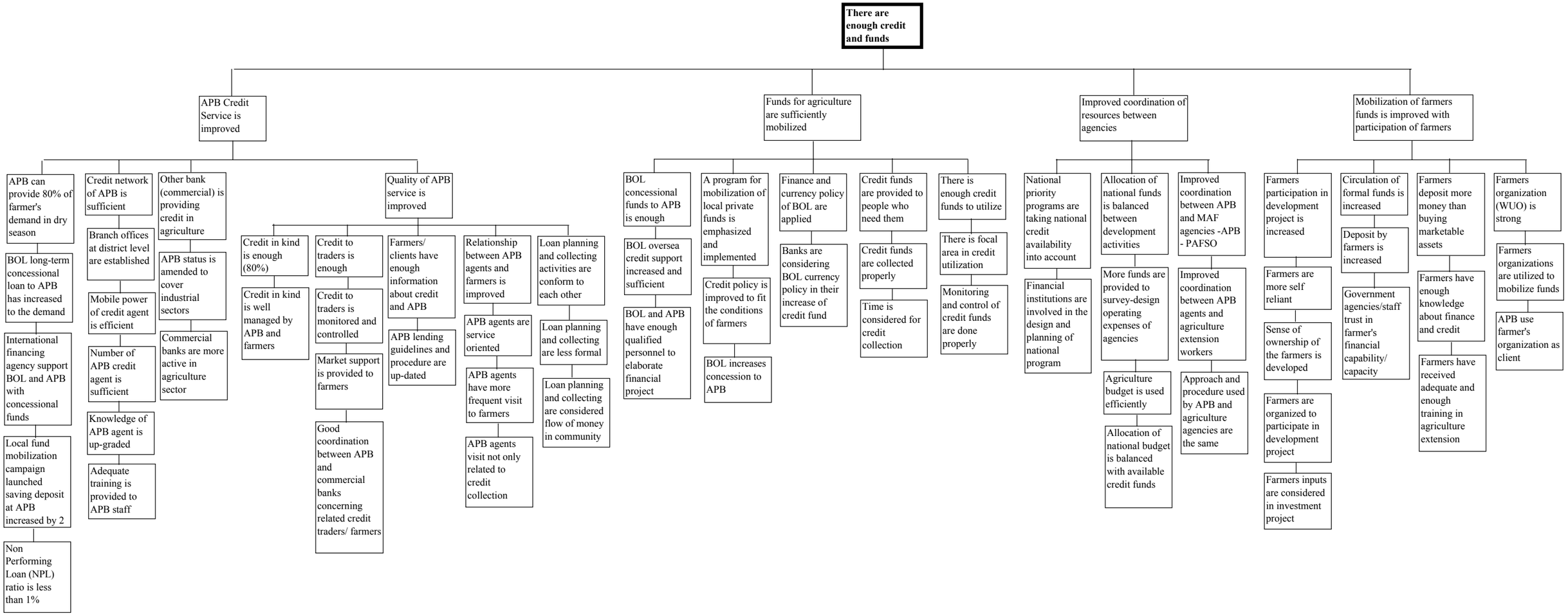


Figure 2-13 Objective Tree (Agricultural Finance)



- The Credit network of APB is limited;
- The staff of APB is not sufficient;
- The APB has not enough funds; and
- The Quality of APB service is poor and farmers do not receive enough loan

On the other hand, financing institution's views on farmers are:

- The farmers lack the opportunity to receive loan;

The farmers do not receive enough information on agricultural finance;

- The APB's credit in kind is not sufficiently supplied to farmers;
- The farmers do not follow repayment schedule in amount and in schedule
- The farmers' accessibility to market is limited

In order to address the said issues and solve the problems, the Study team prepared the Project Design Matrix (PDM) as mentioned in Tables 2-7 to 2-10, which include (a) expansion and strengthening of APB, (b) expansion to mobilize domestic fund resources for capital requirement of agricultural/rural development, (c) effective utilization of surplus money in rural areas for seasonal production loans, and (d) strengthening the collaboration between financial institutions and other public agencies.

2.6 Farmer's Support System

(1) Agricultural Extension

The Department of Agriculture and Extension (DAE), Department of Irrigation (DOI) and Department of Livestock and Fishery (DLF), all belonging to the Ministry of Agriculture and Forestry (MAF) are separately conducting agricultural extension and the actual services are being implemented through PAFSO and DAFSO. The technical level of PAFSO staff is generally unsatisfactory in order to understand the field problems of farmers and to give proper suggestions to the extension staff. The following were observed through the survey of staffing structure and available facilities in DAFSO which is the contact point of the local community.

- In general, the percentage of forestry staff is high and the percentage of irrigation staff is low.

- The percentage of staff with university level education is very low and the percentage of female staff varies from office to office.

- Available facility also varies among offices and generally poor in building structure, furniture supply, office appliances such as computers, fax and copying.

Table 2-7 PROJECT DESIGN MATRIX (APB Strengthening)

Project name: Strengthening the Agricultural Promotion Bank (APB) **Duration: 5 years (2000-2004)**
Project area: 17 provinces **Target group: APB, APB's staff, Farmers** **Date: 26 January 1999**

Narrative Summary	Objectively Verifiable Indicators	Means of verification	Important Assumptions
Overall Goal – Agricultural production and yield are increased – Dry season cropping is introduced – Farmers' living standard is improved		– Annual report of DAFSO and PAFSO – Statistics report on social sector	– There is no severe flood or drought
Project Purpose – APB can supply enough credit for farmers	– Credit volume per agent increased from 80 Million Kips/person (39 Billion Kips/ 490 persons) to 160 M Kips/person (134 Billion Kips/ 840 persons) – Volume of credit increased 200% – Number of client increased 2 times – Non performing Loan ratio is less than 1% – Agriculture credit increased from 52% to 80% in the dry season and from 16% to 40% in the raining season.	– Inventory of APB assets – Annual balance sheet and result report of APB	– There are enough funds for infrastructure development – There are enough funds for credit provision – There are enough funds for project operation
Outputs – APB is institutionally strengthened – APB network is developed – Human resources of APB are improved – Servicing mechanism of APB is improved – Lending procedures are improved – Farmers know more about APB and market system	– 70 district offices are established – 350 new credit agent recruited and trained – Lending procedures to credit groups and farmers organization is improved – Handbook for credit agents is prepared – Handbook for farmers is prepared	– Published policies, guidelines of BOL and APB – Inventory of APB personnel	– Technical assistance is provided by local and international expertise
Activities – Construct 70 new district offices – Refurbish and improve 49 existing district offices – Improve existing training program and curriculum for APB staff – Recruit new credit agents and provide them training with improved training curriculum – Establish in-service training program for APB staff that include short term training for 50 persons/year, long term training for 10 persons/year, short term overseas training for 10 persons/year and long term overseas training for 2 persons/year – Improve procedure for credit group establishment – Elaborate and publish guidelines and hand book for credit agents and for farmers – Elaborate, publish and broadcast APB news and market information system to farmers in newspapers, TV and radio.	**Inputs** – Construction and equipment for district offices 2,010,400 US $ – Training, information and propaganda material 425,000 US $ – Information and propaganda material 95,000 US $ – Operating expenses for APB main office 86,000 US $ – Technical Assistance 30 man/month 450,000 US $ – Government staff assigned to project 120,000 US $		– Financial assistance for technical assistance, part of infrastructure development (70%), part of project operating expenses is provided by ODA. – Financial assistance for credit funds is provided by foreign financial institutions – GOL provides enough staff, office premises, and national budget for infrastructure development (30%). **Preconditions** There are enough funds for credit and for the project

Table 2-8 PROJECT DESIGN MATRIX (Rural Fund Mobilization)

Project name: Accelerated Agricultural Development Fund Mobilization **Duration: 5 years (2001-2005)**
Project area: 17 provinces **Target group: BOL, APB staff, Farmers** **Date: 26 January 1999**

