primarily due to unstable market condition.

In Nakham Tai, a few farmers have been successful in operating fish culture activities in improved natural ponds in a rather holistic manner including fruit production and duck raising around the fishpond. Market demand of fish is very high and the expansion of fish culture activity should seriously be considered in this area. Similarly, high market demands are observed for small animals such as chicken, duck and pig. Middlemen from outside visit the villages frequently seeking for such kinds of small animals.

Collection of forest products by the villagers is not very common in this area, but sometimes middlemen come to this area to buy frog specifically during the rainy season. Farmers collect bamboo shoots only for home consumption.

## 2.5 Agricultural Finance

In connection with the agricultural finance operated by APB in the three provinces of Bolikhamsai, Khammouane and Savanakhet where the model areas are located, Table 2-1 and Figure 2-4 show the APB's lending situation including (a) loan amount by type, (b) share of concessional loans, (c) deposit business, (d) average loan amount per account, (e) concessional loan by interest rate, (f) increase of concessional loans, (g) increase of deposit business and (h) average deposit amount per account.

(1) Thongharb-Nakhua Area

There is no APB field office at Pakkading. APB used to send out its officers for the purpose of rendering financial services from its office at Paksan which is the provincial capital located 70 kilometers on the Highway No.13 from Thongharb-Nakhua area. The APB office in Paksan City is one of the Service Units of APB. Among the service units of APB, its status is high even if its facilities and equipment are as poor as the other SUs. The Paksan office is responsible for financial services in all 6 Districts which involves a population of 164 thousand in 409 villages. There are only two (2) field offices of APB. The amount of loans and deposits are shown in the Tables below. The share of the concessional loans in the total loan amount of the Paksan office is 77.3%, which is higher than the

Table 2-1 APB's Loan in Three Provinces

(1) Loan Amount by Type

(Unit: Kip million)

| Interest Rate | 10% & lower | | Over 10% | | T o t a l | |
|---|---|---|---|---|---|---|
| | No | Amount | No. | Amount | No. | Amount |
| 1998 | | | | | | |
| Savanakhet | 5,039 | 2,650 | 505 | 685 | 5,544 | 3,335 |
| Khammouane | 2,448 | 1,113 | 592 | 1,808 | 3,040 | 2,921 |
| Bolikhamsai | 2,024 | 2,166 | 512 | 636 | 2,536 | 2,802 |
| Others | 18,559 | 19,792 | 5,513 | 17,751 | 24,072 | 37,543 |
| T o t a l | 28,070 | 25,721 | 7,122 | 20,880 | 35,192 | 46,601 |
| | | | | | | |
| 1997 | | | | | | |
| Savanakhet | 4,817 | 2,543 | 370 | 433 | 5,187 | 2,886 |
| Khammouane | 1,656 | 1,376 | 164 | 109 | 1,820 | 1,485 |
| Bolikhamsai | 1,172 | 1,801 | 424 | 768 | 1,596 | 2,569 |
| Others | 13,007 | 11,869 | 12,642 | 10,197 | 25,649 | 22,066 |
| T o t a l | 20,652 | 17,499 | 13,600 | 11,507 | 34,252 | 29,006 |

(2) Share of Concessional Loans

(Unit: %)

| Interest Rate | 10% & lower | | Over 10% | | Total | |
|---|---|---|---|---|---|---|
| | No. | Am'nt | No. | Am'nt | No. | Am'nt |
| 1998 | | | | | | |
| Savanakhet | 90.9 | 79.5 | 9.1 | 20.5 | 100.0 | 100.0 |
| Khammouane | 80.5 | 38.1 | 19.5 | 61.9 | 100.0 | 100.0 |
| Bolikhamsai | 79.8 | 77.3 | 20.2 | 22.7 | 100.0 | 100.0 |
| Others | 77.1 | 52.7 | 22.9 | 47.3 | 100.0 | 100.0 |
| T o t a l | 79.8 | 55.2 | 20.2 | 44.8 | 100.0 | 100.0 |
| | | | | | | |
| 1997 | | | | | | |
| Savanakhet | 92.9 | 85.0 | 7.1 | 15.0 | 100.0 | 100.0 |
| Khammouane | 91.0 | 92.7 | 9.0 | 7.3 | 100.0 | 100.0 |
| Bolikhamsai | 73.4 | 70.1 | 26.6 | 29.9 | 100.0 | 100.0 |
| Others | 50.7 | 53.8 | 49.3 | 46.2 | 100.0 | 100.0 |
| T o t a l | 60.3 | 60.3 | 39.7 | 39.7 | 100.0 | 100.0 |

Table 2-1 APB's Loan in Three Provinces (Cont'd)

(3) Deposit Business

(Unit: Kip million)

| | Current A/C | | Savings A/C | | Fixed Deposit | | Total | |
|---|---|---|---|---|---|---|---|---|
| | No. | Amount | No. | Amount | No. | Amount | No. | Amount |
| 1998 | | | | | | | | |
| Savanna | 2,401 | 319 | 3,705 | 212 | 172 | 85 | 6,278 | 616 |
| Kammuan | 1,774 | 179 | 1,205 | 115 | 73 | 38 | 3,052 | 370 |
| Borikam | 1,571 | 159 | 2,560 | 174 | 45 | 60 | 4,176 | 393 |
| Others | 19,065 | 9,472 | 47,143 | 3,868 | 103 | 1,674 | 66,311 | 14,976 |
| T o t a l | 24,811 | 10,129 | 54,613 | 4,369 | 393 | 1,857 | 79,817 | 16,355 |
| | | | | | | | | |
| 1997 | | | | | | | | |
| Savanna | 1,864 | 231 | 2,906 | 100 | 64 | 3 | 4,834 | 334 |
| Kammuan | 1,274 | 87 | 955 | 59 | 8 | 1 | 2,237 | 147 |
| Borikam | 1,289 | 131 | 2,269 | 95 | 7 | 6 | 3,565 | 232 |
| Others | 11,418 | 3,183 | 29,514 | 1,779 | 764 | 883 | 41,696 | 5,845 |
| T o t a l | 15,845 | 3,632 | 35,644 | 2,033 | 843 | 893 | 52,332 | 6,558 |