Narrative Summary	Objectively Verifiable Indicators	Means of verification	Important Assumptions
Overall Goal – Agricultural production and yield are increased – Dry season cropping in introduced – Farmers' living standard is improved		– Annual report of DAFSO and PAFSO – Statistics report on social sector	– There is no severe flood or drought – Surplus production of agriculture products must be marketable – There are better conditions to develop agriculture industries and agri-business
Project Purpose Funds for agriculture are sufficiently mobilized	Staged increase of local fund by 50% after 5 year. – 1st year by 10% – 2nd year by 20% – 3rd year by 30% – 4th year by 40% – 5th year by 50%	– Progress report of APB by monthly, quarterly and annually	– Actual related policies remain unchanged
Outputs – Loan fund is increased – More confessional loan is provided to farmers – Financial assistance to rural people is provided for non-farm activities to increase off-farm income – Capability of APB staff is up-graded – APB field office is strengthened	–	– Outstanding of saving account – APB balance sheet and profit and loss statement – Aggregated loan record	– Policies, plan, target and strategy of the capital fund mobilization are understood among the concerned parties
Activities – Launch capital fund mobilization campaign (TV, radio program, newspaper, etc.) – Establish new district offices of APB – Recruit and train new credit agent – Establish mobile unit for capital fund mobilization	**Inputs** – Tangible: tools, equipment, man power – Intangible: training service, technical assistance		– The required activities and the needs of inputs are already fulfilled **Preconditions** There is political and economical stability in the country

Table 2-9 PROJECT DESIGN MATRIX (Use of Rural Fund for Production Loan)

Project name: Improvement of the Farmers' Participation **Duration: 10 years (2000-2009)**
Project area: Pilot project of 200 ha in Bolikhamxay Province **Target group: Farmer organization, Farmers** **Date: 26 January 1999**

Narrative Summary	Objectively Verifiable Indicators	Means of verification	Important Assumptions
Overall Goal - Agricultural production and yield are increased - Dry season cropping is introduced - Farmers' living standard is improved	- 200 ha of the agricultural land is utilized in both dry and wet season - rice yield increased to 5 tons per ha after 2 crop season production - 80% of APB credit provided according the need during dry season production	- Annual report of DAFSO and PAFSO - Statistics report on social sector	- There is no severe flood or drought
Project Purpose Irrigated agriculture is developed with the participatory approach	- Farmer contribute more than 20% of investment (GoL provides 40%, APB provides 40% of investment as credit.)	- Annual report of APB branch office	
Outputs - Farmers' organization (WUO) is strengthened to operate and maintain irrigation system and to improve agriculture production and marketing - Community organization of the villages are improved and trained in participatory approach and methods - WUO's status is improved	- 1 working committee is established		- There are enough funds for infrastructure development - There are enough funds for credit provision - There are enough funds for project operation
Activities - Meet with village authorities to get consensus about farmer funds mobilization - Plan and design irrigation system involving WUO and village authorities - Set up working committee and assign WUO to mobilize local funds and resources - Rehabilitate irrigation system with WUO - Provide training in irrigation management and farming techniques for WUO committee and farmers - Establish Irrigation Service Fee and capital re-investment fee	**Inputs** - Training funds - Rehabilitation funds - Credit for production - Credit for rehabilitation - Operating funds - Technical assistance		- There is a consensus on farmer funds mobilization - There is adequate training and extension provided by PAFSO to farmers - Financial assistance for technical assistance, part of rehabilitation, training is provided by external institutions. - Financial assistance for credit funds is provided by APB **Preconditions** There are enough funds for credit and for the project

Table 2-10 PROJECT DESIGN MATRIX (Coordination among Concerned Agencies)

Project name: Strengthen the Coordination Between Financial Agencies and Other Government Agencies **Duration: 5 years (2000-2004)**
Project area: Pilot areas in 3 provinces (Bolikhamxay, Khammouane, Savannakhet). Target group: APB, GoL Agencies, GoL staff **Date: 26 January 1999**

Narrative Summary	Objectively Verifiable Indicators	Means of verification	Important Assumptions
Overall Goal - Agricultural production and yield are increased - Dry season cropping is introduced		- Annual report of DAFSO and PAFSO - Statistics report on social sector	- There is no severe flood or drought
Project Purpose Resources and budget are coordinated between agencies concerned		- Progress report of national projects - Annual balance sheet and result report of APB	
Outputs - Institutions of APB and government agencies are strengthened - Agriculture extension approach which could be both used by APB and PAFSO is developed - Allocation of national budget is balanced between all development activities - Management of credit funds by APB is improved - Data and information system of agencies are improved	- Working committee established at ministerial level, provincial level and district level - National budget is allocated to survey and design and operating expenses at least to cover 80% of the need. - Plan of APB for credit allocation is considered in national budget program. - About 200 credit agent and extension workers trained in new approach and extension methods	- Published policies, guidelines of concerned agencies - Annual plan and budget of agencies concerned - Working committee minutes of meeting	- Technical assistance is provided by local and international expertise - There is a consensus on the leading coordinating agencies. - There is political, economical and social stability - Government of Lao PDR allows changes in government administration structure - There is enough credit to balance with the national budget funds
Activities - Establish working committee between government agencies and banks at ministerial, provincial and district level - Establish coordination unit in MAF to elaborate and implement national agriculture program - Elaborate management guidelines and working procedures for agencies' staff responsible for national project implementation and planning - Allocate national budget to survey and design expenses operation - Provide training for about 200 credit agent and PAFSO extension workers in financial, credit and project management	**Inputs** - Funds for institution strengthening - Training and workshop funds - Operating funds for meetings of working committees - Technical assistance		- Training, operating expenses and technical assistance are provided by grant **Preconditions** There is a willingness to coordinate in the agencies concerned

machine, transportation means, etc.

- vailable facilities for most of the offices are the equipment necessary for vaccination services and typewriter.

The following are the extension activities being carried out.

- Many extension methods have been employed so far, including demonstration farm, utilization of TV and Radio, but the national extension system is not yet established.

- The main function of AEA is training and information services including the training of province and district staff, technology transfer to such staff and the preparation of technical information. The basic training course is organized by the agency and occasional training courses are also being carried out in collaboration with various donors. Those training courses are, however, not efficiently conducted.

- As for information services, TV program and daily FM radio program are being operated. Various pamphlets, booklets and Video programs as teaching and training materials are also produced for provincial staff, district staff and farmers, but those are very limited.

- The major activity of livestock section is veterinary network establishment for vaccination services in order to prevent outbreak of disease. Furthermore, the technical supervision is being carried out through contact farmers for poultry, fish and pig raising. Those activities are, however, not efficiently conducted.

(2) Agricultural Research

The National Agriculture and Forestry Research Institute (NAFRI) was recently established and all the research centers of the different sectors were organized under the same umbrella. As for the crop production, the National Agricultural Research Center (NARC) at Napock is carrying out the agricultural research. Under the project of Lao-IRRI, the research on paddy and the seed multiplication are also carried out. Hat Dokkeo Agricultural Research Station (HDK) is responsible for researches on vegetable and fruit crops for alluvial soil of riverbank.

(3) Agricultural Education and Training

Pre-service training for potential candidates to the technical staff positions of MAF is being carried out by the National University under the Ministry of Education and various colleges under the Ministry of Agriculture and Forestry. The Departments of Agriculture, Livestock and Forestry are available under the Faculty of Agriculture, National

University. Irrigation belongs to the Faculty of Engineering. The number of teaching staff and the necessary facilities for the basic education is not satisfactory and sufficient education may not be expected under the present system.

Salakham station, as an Agricultural Extension Agency, should perform the main function for the in-service training of extension staff assigned in provinces and districts. It seems that the necessary facilities including training facilities and accommodation facilities are rather poor for the conduct of effective training activities. The coordination of various donors might be needed for the effective research and in-service training activities.

(4) Supply of Agricultural Inputs

There are two channels of input supply to the farmers in the study area, one is the donor-supported fertilizers supply (basically KR-II) and the other is through private basis supply. The actual distribution procedures were controlled by the Ministry of Commerce. This system has, however, recently been changed in a way that APB is directly receiving the fertilizer for distribution in the close cooperation with PAFSO/DAFSO. But, in fact, farmers are often facing the problems of shortage in volume and also untimely delivery of supply.

Foundation seeds (F1) of high yield variety are annually produced in the NARC. The quality of foundation seeds is not satisfactory. Production of F2 is mainly carried out by the seed processing centers and F3 is usually produced by modern farmers under a contract. The quality of both F2 and F3 are also unsatisfactory due to poor processing and are sometimes treated as food because of less capacity of processing. Farmers are thus facing the problem of shortage of seed supply.

(5) Marketing System of Agricultural Products

The agricultural commodities produced by farmers including paddy are usually sold to the middleman (small trader) who is visiting individual farmers. Since there is no farmer's marketing organization in the study area, the farmer has less power to negotiate with the middleman on the price of the products. In case of paddy, however, the farmers can sell their products with rather attractive price mainly due to the recent high demands. Since many farmers are producing on contract basis with the company, in case of tobacco, there is no major marketing problem. Some other products such as fresh vegetables and the forest products are sold to the retailer or directly to the consumer at the nearest market by farmers. Unstable market is a major constraint for the promotion of many cash crops such as cucumber and tomato. Soybean, groundnut and maize production were once promoted but this attempt was not successfully carried out mainly because of the unattractive prices and also the unstable market (See Figure 2-14).

There are generally two flows in purchasing system of rice. One is the private system operated mainly by the middleman and the other is the purchasing done by the food

supply company (FSC). FSC was recently established in each Province aiming at (i) promotion of agricultural production, (ii) stabilization of rice price and (iii) distribution of surplus rice to areas of deficiency. The major constraints for purchasing paddy by FSC are (i) shortage of budget, (ii) inconvenient transportation and (iii) insufficient rice mill and storage capacity (See Figure 2-14).

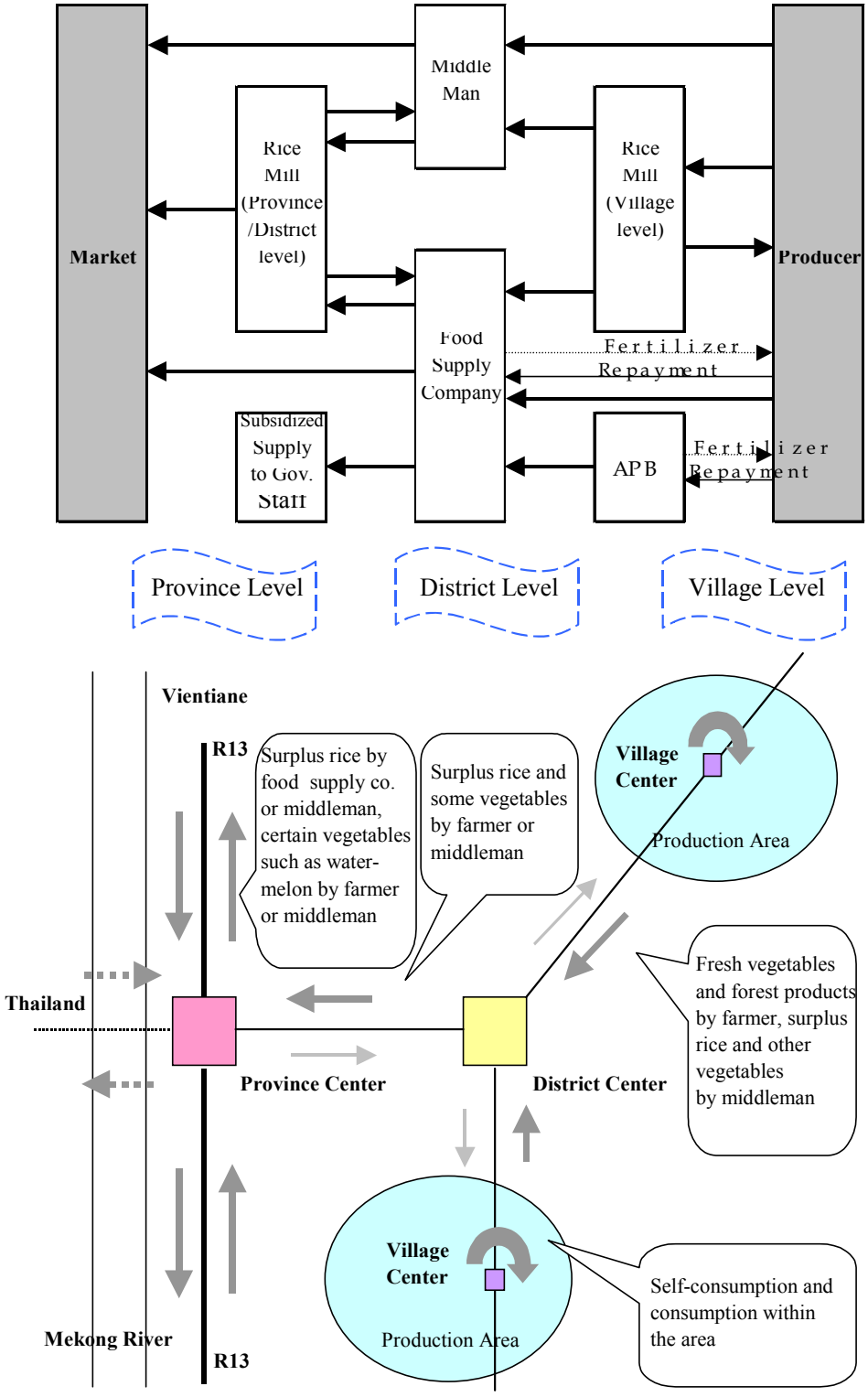


Figure 2-14 Marketing System of Agricultural Products

2.7 Irrigation and Rural Infrastructure

2.7.1 Existing Irrigation Project

(1) Outline of irrigation system

In the past, many irrigation projects have been implemented in the study area. These projects can be classified into pump lifting, gate/weir and small reservoir, depending on topography and accessibility to water resources. All of them can be categorized into small to medium size with service area of 50 to 500 ha.

Pump irrigation scheme has been developed along rivers from where irrigation water can be directly drafted. However, their service area is generally limited to areas along the river. The pumping structure consisted of a pumping facility, delivery pipe, distribution pond and delivery open canal. As for pumping facility, two types exist - the pontoon and fixed-type. The fixed-type is relatively few, found mainly in the Sebangfai and Sebanghiang plains, with service area of more than 500 ha and pump capacity 100 KW. Most of the pumping facilities are of the pontoon type with service area from 100 ha to 300 ha. For pumping, either electric or diesel engine is used, depending on the accessibility to the electricity grid. In recent years, the power supply for pumping is being changed from diesel to electricity. The pontoon type is the most effective for small-scale irrigation since it has the advantage of flexibility in water intake.

The gate/weir type is generally small in scale and used mainly for supplementary wet season irrigation due to limited dry season flow in the stream. Most of the weirs are of concrete structure equipped with either small wooden or steel manual gate (stop-log). In some sites of the river or stream, small reservoirs are located, the dike height is from 2 to 4 m. Most of them are mainly used for wet season supplementary irrigation since runoff from the basin is not sufficient for dry season cropping. At present, most of the gate/weir and reservoirs have deteriorated due to frequent flooding and lack of proper and timely maintenance work.

Since the 1995/96 flood, the National Program for Installation and Management of Irrigation Pump has been implemented nationwide to compensate for rice production loss by encouraging dry season second rice cropping where possible. The program is fully funded by Lao government. It impacted on the expansion of dry season rice production. Under the program, a total of 7,144 units of both diesel (5 to 125HP) and electric (1 to 90 KW) types of pumps were purchased. Most of the pumps have been installed as pontoon type on the basis of requests from farmers' group. In the study area, the number of pump units installed totaled to about 430, not including the installation scheduled for 1999's program. The program is in the 3rd year and will probably end at the 4th stage in 1999.

(2) Irrigation area

About 283 projects have been constructed so far in the study area. In 234, pumping schemes have been installed. Pump irrigation schemes are still being developed and its use are extending from the low-lying paddy fields to the newly reclaimed fields on higher ground. As the result, present irrigated area in the study area has increased as compiled below.

Irrigation Area of the Study Area

Province	Rainfed Paddy Field (ha)	No. of Project	Planning Irrigation Area		Actual Irrigated Area	
			Wet (ha)	Dry (ha)	Wet (ha)	Dry (ha)
Bolikhamsai	17,591	74	12,335	6,887	12,335	5,081
Khammouane	29,547	132	14,480	8,815	10,710	3,500
Savanakhet	39,391	77	15,842	11,903	15,672	9,046
Total	86,529	283	42,657	27,605	38,717	17,627

Source: Rainfed Paddy Field is based on District Database Survey. Irrigation/irrigated area is based on the irrigation facilities inventory survey, as of December 1998.

Actual irrigated area is lower than that of planned target, especially during the dry season. This condition is mainly due to incomplete canal system. Since irrigation canals have not been fully provided in the pump scheme, its service area is generally limited to the areas along the existing canals.