(4) Loan Amount Average per Account at the F/Y 1998 End

(Unit: Kip thousand)

| Interest | 10% & lower | Over 10% | T o t a l |
|---|---|---|---|
| Savanakhet | 526 | 1,356 | 602 |
| Khammouane | 455 | 3,054 | 961 |
| Bolikhamsai | 1,070 | 1,242 | 1,105 |
| Others | 1,066 | 3,220 | 1,560 |
| 1998 Total | 916 | 2,932 | 1,324 |
| | | | |
| Savanakhet | 509 | 1,170 | 556 |
| Khammouane | 831 | 645 | 816 |
| Bolikhamsai | 1,537 | 1,811 | 1,610 |
| Others | 913 | 807 | 860 |
| 1997 Total | 847 | 846 | 847 |

Note: The above amount is the average per group of borrowers which composed of 7 – 15 farm households. Loans10% & lower are on-lent through the good office of these groups. Loans over 10% are sometimes on-lent through groups and in most cases directly to individual farmers and rural enterprises.

Table 2-1 APB's Loan in Three Provinces (Cont'd)

(5) Concessional Loans byInterest Rate

(Unit: Kip million)

| Interest | 7% | | 8% | | 10% | | Total | |
|---|---|---|---|---|---|---|---|---|
| | No. | Am'nt | No. | Am'nt | No. | Am'nt | No. | Am'nt |
| 1998 | | | | | | | | |
| Savanakhet | 1,178 | 1,492 | 1,191 | 365 | 2,670 | 793 | 5,039 | 2,650 |
| Khammouane | 766 | 194 | 507 | 352 | 1,175 | 567 | 2,448 | 1,113 |
| Bolikhamsai | 608 | 1,155 | 558 | 482 | 858 | 529 | 2,024 | 2,166 |
| Others | 393 | 5,040 | 5,756 | 6,097 | 12,410 | 8,655 | 18,559 | 19,792 |
| T o t a l | 2,945 | 7,881 | 8,012 | 7,296 | 17,113 | 10,544 | 28,070 | 25,721 |
| | | | | | | | | |
| 1997 | | | | | | | | |
| Savanakhet | 2,090 | 947 | 1,095 | 783 | 1,632 | 723 | 4,817 | 2,453 |
| Khammouane | 889 | 754 | 413 | 455 | 354 | 167 | 1,656 | 1,376 |
| Bolikhamsai | 118 | 1,033 | 485 | 539 | 569 | 229 | 1,172 | 1,801 |
| Others | 1,519 | 4,216 | 4,301 | 5,104 | 7,187 | 2,549 | 13,007 | 11,869 |
| T o t a l | 4,616 | 6,950 | 6,294 | 6,881 | 9,742 | 3,668 | 20,652 | 17,499 |

(6) Increase of Concessional Loans (1998F/Y)

(Unit:Kip million)

| Interest | 7% | | 8% | | 10% | | Total | |
|---|---|---|---|---|---|---|---|---|
| | No. | Amount | No. | Amount | No. | Amount | No. | Amount |
| Savanakhet | △43.6 | 57.6 | 8.8 | △53.4 | 63.6 | 9.7 | 4.6 | 8.0 |
| Khammouane | △13.8 | △74.3 | 22.8 | △22.6 | 231.9 | 239.5 | 47.8 | △ 19.1 |
| Bolikhamsai | 415.3 | 11.8 | 15.1 | △10.6 | 50.8 | 131.0 | 72.7 | 20.3 |
| Others | △74.1 | 19.5 | 33.8 | 19.5 | 72.7 | 72.7 | 42.7 | 66.8 |
| T o t a l | △36.2 | 13.4 | 27.3 | 6.0 | 75.7 | 239.5 | 35.9 | 47.0 |

(7) Increase of Deposit Business(1998F/Y End)

(Unit: Kip million, %)