(3) Dry season water use condition

The irrigation scheme developed in the past is most likely operated without any basin-wise water use adjustment, although it must have been essentially designed based on a basin-wide water resources development study. It is important and necessary to view the development prospect of irrigation scheme in the basin's water resources potential. Water balance analysis was conducted to analyze the present water use condition in the dry season.

Irrigation development potential is dependent on the amount of dry season run-off from December to May. Monthly specific discharge of the major hydrological stations was adopted to understand the run-off characteristics since discharge observation stations are few. Dry season water requirement was estimated based on the irrigation planning area. Water resources development potential can thus be assessed for each of the river basin, from the water balance study of dry season run-off and irrigation water requirement.

As the result, it can be said that water resources development potential differs much among the river basins. Compared with the development potential of each river, Sebangfai basin is relatively low. Considering the progress of ongoing large-scale pump irrigation projects, dry season water use conditions could turn critical in the drought year. Even in the basins with ample water resources, some negative impacts on the water use condition of present irrigation projects can be expected if irrigation projects continue to

be developed unrestrainedly. In the smaller tributary, especially, dry season water resources are not sufficient to irrigate the target area.

2.7.2 Operation and Management of Facilities and Water Management

(1) Pump facilities

In general, the person who will operate the pump at farmer's request is hired by WUO. The time and operation details are supposed to be recorded by this operator, which is not the case for most pump schemes. The amount drafted is not measured, and not based on crop water requirement. At present, most of the water lifting is operated without any restriction.

Since most of the pumping facilities were newly constructed after 1995/96 flood, not much maintenance or repair work is needed so far. However, it has been observed that some pumps are compelled to draw muddy water – high in silt and sand content - as water level recedes during dry season. This will eventually shorten the life span of pump facilities. Adequate maintenance work involving regular check and provision of spare-parts will be required in near future.

(2) Other irrigation facilities

Most of the canals in the study area are unlined earth canals - not systematically planned and designed for efficient water conveyance and distribution. Water in the plot-to-plot irrigation is generally large. Canal maintenance such as weeding and bank repair is the collective effort of the farmers. On-farm facilities such as feeder canal and diversion works have not been fully provided in the fields, especially in some medium to large-scale irrigation project sites.

According to the irrigation development policy, irrigation canals and on-farm water management are supposed to be provided by WUO. However, these have not been fully provided yet due to financial and technical limitation of WUOs, especially for newly constructed pump schemes with incomplete canal system. Irrigation area is thus limited around pump station due to lack of feeder canal.

The lack of maintenance work can be seen in agricultural infrastructures such as farm roads, reservoir, dikes and weirs. Eroded canal slope and sedimentation lead to delivery loss of pumped water. Deterioration of reservoir dikes reduces the storage capacity. WUOs are not active except in some areas supported by SIRAP, FIAT and other international supporting agencies. In the pump irrigation project, collection of irrigation service fee is the major job of WUO at present. Since WUOs in reservoir or weir irrigation scheme have not been properly organized, no maintenance work was undertaken so far, and the dike and gate structures are left to deteriorate. Free access to such facilities also weaken ownership and cooperative sense among villagers.

(3) Institutional framework related to water management

(a) Legislation on water rights

The introduction of water rights concept is important for WUOs to mobilize their resources to recover the investment cost in infrastructure operation and management. Related to this, the "Water and Water Resources Law" was enacted in October 1996, which deals with the general concept of water resources development and use of water and water resources.

(b) Legislation on Water Users Association:

The establishment of Water Users Associations (WUA) is a key concern for the smooth implementation of the government's irrigation development policy aiming at handing over the operation and management to farmer group. The "Decree on Article of Association Irrigation Water Users Association" was enacted in March 1997, granting WUA the authority to prepare operation and management funds and to mobilize their own resources for irrigation development.

The Implementing Guidelines for the Ministerial Decree on Water Users Association was also prepared by DOI in October 1997 to clarify the role of WUA, to enhance a common understanding on WUA Decree's Clauses and items, and to assist in the actual implementation in accordance with the Decree's clauses.

The government policy mentioned above is not being fully understood by farmers and the related local staff and as such, the legal framework of WUO on proper irrigation transfer should be upgraded, and management activities such as collection of irrigation service fees and reinvestment cost should be authorized for further development of WUOs.

2.7.3 Public Organizations for Implementing Irrigation Projects

(1) Organization of DOI

The Department of Irrigation (DOI) is responsible for every development aspect of irrigation in Lao PDR. The organizational structure of DOI consists of five divisions: the Administration, Technical Management, Planning & Cooperation, Operation & Maintenance and Study Survey Design Center. At the provincial level, the Provincial Irrigation Section (PIS) under PAFSO is responsible for implementing small and medium irrigation projects such as the existing pump irrigation scheme. In general, the organization of PIS consists of some units such as the operation & maintenance unit, technical unit, planning unit, supervision and monitoring unit and survey/design unit. The PIS controls the irrigation unit of DAFSO, in which a few staff is assigned for operation and maintenance of project, and data collection for irrigation development planning. The total number of DOI and PIS staff is 740 (in 1997), 34 in head office of

DOI, 625 in PIS, 81 in Study Survey Design Center and Implementing Projects. The staff composition of the three provinces is as follows:

Head/Province	No. of Staff	Engineer(Univ.)	Technician(Collage)	Basic(Training)
Head Office	34	25	4	4
Bolikhamsai	23	11	10	2
Khammouane	48	22	9	17
Savanakhet	76	16	33	27

(2) Irrigation Management Transfer (IMT)

It is the basic policy of Lao government, that all irrigation systems including existing, ongoing and those to be constructed in the future whether through grants or domestic or foreign loans, will have to be turned over entirely to the related communities. In the basic frame of IMT program, the following process is envisaged.

- Before the transfer of irrigation systems, responsible organization for operation and maintenance of IMT shall be established in the form of association, group or collectives to properly operate and manage irrigation facilities.

- The village development fund shall be set up to perform the duty to collect investment funds and to manage development budgets allocated for village development.

- After setting up the responsible organization and the village development funds, the irrigation system will be transferred to the communities of water users.

- The communities of water users are responsible for operation and maintenance of the irrigation system transferred to them.

The communities shall be responsible for collecting irrigation water fees from beneficiary farmers.

The collected water fees will be allocated into three (3) categories as compensation for:

1. Village Development Fund (for reinvestment and to cover expenses for village development)

2. State compensation (compensation to the government)

3. Project management (for operation and maintenance of irrigation system)

The compensation rates will be decided based on the some criteria such as the type of irrigation facilities and year such were constructed. The government has recommended

an example of calculation methods for water fee in the form of paddy rice. The compensation period is basically set for 20-years, depending on the scale of project.

(3) Implementation of Irrigation Project

(a) Implementation Procedure

The three provinces in the study area have also received hundreds of pumps during the last 4 stages. Applying for the pump is normally initiated by the farmers themselves. PAFSO, upon receiving the request from the farmers, orders DAFSO to assess the needs. A team is nominated by DAFSO to survey the command area, to interview the farmers in assessing the needs and intentions, and to survey and locate the potential construction sites for the pump. The applications are then compiled in the annual plan of PAFSO. Submission of application is made by PAFSO to DOI in Vientiane before October. For small-scale project (<300ha), the normal procedure of request is from the farmers to DAFSO to PAFSO to Governor to Central Government. The flow of permission is the reverse. The SSDC (Study Survey Design Center) of DOI is mainly involved in large and complicated project or in the construction of major facilities such as the headwork of a project, although assistance may be provided to PAFSO whenever it is needed. PAFSO can take initiatives in planning, design and construction of small-scale projects. However, the PIS of PAFSO is normally required to report to DOI about the budget and technical aspect of their projects.

The pumps and accessories normally start to arrive in the provinces in October, via the nearest port/customs clearance along the Mekong. The construction and installation of the pumps are normally contracted to a parastatal or private company. For large pumps, such as the 150kW, survey, design and construction are contracted to a parastatal or private company. For pumps less than 90kW, PAFSO/DAFSO conducts an initial survey to locate the installation site. The construction cost is estimated based on this survey. Like other construction works, unit costs prepared by DOI are adopted in the costing. But unlike the cost of materials, which fluctuate with exchange rate, the unit costs normally stays the same through the fiscal year.

The installation of pump, done mostly by parastatal and private company, is normally completed within 1 to 3 months. In Khammouane there are 3 large and competent construction companies (parastatal and private) and over 30 smaller ones. These large companies have sufficient technical experience to carry out construction of irrigation project works, both pump and gravity irrigation facilities. In Bolikhamsai there are 2 large and competent construction companies (parastatal and private). In Savanakhet the 100% government-owned parastatal company implements the construction work. Most of the parastatal companies were established in recent years to cope with the urgent and massive introduction of pumps.

(b) Cost of Implemented Projects

The cost per KW of capacity of pumps introduced in the study area varies from $130 to $450/KW for the electric pump. And the costs of the most common pumps - the 37 and 75KW type - are $251 and $186/KW, respectively. For electric pumps, the unit price per KW decreases with increase in pump capacity. This trend is not so distinct for diesel pump, varying from $145 to $295/HP. The most common type – 65HP – costs about $188/HP.

Installation cost is primarily determined by the topographical conditions of construction sites. For pumps of 37KW, the average installation cost varies from 480 to 1100 thousand Kip/ha and for 75KW from 230 to 560 thousand kip/ha. The difference between maximum and minimum cost could be 3 times or more.

As a rule, a pair of 37KW pump is needed to irrigate 80ha or a 75KW for 150ha. Most of the pumps are installed in pairs and the cost of project is estimated using the sum of cost for pump and installation work.

2.8 Environment

2.8.1 Relevant Agencies and EIA System in Lao PDR

(1) Science, Technology and Environment Organization (STENO)

The Science, Technology and Environment Organization (STENO) established in the Prime Minister's office in 1993, is the agency which has the function to coordinate the relevant agencies on environmental matters. The STENO has the following functions in relation to environmental concerns:

- to act as the main coordinating agency for environmental planning management activities across all sectors
- to advise the PMO concerning environmental planning management issues
- to develop a national environmental policy framework that links the macro to sector levels environmental activities and integrate environmental and economic planning and management process
- to develop a set of environmental planning and management process, regulatory framework and procedures that will be adopted by all private and public sector institutions
- to establish and operate an environmental monitoring system covering planning procedures, guidelines for project implementation, and environmental codes for new development programs

- to develop the national environmental assessment system and to take the lead in ensuring the implementation of the national environmental assessment system

- to coordinate environmental programs operated by line technical agencies

At present, the STENO is composed of eight (8) units and the branch offices in the several provinces. However, the organization is under going a restructuring process. Out of eight units, two (2) technical departments, which are "Department of Environmental Quality Development and Promotion" and "Department of Environmental Policy and Management", have the main responsibility for planning of the environmental policy and maintaining of the environmental quality through establishment and operation of EIA system.

(2) Environmental Law

The Law on Environmental Protection has been prepared by STENO with financial support from the Swedish government. The law was submitted to the national assembly of Laos in March and approved on 3rd April 1999. It will be legislated and enforced in July or August 1999. According to the working draft of the Law on Environmental Protection, the law is composed of nine chapters.

(3) Environmental Impact Assessment System

The Environmental Impact Assessment (EIA) Guideline has just been drafted up by STENO. The draft will be reviewed by the coordinating committee composed of the line-agencies. According to the draft guideline, the requirement of EIA study for agricultural development project is classified based on the scope and scale of development size as shown below.

Projects requiring the conduct of EIA study (Agricultural and Forestry Project)

i) Forestry Development on over 500 ha of land

ii) Agricultural and/or Forestry Development with over 100 families for resettlement

iii) Construction of reservoir (over 400 ha)

iv) Irrigation development on over 5,000 ha of land

v) Changing land use in Forest area (over 100 ha)

vi) Logging activity and changing land use in the watershed area of important water resources such as urban water supply, irrigation, and electric power generation (any size)

vii) Reclamation of swamps, ponds, and lakes (over 50 ha)

For projects that fall within the above categories, project proponents must carry out the EIA study and submit EIA report to STENO by entrusting registered consultants or third parties. For projects that are not classified into the categories, project proponents must submit the project description to STENO. The project proponents who submitted the project description may be required to carry out IEE or EIA.

2.8.2 Natural Environmental Condition in and around the Study Area

(1) Water Quality of Major Rivers

The water quality of several rivers that run through the Study area has been monitored by the Water Quality Laboratory in DOI. The results of analysis are summarized as follows:

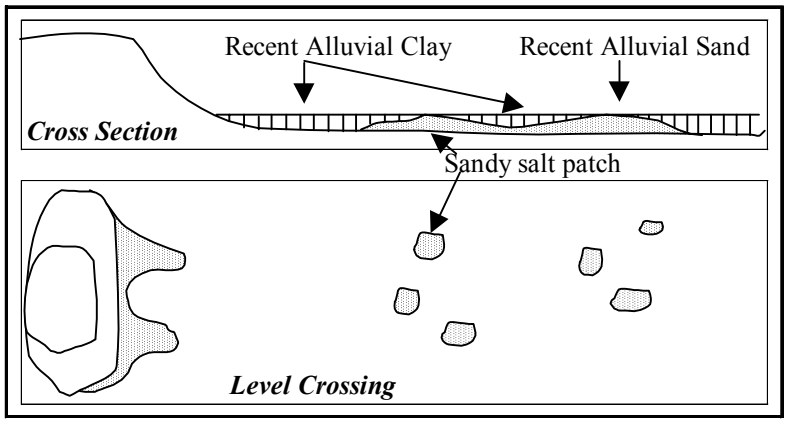
River name	Temp (C)	pH	EC mS/m	Ca Me/l	Mg me/l	Na me/l	SAR	Cl me/l	DO mg/l	COD mg/l	NO_X-N mg/l
Nam Luek	24.5	6.5	2.5	3.3	1.1	0.9	0.6	1.1	0.1	n.d.	0.1
Nam Mang	23.1	6.7	3.5	4.0	1.2	2.6	1.0	0.9	7.1	n.d.	0.1
Nam Xan	22.1	6.7	4.1	4.9	1.9	2.6	0.9	0.5	7.8	n.d.	0.0
Nam Hinboun	n.d.	7.7	26.0	1.6	0.5	0.0	0.2	0.0	n.d.	1.4	0.1
Sebangfai	26.3	7.7	25.8	1.9	0.6	0.1	0.3	0.1	8.4	1.3	0.1
Sebanghiang	27.6	7.5	10.4	0.6	0.2	0.2	0.7	0.1	8.4	1.9	0.1
Xechampone	29.6	7.1	15.1	0.8	0.3	n.d.	n.d.	0.1	6.8	3.6	0.0
Xebangnoun	28.8	7.2	6.3	0.4	0.2	n.d.	n.d.	0.1	8.6	2.7	0.0

Source : Water Quality Laboratory in DOI

Based on FAO's water quality criteria for agriculture (I&D Paper 29), the water quality of the above rivers in the Study area is classified as suitable for agricultural use. Since the geological materials, watershed and land use types for all the rivers in the Study area are almost same in the above rivers, it is assumed that the water sources in the Study area are also suitable for agricultural purpose.

(2) Soil Salinity

It is confirmed that some parts of Khammouane and Savanakhet provinces have potential for future salt accumulation into the groundwater and sub-surface soils, on the assumption that there exists a salt-beard layer under the said area. According to the EIA report for the SIRAP project, the Study area is considered as the part of the Korat Plateau (the famous place for serious salinity problems in Thailand) in terms of geographical feature. At present, the potential area for future salinization is not extensive in the study area. In the case of the Korat Plateau in Thailand, it is considered that the salt concentration area is related with the texture of sub-layer as illustrated below.