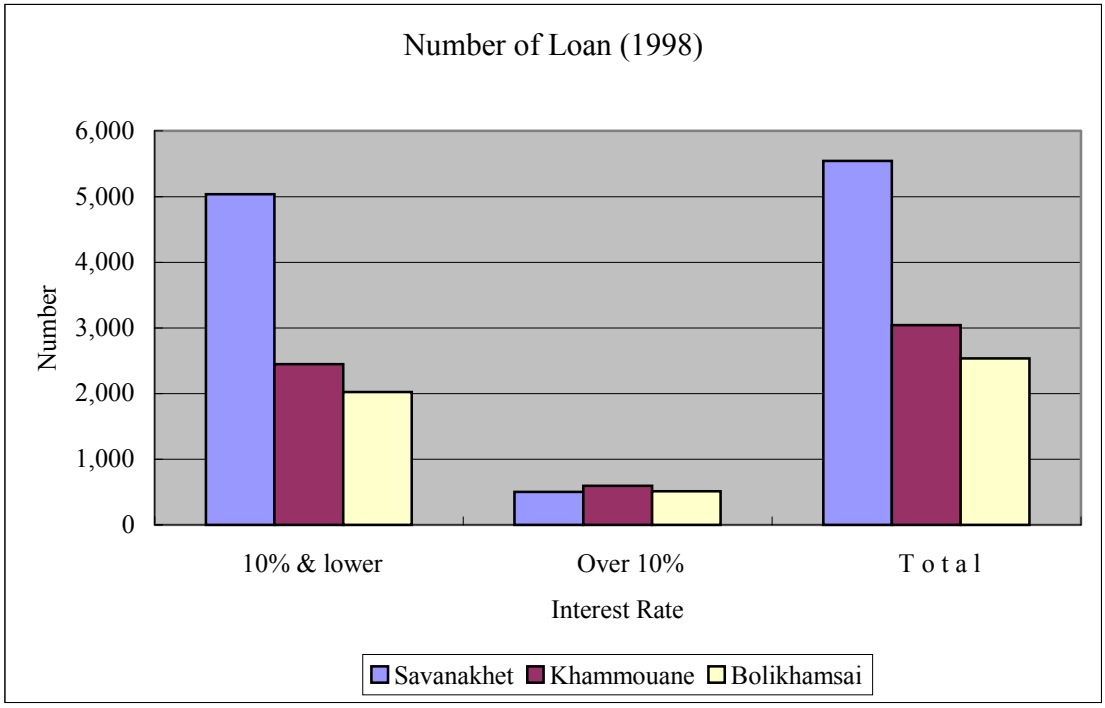
| | Current a/c | | Savings | | Fixed Deposit | | T o t a l | |
|---|---|---|---|---|---|---|---|---|
| | No. | Amount | No. | Amount | No. | Amount | No. | Amount |
| 1998 | | | | | | | | |
| Savanakhet | 28.8 | 38.1 | 27.5 | 112.0 | 171.9 | 27times | 29.9 | 84.4 |
| Khammouane | 39.2 | 105.7 | 26.2 | 94.9 | 812.5 | 38times | 36.4 | 151.7 |
| Bolikhamsai | 21.9 | 21.4 | 12.8 | 83.2 | 542.9 | 10times | 17.1 | 69.4 |
| Others | 67.0 | 197.6 | 59.7 | 117.4 | △86.5 | 89.6% | 59.0 | 156.2 |
| T o t a l | 56.6 | 263.2 | 53.2 | 114.9 | △53.4 | 108.0 | 52.5 | 149.4 |

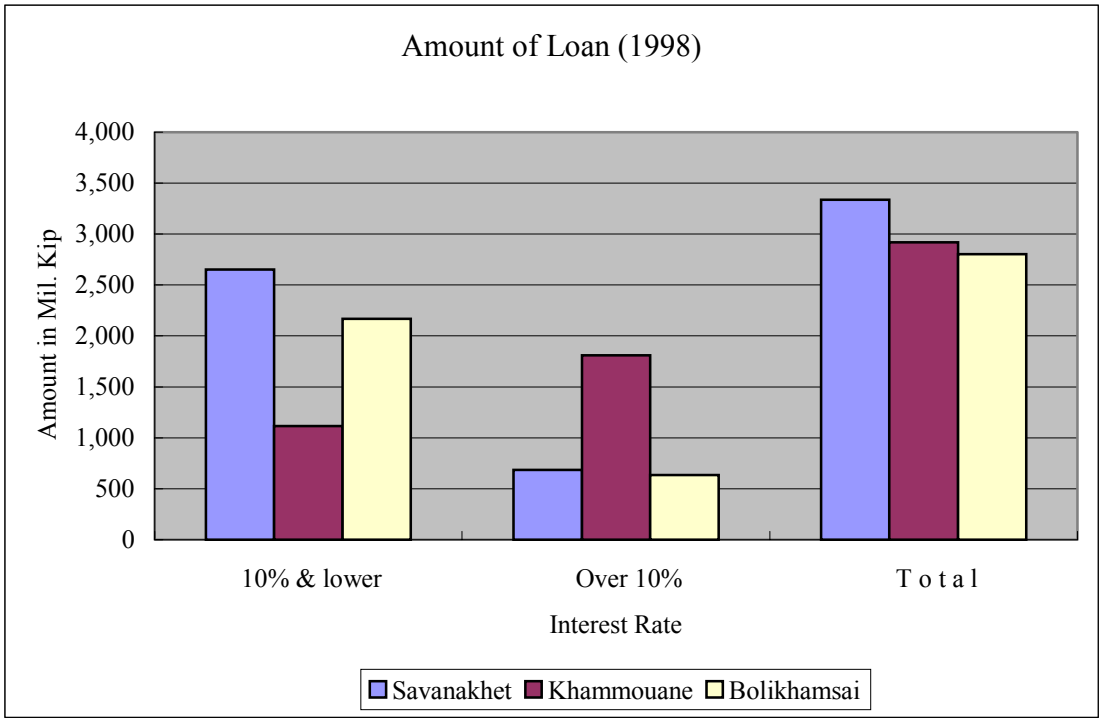
Table 2-1 APB's Loan in Three Provinces (Cont'd)

(8) Deposit Amount Average per Account (as at F/Y end)

(Unit:Kip thousand)

| | Current a/c | Savings | Fixed Deposit | Total |
|---|---|---|---|---|
| 1998 | | | | |
| Savanakhet | 133 | 57 | 494 | 98 |
| Khammouane | 101 | 95 | 521 | 121 |
| Bolikhamsai | 101 | 68 | 1,333 | 94 |
| Others | 497 | 82 | 16,252 | 226 |
| T o t a l | 408 | 85 | 4,725 | 205 |
| | | | | |
| 1997 | | | | |
| Savanakhet | 124 | 34 | 47 | 69 |
| Khammouane | 68 | 62 | 125 | 66 |
| Blrikhamsai | 102 | 42 | 857 | 65 |
| Others | 279 | 60 | 1,156 | 140 |
| T o t a l | 229 | 57 | 1,059 | 125 |




Note: Interest Rate: 10% & lower = Institutional Loan
Over 10% = Ordinary Loan

Figure 2-4 APB Lending in Three Provinces

national average of 60.3%. The amount of loan per group is also high. This shows that the concessional loan facility has widely penetrated into the rural sector. These years the allocation of concessional loan has become restrictive to borrowers. However, at Paksan office, the amount of concessional loans is increasing except for the long and medium term loans (Table 2-1 (5), (6)). The average amount of loans with interest rate over 10% is relatively small and this may be the result of a small number of rural enterprises operated in the area (Table 2-1(4)).