Schematic Picture of Distribution of Salty Sand Patches on the Korat Plateau

(3) Land Use / Vegetation

Forest areas significantly remain in 12 districts even though the forest have been degraded and decreased gradually. The "Nationwide Reconnaissance Survey", which is the first nation-wide forestry inventory survey in Laos, was initiated in 1987. In this survey, the land use map was prepared by interpreting aerial photo (1982) and SPOT satellite image (1987-1991). The land use conditions in the study area are analyzed based on the result of the above-mentioned survey. The extent of each land use type in the Study area are summarized as follows:

Land Use Group	Bolikhamsai		Khammouane		Savanakhet		Total	
	(km^2)	(%)	(km^2)	(%)	(km^2)	(%)	(km^2)	(%)
Current Forest <1	3,789	62	1,811	35	1,900	54	7,500	51
Potential Forest <2	1,612	27	1,443	28	518	15	3,572	24
Other Wooded Area <3	58	1	142	3	0	0	200	1
Permanent Agricultural Land <4	310	5	747	14	951	27	2,009	14
Other Non-forested Land <5	310	5	1,073	20	147	4	1,530	10
Total	6,079	100	5,216	100	3,516	100	14,811	100

Source : Forest Cover and Land Use in Lao PDR., Nationwide Reconnaissance Survey (1992)
Remarks: <1 The Current Forest is the forest having a crown density of at least 20 % including forest plantation even with lesser densities.
<2 The Potential Forest is the degraded forest land suitable for forestry.
<3 The Other Wooded Area is the degraded land unsuitable for forestry.
<4 The Permanent Agricultural Land is the crop production and grazing land.
<5 The Other Non-forested Land is composed by the non-productive land, land used for purposes other than

(4) Conservation, Protected and other Forest Land

Four (4) National Bio-diversity Conservation Areas (NBCAs) are located in and around the study area. Other than NBCA, the classified forest lands are further categorized by Forest Law (Decree 125/PR) such as "Conservation Forest", "Protection Forest", "Production Forest", "Regeneration Forest" and "Degrading Forest". These are also located in the study area, the following table shows the extent of each forest type:

Forest Type	No. place	of Total area (ha)<1
1. National Biodiversity Conservation Area (NBCA)	4	469,000
2. Protection Forest Area	3	61,400
3. Conservation Forest Area (Provincial, District, Village)	16	15,000
4. Production Forest Area	5	443,300
5. Regeneration Forest Area	3	10,800
6. Degrading Forest Area	N/A.	N/A.
Total	31	999,500

Source : Forestry Division, PAFSO of three provinces
Remarks : <1 Some of the Forest Areas include the area out of the Study area.

(5) Wildlife (Fauna)

Wildlife, particularly large species of mammals are rarely observed in and around the agricultural land in the study area primarily due to human intervention. On the contrary, the protection and conservation forests are still inhabited by some species. It is also reported that some important species of birds, reptiles and fishes are seen in the natural and artificial wetlands in the Study area. For example, Siamese Crocodile (*Crocodylus siamensis*) and otters (*Lutra sps.*) are believed to inhabit the Nong Loung wetland group in Savanakhet area.

(6) Wetlands

Most of wetlands in the country play an important role in the livelihood of many rural households, and some wetlands provide habitat for endangered wildlife species. According to the recent assessment report, eight (8) major wetlands exist in the study area, and they are closely related to rural life and provide a great variety of products and services. The characteristics of the wetlands are summarized as follows:

Name	Location (District)	Area (km^2)	Benefit for villagers from Wetlands	Benefit for Biodiversity
Nong Nia wetland	Paksan	0.75	- high (water supply, fishing and spiritual place)	high
Nam Kadan wetland	Paksan	7.5 - 15	- moderate in wet season (flooding) - high in dry season (water supply, fishing)	low
Nam Sa wetland	Paksan	2 - 6	- high (water supply, fishing, hunting)	low
Nam Thon wetland	Pakkading	28	- high (water supply, fishing)	low - moderate
Nam Hinboun wetland	Hinboun	n.d.	- high (water supply, fishing)	moderate
Sebangfai wetland	Sebangfai	30	- high (water supply, fishing)	low - moderate
Savanakhet wetland	Khanthabouri	5 - 6	- moderate (fishing, water supply)	high
Nong Loung wetland	Songkhon	4 - 90	- high (water supply, fishing)	high

Source: An Inventory of Wetlands of the Lao PDR., IUCN (1993)

From the management viewpoint, these wetlands are broadly divided into two types, i.e. conservation and sustainable utilization. It is recommended that the wetlands, having a high bio-diversity should be conserved. On the other hand, those which have only the value for fishing place should be managed by the surrounding villages to maintain the production.

(7) Flood Condition

The flood conditions of the study area are analyzed by using satellite image (Land Sat TM.) of two (2) contrasting years, severe flooded year (1995/1996) and drought year (1998). The extent of damage for each land use type is summarized below.

Severe Flooded Year (1995/1996)

Land Use Category	Paksan Plain (Bolikhamsai)		Sebangfai Plain (Khammouane)		Savanakhet Plain (Savanakhet)	
	Flooded Area	Proportion of total area	Flooded Area	Proportion of total area	Flooded Area	Proportion of total area
	(ha)	(%)	(ha)	(%)	(ha)	(%)
Current Forest	3,752	1	990	1	4,156	2
Potential Forest	21,615	13	6,486	4	1,637	3
Other Wooded Area	1,361	1	16	0	0	0
Permanent Agricultural Land	14,327	46	37,182	50	10,907	11
Other Non-forested Land	10,504	54	4,222	4	1,056	31
Total	51,595	9	48,896	10	17,756	5

Drought Year (1998)

Land Use Category	Paksan Plain (Bolikhamsai)		Sebangfai Plain (Khammouane)		Savanakhet Plain (Savanakhet)	
	Flooded Area	Proportion of total area	Flooded Area	Proportion of total area	Flooded Area	Proportion of total area
	(ha)	(%)	(ha)	(%)	(ha)	(%)
Current Forest	548	0	147	0	676	0
Potential Forest	4,937	3	1,429	1	367	1
Other Wooded Area	538	9	5	0	0	0
Permanent Agricultural Land	7,063	23	7,906	11	4,610	5
Other Non-forested Land	084	31	1,373	1	173	5
Total	19,170	3	10,860	2	5,826	2

(8) Agrochemical Use

The usage of agrochemical in the study area is presently not common, especially in rainy season. However, in some areas under irrigated conditions in the dry season, agrochemical is used to maintain the level of rice production. According to the interview with farmers, they are aware of the hazards of agrochemical usage to their health, and they have the intention of avoiding agrochemical use as much as possible, considering its hazards and their economic situation. However, their knowledge in terms of selection of agrochemical and handling of chemicals is not satisfactory. In addition, the availability of eligible agrochemical is also quite limited in the country. Several toxic chemicals classified as “extremely hazardous” and “highly hazardous” based on the WHO classification (1992) also proliferate in the market. A list of agrochemicals available in markets in the Study area is presented in Table 2-11.

Table 2-11 Agro-chemicals Utilized in the Study Area (1/3)

Use	Name (Products)	Type	Common Name	Concentration	Remarks
Insecticide:	Applaud 10 WP	WP	Buprofesin	100 g/kg	
	Ascend 50 SC	SC	Fipronil	50 g/lit.	
	Attack 5R	EC	Cypermethrin	50 g/lit.	
	Azodrin 202R	EC	Monochrotophos	285 g/lit.	Restricted for beanfly
	Basudin 40 WP	WP	Diazinon	400 g/kg	
	Basudin 400 EC	EC	Diazinon	400 g/lit.	
	Basudin 5 G	G	Diazinon	50 g/kg	
	Basudin 600 EC	EC	Diazinon	600 g/lit.	
	Blaster	EC	Cypermethrin	50 g/lit.	
	Brodan 31.5 EC	EC	Chlorpyrifos + BPMC	210+105 g/lit.	
	Cymbush 5 EC	EC	Cypermethrin	50 g/lit.	
	Decis R	EC	Deltamethrin	10 g/lit.	
	Etrofolan 50 WP	WP	Isoprocarb	500 g/kg	
	Fenom D 225 EC	EC	Diazinon+Cypermethrin	200+25 g/kg	
	Furadan 10 G	G	Carbofuran	100 g/kg	
	Furadan 3 G	G	Carbofuran	30 g/kg	
	Furadan 5 G	G	Carbofuran	50 g/kg	
	Hostathion 20 EC	EC	Triazophos	200 g/lit.	
	Hostathion 40 EC	EC	Triazophos	400 g/lit.	
	Hopcin 50 EC	EC	BPMC	500 g/lit.	
	Karate 2.5 EC	EC	Lambdacyhalothrin	25 g/lit.	
	Lorsban 3 E	EC	Chlorpyrifos	300 g/lit.	
	Lorsban 40 EC	EC	Chlorprifos	400 g/lit.	

Source; Farm Household Survey made by the JICA Study Team.
List of Registered Agricultural PesticideProducts, Fertilizer and Pesticide Authority DA, June 1997.