The current account is performing poorly, however, savings and fixed deposits are increasing very fast. The amount of current account and other deposits is too small to be utilized to support the funding operation in the APB office.

(2) Vangkhong Area

The Vangkhong area is serviced by the APB field office at Hinboun which is under the control of Thakhek office of APB. Khammouane Province has population of 295 thousand living in 9 Districts comprising 798 villages. There are 5 field offices in addition to Thakhek office which implements all the APB services in the province. The operational policy of Thakhek office is to give a freehand to the field offices as much as possible. This is due to difficult traffic and communication conditions in the province. On the other hand, Hinboun field office is directly linked by Highway No.13 wherein traffic and communications are easier than others. If the workload is too much, Thakhek office sends out its officers to assist Hinboun. Once the project gets started, it will be easy for Hinboun field office to work in close cooperation with Thakhek office. However, Hinboun is the center for agricultural production and dry season rice farming is also increasing very fast. It is evident that there is a need to increase the number of field officers by at least 2 – 3 more.

In Khammouane province, the average size of concessional loans is small and concentrated in the short-term loans (Table 2-1 (5), (6)). The amount of deposits is too small to be utilized as for farming fund in the province. However, without much effort on the part of APB, its deposit amount is increasing year by year. If there is a promotional policy for rural fund mobilization, the deposit business will gather momentum.

(3) Phonthan Area

The Province of Savanakhet is the largest province in Lao PDR with a population of 729 thousand living in 15 Districts comprising 1,543 villages. APB has its Savanakhet Branch office and 5 field offices in the province. Although Savanakhet is the largest province in the country, the performance of loan and deposit business of APB is not very much different from other provinces (Table 2-1 (1), (3)). This may be due to the fact that urban citizens comprise a higher ratio among the residents and there are many banking institutions on a severe competition among them. There are only 5 field offices which are grossly inadequate for the 15 districts. At the Savanakhet Branch, the concessional loan with interest rate of 10% and lower has a share of 90.9% of total loan of Kip 3,335 million at the end of 1998, which is the highest among the APB offices. At the end of 1997 the share reached 92.9% (Table 2-1 (2)). Among the concessional loans, the share of medium and long term loans at 7% and 8% is high indicating

that the APB offices and farmer borrowers are used to make longer term loans. No particular aspects are observed in its deposit business.

## 2.6 Irrigation and Rural Infrastructure

### 2.6.1 Irrigation infrastructure

(1) Thongharb-Nakhua Area

(a) Water source

The source of irrigation water is river flow in Nam Dua and its tributaries, Houay Khot and Houay Makson. Nam Dua and its tributaries are the meandering streams, with width 20 - 40 m and depth 4 - 5m. Its river/invert slope is about 1/600 to 1/4000 in the plain. The size of the basin is estimated at 145 $km^2$ at the pumping station in Thongharb. The basin is formed with steep mountain and gentle plain. The plain is mixed with cultivated paddy fields and natural shrub forest. Strong and heavy flood in the wet season can cause bank erosion and deep sedimentation. On the other hand, water flow in the dry season is very limited, and the river can dry up in drought year.

Since there is no hydrological observation station in the basin, the discharge of the basin was estimated using data from adjacent basins. Since discharge is not measured in small streams, the basin discharge was estimated based on the specific discharge of Nam Xam at Muong Borikhanenag. In this study, river discharge was calculated for two sites, Nahin and Thongharb, the former in the up-stream and latter in down- stream, as follows.

Calculated Monthly Discharge ($m^3$/sec)

| Station | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nahin | 0.22 | 0.15 | 0.12 | 0.11 | 0.43 | 1.70 | 3.61 | 4.03 | 2.54 | 1.07 | 0.57 | 0.39 |
| T.harb | 1.10 | 0.75 | 0.62 | 0.57 | 2.18 | 8.58 | 18.22 | 20.32 | 12.79 | 5.39 | 2.89 | 1.84 |
| Total | 1.32 | 0.90 | 0.74 | 0.68 | 2.61 | 10.28 | 21.83 | 24.35 | 15.33 | 6.46 | 3.46 | 2.23 |

Note: The size of basin is 24 $km^2$ at Nahin and 121 $km^2$ for Thongharb. Total 145 $km^2$ at Thongharb.

The maximum and minimum discharges are also estimated from the discharge data from 1987 to 1993. At Thongharb maximum discharge is 120 m3/s. In 1995, the model area was flooded and damaged; inundation depth and duration were 2m and 21 days, respectively, according to the map of "1995/96 flood extent in Bolikhamsai Plain". In the basin, Thongharb area is most prone to annual flooding.

(b) Irrigation facilities

In this basin, there are five pump stations along Nam Dua and H Makson. These pumps were constructed under the National Pump Program from 1997 to 1998. Most of them are of the small pontoon-type equipped with diesel engines. These pump stations are supposed to operate in dry season to irrigate paddy fields in the allocated villages. According to the survey results in this study, some of the pumps are already requiring regular maintenance, repair and replacement of spare-parts. The

existing pumps are shown as follows.

| Village | River | Pump Type | Pump Capacity | Unit |
|---|---|---|---|---|
| Nahin | H. Makson | Portable | 14 HP | 2 |
| | | | 6 HP | 3 |
| Nakhua Nai | H. Makson | Pontoon | 65 HP | 1 |
| | | Pontoon | 65 HP | 1 |
| Nakhua Nok | | | | |
| Nam Dua | | | | |
| Thongharb (north) | Nam Dua | Pontoon | 65 HP | 2 |
| Thongharb (south)* | Nam Khou | Pontoon | 65 HP | 2 |

Note : * is located in Nam Khou, not included in the basin of 145 $km^2$.

According to the interview survey, in Nahin, a simple weir made from wood and earth-bags was constructed temporarily by the affected farmers even before dry season irrigation has started. After construction a portable pump was installed beside the weir to be able to draw water from the river. Nakhua Nai has two pump stations along H Makson. Since the river discharge in dry season is very limited, the concrete weirs were constructed by PIS in Nakhua Nai and Thongharb to control and secure water level in the dry season. However, these weirs were destroyed by the heavy flow in wet season. It was due mainly attributed to poor structural design, without giving serious consideration on the regular occurence of flash flood. There are small earth irrigation canals in each pump irrigation scheme. However, these canal systems are insufficient to cover all of the irrigation area, and large delivery loss could occur in these canals due to seepage and flow retardation by sediments and weeds.

Irrigation services area changes every year, depending on the availability of river flow and operation method of pump and water distribution. Although pump irrigation has been introduced and tried out in all of the villages, it has not been successful so far. The reasons are lack of water resource, high water losses coupled with poor field management and costly pump operation. Judging from the interview survey, pump irrigation has not been well operated in the past except in Thongharb area. Thongharb has the largest irrigated area in the basin, because of the existence of two irrigation systems, one in the north and the other in the south of the fields. They draw from different water source, the one in the north is fed by water from Nam Dua while the one in the south is fed from Nam Thou. According to the interview survey the total irrigation area of the two systems is 73 ha. Nakhua Nok and Nam Dua have tried to irrigate their paddy fields by pump, but have failed due to lack of water resource and unsuitable mechanical operation of pump equipment. The present irrigation facilities are summarized as follows.

Present Irrigation Facilities of the Villages

| Village | Pump | Canal Length (m) | Intake facility | Agricultural Area (ha) | Actual irri. area (ha) |
|---|---|---|---|---|---|
| Nahin | 14 HP×2, 6 HP×3 | 400 | Temporary weir (dry season only) | 57 | |
| Nakhua Nai | 65 HP×1 (up-st.) | 200 | Weir (broken) | | |
| | 65 HP×1 (down-st.) | 1,000 | No | | |
| Thongharb | 65 HP×2 (north) | 3,100* | Weir (broken) | 150 | 73 |
| | 65 HP×2 (south) | 3,350 | No | | |

Note: Size of area and canal length are based on the interview survey. * Surveyed by JICA Study team.

(c) Water management

The pump stations in these villages are operated and managed independently by each of the villages. According to the interview survey, irrigation fields are allocated equally to all village households along the canal before starting cultivation. However, definite water users group for irrigation purpose is not yet organized in all the villages. Pump operation and water distribution are supposed to be managed under the villagers' internal solidarity and responsibility. Pump operation fee, in the form of fuel, is collected from the villagers and must be paid by the allocated time. The amount of fuel fee is based on the size of irrigated field. Irrigation canal is reshaped by labor contribution from the villagers themselves. The most common irrigation development constraint in the basin is water shortage. The river discharge is insufficient to meet the demand of all irrigable fields. In Thongharb village, rotational irrigation of 2 days and 4 days intervals is applied between the south and north system, respectively, during pump operation.

(2) Vangkhong Area

The main water resource for agricultural activities and other domestic uses is the Hinboun river, one of the major tributaries of Mekong River. In the Hinboun river basin, many pump irrigation schemes have been installed along the river, since the river has enough flow in the dry season to irrigate its surrounding area. The model area will be one of the typical pumping schemes as it represents the general characteristics of the area i.e. generally undulated and mixed with natural shrub and open paddy fields. Land opening is being tried with the introduction of pump irrigation scheme.

A pumping station is now under construction. It is of the pontoon-type with two units of 75 kw pump and a total head of 26 m. At the time of interview survey, the pumps are not yet installed on the pontoon, but the delivery pipes and diversion pond were nearing completion. Electricity is not provided yet but construction work for feeder line was started in December. The main irrigation canal connected to the diversion pond had already been constructed by mobilizing farmer labor. It is a small earth canal, with a total length of about 1,000 m and about 0.8 m wide and 0.5 m deep. With the construction of electricity supply, provision for irrigation system will be completed.

The land around the canal is covered with natural shrubs and non-cultivated opened fields. Villagers would want an irrigation area of about 60 ha. To reach full land opening, they prefer a gradual opening

based on their capability in mobilizing the resources required. According to the interview survey, about 52 ha of rainfed paddy field exist at about one km from the pump station. There are two small drainage streams covered with shrubs. Since the area is located in the low-lying area along the river, it is prone to flooding every year. The average flood depth is 0.5 m lasting from 20 to 30 days. Severe flood is the major development constraint for wet season paddy. To mitigate flood damage, flood prevention work must be planned and executed. This is definitely costly and far beyond the capability of the farmers. Considering the frequent flood occurrence in the fields, introduction of dry paddy cultivation is urgently needed to ensure the food security of the villagers. To introduce dry season paddy production, as the next best alternative, costly land reclamation work will be needed and canal system must also be constructed in the reclaimed land.