Type; WP: Wettable Powder, L: Liquid, SC: Soluble Concentrate, EC: Emulsifiable Concentrate,
P: Powder, G: Granule, EW: Emulsion in Water, F: Flowable, D: Dust, SL Souluble Liquid.

Table 2-11 Agro-chemicals Applied in the Study Area (2/3)

Use	Name (Products)	Type	Common Name	Concentration	Remarks
Insecticide:	Lorsban IPE	IP	Chlorpyrifos	10 g/kg	
	Magnum 5 EC	EC	Cypermethrin	50 g/lit.	
	Meptox				Banned
	Mipcin 50 WP	WP	MIPC	500 g/kg	
	Nurelle D	EC	Chlorpyrifos+Cypermeth	250+25 g/lit.	
	Nuvacron SCW	SC	Monocrotophos	300 g/lit.	Restricted for beanfly
	Regent 0.3 GR	G	Fipronil	30 g/kg	
	Sherpa 5 EC	EC	Cypermethrin	50 g/lit.	
	Tamaron 600 SL	SL	Methamidophos	600 g/lit.	
	Thiodan				Banned
	Trebon 10 EC	EC	Ethofenprox	100 g/lit.	
	Vindex plus	EC	Phentoafe+BPMC	250+100 g/lit.	
	Vexter 300 EC	EC	Chlorpyrifos	300 g/lit.	
Molluscicide:	Bayluscide 250 EC	EC	Niclosamide	250 g/lit.	
	Bayluscide 70 WP	WP	Niclosamide	700 g/kg	
	Pond snail				Banned
Fungicide:	Benlate 50 WP/OD	WP	Benomyl	500 g/kg	
	Champion WP	WP	Cupric Hydroxide	770 g/kg	
Rodenticide:	Racumin Dust	D	Coumatetralyl	7.5 g/kg	
	Ratoxin				Banned

Source; Farm Household Survey made by the JICA Study Team.
List of Registered Agricultural PesticideProducts, Fertilizer and Pesticide Authority DA, June 1997.

Type; WP: Wettable Powder, L: Liquid, SC: Soluble Concentrate, EC: Emulsifiable Concentrate,
P: Powder, G: Granule, EW: Emulsion in Water, F: Flowable, D: Dust, SL Souluble Liquid.

Table 2-11 Agro-chemicals Applied in the Study Area (3/3)

Use	Name (Products)	Type	Common Name	Concentration	Remarks
Herbicide:	Advance EC	EC	Butachlor + Propanil	300+500 g/lit.	
	Lead Corp, 2,4-D Amine	SC	2,4-D Amine	400 g/lit.	
	Miracle 2,4-D Amine	SC	2,4-D Amine	400 g/lit.	
	2,4-D Granules	G	2,4-D Isobytyl	30 g/kg	
	2-4 D Ester	EC	2,4-D Ester	400 g/lit.	
	Clencher				Banned
	Direk 800	EC	Butachlor+Safener	800 g/lit.	
	Lambast 5G	G	Butachlor	60 g/kg	
	Lambast EC	EC	Butachlor	600 g/lit.	
	Londax WP	WP	Bensulfuron	100 g/kg	
	Machete 60	EC	Butachlor	600 g/lit.	
	Machete EN	EN	Butachlor	600 g/lit.	
	Relof-H 500 EC	EC	Piperophos+2,4-D IBE	330+170 g/lit.	
	Rogue EC	EC	Butachlor+2,4-D	360+240 g/lit.	
	Rogue G	G	Butachlor+2,4-D	37.5+25 g/kg	
	Ronstar 25 EC	EC	Oxadiazon	250 g/lit.	
	Ronstar 2 G	G	Oxadiazon	20 g/kg	
	Sofit 300 EC	EC	Pretilachlor	300 g/lit.	
	Thunder EW	EW	Butachlor	600 g/lit.	2 to 3 table sppoon/lit.
	Weedkill 2,4-D	WP	Ibe of 2,4-D	400 g/lit.	
Foliar Fertilizer:	Agro Well	C	compound fertilizer	N15-P7-K7 %	
	Byfolan	C	compound fertilizer	N11-P8-K6 %	
	Crop Giant	C	compound fertilizer	N15-P15-K30 %	
	Crop Giant	C	compound fertilizer	N19-P19-K19 %	

Source; Farm Household Survey made by the JICA Study Team.
List of Registered Agricultural PesticideProducts, Fertilizer and Pesticide Authority DA, June 1997.

Type; WP: Wettable Powder, L: Liquid, SC: Soluble Concentrate, EC: Emulsifiable Concentrate,
P: Powder, G: Granule, EW: Emulsion in Water, F: Flowable, D: Dust, SL Souluble Liquid.

2.8.3 Socio-economic Environmental Condition

(1) Ethnic Condition

The Laolum (Lowland Lao People) is the most dominant group in the study area representing 97 % of the total population (about 521,400 persons). Following the Laolum, the Laotheung shares 2 % of the population (about 12,500 persons). The others (1%) consist of the Laosoung and foreigners who mainly live in city or remote areas. According to the local government, there is no remarkable social conflict among the ethnic groups in the Study area.

(2) Health Condition (Vector-borne Disease)

According to the public health department in the provincial offices, malaria disease is still common in the Study area. Other vector-borne diseases such as schistosomiasis, filariasis, encephalitis are not found. Tendency of malaria disease differs among the provinces. In Borikhamxay area, the incidence is high in wet season. On the contrary, an epidemic is also shown during dry season in Savanakhet area. In case of the Khammouane area, the incidence is basically higher during the wet season, however, small peaks can be seen in the beginning of dry season (December to January). These tendencies might be related to the area of water bodies such as swamps, reservoirs, irrigation fields, fishponds, etc. To date, no clear relation has been established.

(3) Present Health Education Program

Provincial Public Health Service Offices in three (3) provinces operated two (2) health education programs with support from several donor agencies, such as EU, GTZ, JICA, and other NGOs.

Title	Concept	Activities
Revolving Drug Fund Program	Setting up chemist in the village and make villagers operate it by themselves	1) Train villagers as Village Health Workers (VHWs) and explain the RDF system to the villages 2) Provide medicines to VHWs 3) Establish a revolving fund system for self-management
Impregnated Bed Net Distribution Program	Distribution of Impregnated Bed Net (IBN) to villagers and make them keep the cost for annual impregnation	1) Promote villagers' understanding of the importance of IBN application 2) Distribute impregnated bed nets to the villagers 3) Establish revolving fund system for annual impregnation

The extent of the activities varies among the provinces. The following table shows the number of target villages for each program in the Study area.

Title	Province	Target Villages	Year of Implementation
Drug fund *1	Bolikhamsai	92	1994 - 2000
	Khammouane	88	1993 - 2000
	Savanakhet	N/A.	1993 - 2000
IBN *2	Bolikhamsai	77	1998/1999
	Khammouane	45	1999/2000
	Savanakhet	34	1996/1997

Sources: *1 Provincial Public Health Office of each province
*2 Station of Malaria Parasitology and Entomology

(4) Historical and Religious Sites

There is no archeological and/or historical sites in and around the agricultural lands in the study area. At the village level, some villages have designated their own spiritual places, which are mostly in swamps and/or forest. Most of them are presently demarcated as village conservation areas.

2.8.4 Present Environmental Issues

Since the study area is assumed to be relatively exploited than the mountainous and hill areas of the provinces, the natural bio-diversity is relatively low. Although the remarkable environmental hazards in the Study area are not clearly obvious at present, two (2) concerns are observed in and around the Study area.

(1) Frequent Floods Damage

The flood damage to crop production is a common concern in the study area, especially in the lowland plain area. As mentioned, the study area experienced severe floods and suffered the huge damage in 1995/1996. Some parts of the study area have been affected even in the normal year. To a greater or less extent, it is obvious that the floods frequently affect the life of farmers in the Study area, especially these living in the area along the tributaries of Mekong River.