(3) Phonthan Area

(a) Irrigation pond

At present, the larger pond is used by farmers in the three villages in Phonthan and Nakham. Based on the survey, the irrigation pond is complemented by earth dikes, intake facilities, service spillway and emergency spillway. Dimensions and capacity of the pond are described below.

| Item | Existing condition | Remark |
|---|---|---|
| Crest height | Av. 4.0 m | Height change from 3.5 m to 4.5 m |
| Crest length | 500 m | |
| Crest width | Av. 3.0 m | |
| Slope | 1: 2.0～3.0<br>1:2.0～2.7 | Up-stream<br>Down-stream |
| Water surface area | 262,000 m2 | At crest of service spillway, max. depth 2.8 m |
| Active storage capacity | 320,500 m3 | At crest of service spillway, |
| Intake facility | Ø1,000 mm | Culvert, intake tower, slide gate |
| Service spillway | B=7.0 m | Concrete structure, wooden bridge |
| Emergency spillway | B=5～10 m | Natural earth canal, overflow type |

Source: All data are either assumed or estimated based on the survey by JICA study team.

Although the pond is well managed as compared to other similar ponds, some facilities have deteriorated. Some parts of the crest and slope are heavily eroded that crest elevation is not constant and the height has changed. Although an intake tower with small slide gate is installed, its spindle and wooden gate has severely deteriorated that leakage from the intake culvert was detected. Service spillway constructed near the intake facility is of poor concrete structure. Although an emergency spillway exists at the right end of the dike, emergency overflow may be obstructed time with deposited soil-sediment and wooden-block during operation. Under such conditions, it is likely that the function of the pond will further deteriorate year after year if improvement works are not undertaken. The pond should be rehabilitated, at the same time the present irrigation system is being developed . To expand irrigation, the effective storage capacity could be expanded by increasing the present crest height.

The size of river basin feeding the pond is about 20.3 $km^2$ as estimated on the 1/50,000 map. Since there is no hydrological observation station in/around the basin, runoff discharge data of the basin must be

assumed from the specific discharge data of the other basins. In this study, monthly average discharge data of Nam Sebanghiang at Tchepon was applied. By applying the specific discharge data of the station, monthly inflow or available discharge was calculated and the annual average reached to 0.86 $m^3$/sec, with highest peak occurring in August and lowest in April. Monthly discharge is as follows.

Calculated Monthly Average Runoff of the Basin ($m^3$/sec)

| Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.28 | 0.22 | 0.21 | 0.19 | 0.42 | 0.73 | 0.98 | 2.18 | 1.68 | 2.18 | 0.79 | 0.49 |

Note: Based on the monthly average specific discharge of Nam Sebanghiang at Tchepon from 1998 to 1993.

According to the interview survey on flooding condition of the pond, no overflow on the crest occurred in the past. Time of flood concentration may be short, with an average of 1.0 day, considering the size, land use and topographic condition of the basin. Maximum flood discharge data is also assumed at 21.0 $m^3$/s by using the specific maximum discharge data from 1988 to 1992.

(b) Irrigation canal

After pond construction a total of about 1,700 m of irrigation canal was built using the villagers' labor contribution with technical support from PIS. One main canal of 470 m and two sub-canals of 300 m and 930 m respectively. The canal is of the earth-type, 0.4 m deep and 0.7 m wide on the average. Although a total of six small diversion boxes along the canal have been installed, most of them do not function well due to sedimentation and broken stop-logs. It is likely that canal network is insufficient to cover the irrigable area and the route may not fit from topographical point of view. Although a small aqueduct exists in the canal, it is already damaged.

Due to poor canal network, irrigated area is very limited, only about 40 ha (1998) confined largely to fields along the canal. As a result, farmers served are limited and priority always go to the same people, and the concept of equal allocation of irrigation fields has thus become inoperable. There is no definite and organized water user group in the villages. Slide gate of intake tower is voluntarily operated by the limited beneficial farmers. Canal network is also supposed to be cleaned and reshaped before dry season irrigation starts.

Since the area is located at higher elevation, flooding is not so severe but supplemental irrigation is needed during wet season.

### 2.6.2 Rural Infrastructure

(1) Thongharb-Nakhua Area

There are two groups of villages in this model area. The first group is composed of three villages: Nahin, Nakhua-Nai and Nakhua-Nok, and the other group includes Nam Dua and Thongharb. These two groups are connected with each other through the use of river flow in Nam Dua, a small tributary of the Mekong River.

The first group of villages: Nahin, Nakhua-Nai and Nakhua-Nok

The villages are located close to national road No.13. The main rural road runs directly from the road No.13 towards the model area. Although this road is trafficable in the dry season, the road surface becomes very bumpy farming the wet season. It can be said that road condition is not enough to provide safe and smooth drive due to lack of gravel pavement and pipe crossings for drainage.

There are three (3) pump stations and weirs. From the main rural road to these sites, the distance is about from 500m to 2,000m, and access is by the walk-ways/ruts/foot paths through paddy fields and forest. The existing condition of these ruts/foot paths access are poor for daily farming and maintenance activities because it is narrow and not allow the passage of large vehicles such as tractors. These ruts/foot paths should be improved and upgraded to initiate rural and agricultural development in the villages.

Existing shallow wells in each of the villages are sufficient to provide domestic water supply for villagers. There is a primary school within the area but the lower secondary school is very far from these villages.

The second group of villages: Nam Dua and Thongharb

The existing rural road-connecting road No.13 to Thongharb is in bad condition. Although a large portion of the whole section (5km) running along the Nam Dua, there are no bridges at two river crossing. It is passable only in dry season but not all year round, rendering it useless to the villagers.