(2) Watershed Degradation

This may not be a typical issue within the study area, and but can often be observed outside the Study area. Most of the watersheds of the rivers flowing through the Study area have been degraded for decades. The watershed degradation is believed to be one of the main factors for unstable river flow, such as seasonal flood in wet season and extreme drying in dry season. The shifting cultivation is still a common practice in the mountainous and hilly area. The environmental impact from the practice has, however, become significant due to the increase of the population pressure and reduction of land holding size. It is also reported that poor management and over-logging in the production forest can cause soil erosion and eventually the increase of sedimentation in

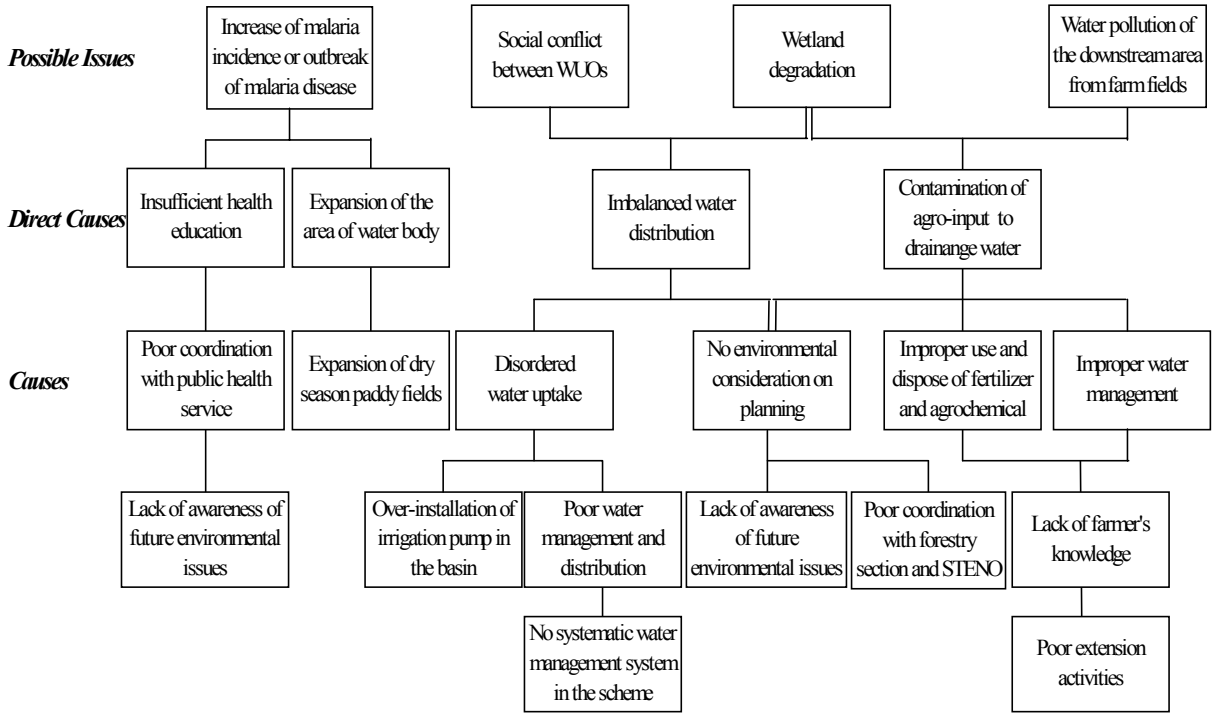
the river.

2.8.5 Possible Environmental Issues under Present Situation

Recently, many pump irrigation schemes have been established along the Mekong river and its tributaries in accordance with the governmental policy. These activities have improved the living condition of farmers in the study area, while it is considered to have a certain potential for the occurrence of the environmental issues. Although there is no any severe environmental issues caused by the irrigation development activities to date, some of environmental issues might occur in near future unless the present situation will be improved. The potential issues could be divided into two (2) types, such as the basin-wide and the scheme-wide issues:

(1) Basin-wide

Four (4) possible environmental issues and their causes are identified through the cause-effect analysis on the basin-wide. The causal relationships are shown below and the summary of issues and causes are described in the following sections.



Possible Environmental Issues and their Relations (Macro Level : Basin-wide)

(a) Possible Issues

It is considered that the following issues might occur at the macro level (basin-wide) in near future unless the proper countermeasures are taken.

- Social Conflicts between the Water Users
- Water Pollution in the Downstream Area
- Wetland Degradation
- Outbreak of Malaria Infection

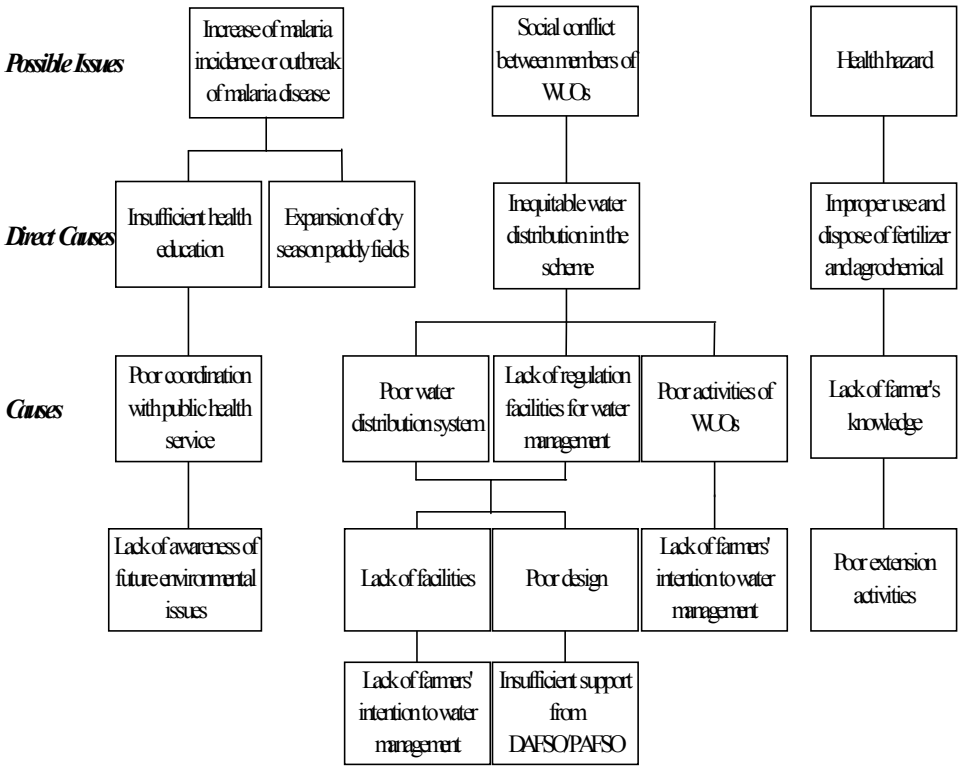
(b) Basic Issues

The following are considered as the basic causes for the above-mentioned possible issues.

- Lack of Awareness on Future Environmental Issues
- Poor coordination among relevant agencies
- No systematic water management
- Poor extension activities

(2) Micro level : Scheme-wide

There are three (3) environmental issues which are critical in the scheme level. Some of the issues and causes associated with the basin-wide type may also occur. At the micro or scheme-wide level. The following sections explain these issues and their relations.



Possible Environmental Issues and their Relations (Micro Level : Scheme-wide)

(a) Possible Issues

Unless the proper countermeasures are taken, the following issues might occur at micro level (scheme-wide) in near future:

- Social Conflict between Members of WUG
- Health Hazard
- Outbreak of Malaria Infection

(b) Basic Causes

The basic causes for the above issues include:

- Lack of Farmers' Intention for Water Management
- Poor Irrigation Facility
- Lack of Awareness on Future Environmental Issues
- Insufficient support services from DAFSO/PAFSO
- Poor extension activities

(3) Other Environmental Issues

(a) Forest Clearing

Forest clearing may pose a sort of indirect environmental issue for the irrigation development. The type of forest that varies from mixed deciduous forest to unstocked forest might be cleared, because of the expansion of irrigation fields following the installation of pumps. Further, other forest areas may also be affected by the fuelwood collection by villagers, most especially if the villagers have depended on the cleared forest for their fuelwood supply. If the cleared area is not significantly large, it is considered as an optimum trade-off between negative and positive impacts. However, it is also expected that they might be independent of the forest and have the intention to manage the forest by themselves through improving and stabilizing the villager's economic situation.

(b) Salinity Risks

As described before, a salt layer is believed underlying in some parts of the Study area. Therefore, a soil survey should be conducted before planning the scheme to determine the potential for the hazard, especially in case of large-scale irrigation scheme. Furthermore, the establishment of adequate drainage systems is also essential to prevent the capillarity and salinization of the irrigation scheme.