It is one of the development ideas to connect Thongharb directly with national road No.13 using the existing rut/foot path through the paddy fields and constructing a 'bridge-weir' to cross Nam Dua at the site of the damaged concrete weir. Since the weir was damaged by past heavy flood, it is necessary to reconstruct for its irrigation purpose and the 'bridge-weir' will serve both as a bridge and weir.

The wells in the villages are enough to supply domestic water for villagers. As for education facility, there is a primary school, but the lower secondary school is far located in the other village.

(2) Vangkhong Area

This model area is composed of only one village: Vangkhong. The distance of the access road from the national road No.13 to this area is about 9 km. but the conditions of some sections of this access road are bad and not suitable for an all-year-round drive, except for the provincial road.

The area along the Hinboun river will be reclaimed for irrigated agriculture in the near future but presently, it is still under forest and dense bush/grass cover. The land cleared so far is still below the level required for paddy cultivation. In these lands covered with forest and grass fields, there is no rural road except for small mountain roads or very narrow walk-ways/foot path from Vangkhong to the paddy fields planned.

The new rural road should be constructed around this area prior to land reclamation, as it can be used as road during the construction of irrigation facilities such as pump stations and canals.

The wells in the village are enough to supply domestic water for villagers. For children in this village there is a primary school but the lower secondary school is located in village nearby.

(3) Phonthan Area

There are two ponds constructed in the area. The smaller one is used only for drinking and domestic water source while the larger one is used for irrigation purposes. The length of access road from the road No.13 to the area is about 11 km. but, some parts of this access road is not suitable to travel all year round except for some running sections in the mountainous side close to road No.13.

As far as rural roads is concerned, there are two problems in the area. The first is the bad condition, very bumpy and frequently inundated in the wet season was it runs through the paddy fields especially in the stretch between Phonthan and Nakham. The second is its very narrow width through the forests which do not allow the passage of vehicles. The secondary rural road leading to the larger pond and the next other village, B. Nake, may provide an example of this condition.

Although the main rural road connecting the two villages of Nakham and Phonthan is accessible during the dry season, its surface becomes bumpy in the wet season. As the result, it is difficult to ensure a smooth drive.

The rural roads from Nakham up to the irrigation pond through Phonthan village need improvement. This road should also be extended to the next village B. Nake passing through the dike of pond and the existing forest area.

There is a well beside the irrigation pond that has sufficient amount of domestic water for Phonthan villagers. Since the elevation difference between the high water level of the pond and top rim of this well is about only 0.60m, increasing the water level will be needed along with the provision to make well wall reinforcement by concrete structures or strong concrete pipes. In this case, a new wooden bridge between the well and the pond dike will be also needed.

For village children, there is a primary school in the Nakham, but the lower secondary school is located very far from the two villages.

## 2.7 Environment

### 2.7.1 Thongharb-Nakhua Area

(1) Flora (Vegetation)

Forestlands in the model area are classified into two types based on the existing conditions, such as thick forest and sparse forest. Tree species found in the forestlands are as follows:

Thick forest: Mai Khaen *(Hopeaodoraya)*, Mai Dou *(Pterocarpus marcrocarpus)*, Mai Peuy (*Lagerstromia cochinchinensis)*, Mai Bak *(Anisoptera robusta)*, Mai Nhang *(Dipterocarpus alatus)*, Mai Mampa (*Fagraea Fragrans)*, etc.

Sparse forest: Phai Ban, Phai Pa, Mai Sot, May Peuy *(Lagerstromia cochinchinensis)*

(2) Fauna (Wildlife)

Large mammals and these considered as endangered species of fauna are not found in and around the existing lowland paddy fields, especially in the potential irrigation area nor are they found in the adjacent villages. However, several species of wildlife, such as deer (*Cervus unicolor*), barking deer (*Muntiacus muntjak*), monkey (*Macaca sps.)*, wild pig *(Cuon aloinus)*, categorized as protected and restricted species in the regulation (Decree 118), are found in the thick forest according to the farmers.

(3) Watershed Condition (from the pump station of Ban Thongharb)

(a) Situation of Shifting Cultivation

At present, only the villagers in Ban Nam Dua practice shifting cultivation. But it is different from the practice of Lao Saung tribe. The total area under shifting cultivation is estimated at about 150 ha, and about 50 ha is under annual cultivation. The other villages (Nahin, Nakhua-Nok, Nakhua-Nai and Thongharb) have stopped the practice since 1995 with the government's declaration on reducing shifting cultivation. The reason why Ban Nam Dua is still practicing shifting cultivation is that Ban Nam Dua is a new village established by migrants from several regions in the early 1960's, while the other villages are formed by the natives. Since Nam Dua lacks lowland paddy fields, most of the villagers cannot help but practice shifting cultivation to sustain their life.

(b) Level of watershed degradation

Although shifting cultivation is presently practiced on limited area, the watershed condition in the area has degraded due to the prior activities, such as shifting cultivation, logging, forest fire, etc. According to the farmers, landslide occurs annually in foot slope of the Sayphou Phapet Mountain, which is the upper part of the watershed area. In fact, a part of the watershed area is classified as the regeneration forest by PAFSO.

(c) Present Forest Management Activity

Within the watershed area (about 100ha), a research and reforestation project has been implemented by DAFSO (Pakkading) and Ban Nam Dua with financial support from FAO. The outline of the project is summarized in the following table.

| Items | Summary |
|---|---|
| Name: | Forestry Research Support Program for Asia and the Pacific (FOSPA) |
| Location: | Phou Petka Forest Demonstration Area (about 2 km northwest from B. Nam Dua) |
| Purpose: | Capacity building of government (PAFSO and DAFSO) officials and villagers<br>Identifying suitable local tree species for reforestation |
| Activity | Nursery development (facility and seedlings), Reforestation and demonstration,<br>Development of monitoring system |

Source: Forestry Section in DAFSO, Pakkading

Other than the above activities, forest conservation and restoration activities are not found in the area. However, DAFSO has a plan to implement the "Land Allocation Program"[4] in the target villages in order to reduce the progress of forest degradation.

(4) Wetlands

There are no important and/or valuable wetlands related with Nam Dua river.

(5) Flood Condition

The project area is subject to a seasonal but short flooding regime. The situation of flood varies depending on the location villages. Thongharb suffers relatively severe damage, while the other villages have minor or negligible damage. The situation of flood is summarized as follows:

| Area | Thongharb | Nahin, Nakhua-Nok , Nakhua-Nai | Nam Dua |
|---|---|---|---|
| Frequency: | 1 time/year | 1 time/2years | None |
| Period (inundation) | 1 – 30 days | 1 – 2 days | - |
| Depth of water: | 1 – 3 m in fields | 1 – 3 m in fields | - |
| Season: | Aug. – Sept. | Aug. – Sept. | - |
| Damage to production | 0 – 90 % | 0 – 10 % | - |

Source: Interview survey to villagers

(6) Fishery Resources

It is reported that eleven kinds of fishes (e.g. catfish, snakehead fish, carp, minnow, sheatfish, featherback, eel) and two kinds of aquatic reptiles (soft-shell turtle and turtle) exist in and around the model area.

[4] "Land Allocation Program" has been implemented by Department of Forestry in whole of the country for reduction of shifting cultivation, conservation of existing forest, and promotion of wise-use of available land. Through the program, villagers formulate a future land use plan by themselves in consultation with DAFSO and PAFSO. Final goal of the program is to achieve the sustainable land and natural resource management through increase of land productivity.

(7) Food Security and Income Source

Some of the villagers in the area suffer from food shortage since the production of rice is insufficient. The following table shows food shortage levels in each village.

(Unit: ha)

| Name of Village | Period of shortage | % of H.H |
|---|---|---|
| B. Thongharb | 3 months | 5 % |
| B. Nahin | 3 – 6 months | 20 % |
| B. Nakhua-Nai | 2 months | 5 % |
| B. Nakhua-Nok | 3 months | 10 % |
| B. Nam Dua | 6 months | 80% |

The period of food shortage is usually experienced at the start of cropping season of rainfed paddy (May) up to its harvest season (October). To overcome this situation, the villagers have to search for other income or food sources besides upland crop cropping, such as gathering of products from the forest (cardamom, resin, rattan, mushroom, and bamboo shoot), resource from river (fish) and resources in fields (frog). The collection of cardamom and resin as the main income sources contributes to supporting their life in this season.

(8) Major Diseases

Major diseases in the area are malaria, dengue fever, and severe diarrhea.

(9) Health Program

The IBN program has just started in the area in September as part of the Primary Health Care (PHC) Project supported by GTZ. Establishment of RDF is also planned in a course of the PHC project. RDFs in each village will be established in 2000. The nearest health post in the area is located in Ban Nakhou, about 1 km away from Ban Nakhua-Nok.

(10) Present Social Conflicts

According to the farmers in the area, they share the irrigated lands in dry season, and/or they decide the land users of the irrigated lands in dry season through a village meeting. In other words, they try to distribute the benefit to the villagers equally as much as possible. So far there has been no social conflict among the villagers. However, since two irrigation pumps and three pumps are located in H Makson and Nam Dua, respectively, there is a possibility that conflict may arise from the competition for water between the irrigation schemes.

(11) Religious and historic sites

There are no important and/or valuable sites from religious and historic viewpoints in the model area.

### 2.7.2 Vangkhong Area

(1) Flora (Vegetation)

The quality of forest in the area is perceived to be low to moderate. Tree species found in the forestlands are as follows:

Thick forest: Mai Bok *(Irvingia malayana)*, Mai Peuy *(Lagerstromia cochinchinensis)*, Mai Xad (*Dipterocarpus obtusifolium)*

Sparse forest: Mai Kaka Lao (*Lagerstraemia macrocarpa)*, Mai Xad (*Dipterocarpus obtusifolium)*, Mai Kadon, Mai Hou Ling, Mai Kae

(2) Fauna (Wildlife)

Large mammals and those considered as endangered species of fauna are not found in and around the present lowland paddy fields and potential irrigated area nor near the villages. Since the forests have been disturbed by human activities, the quality of animal diversity has also degraded. However, several species of wildlife, such as barking deer (Muntiacus muntjak), pangolin (Manis javanicus) and jellow tree monitor (Varanus bengalensis) are found in the thick forest.

(3) Wetlands

There are no important and/or valuable wetlands related with Hinboun river.

(4) Flood Condition

The model area is subjected to severe flooding every year, hence, the life of the villagers is significantly affected. The situation of flood is summarized as follows:

| Area | Severe year | Normal year | Less-affected year |
|---|---|---|---|
| Recent years | 1997 | 1996 | 1998 and 1999 |
| Duration (inundation) | 20 days | 20 days | 0 days |
| Depth of water: | 2 – 3 m in field | 1 – 2 m in field | no |
| | 1.5 m in village | 0 m in village | no |
| Damage to production | 90 - 100 % | 50 % | 0 % |

Source: Interview survey

Other than damage to rice production, flooding also cause other problem issues, such as killing the livestock, inducing incidence of water-related diseases (but not outbreak) and interruption of communication with outside areas.

(5) Fishery Resources

It is reported that ten kinds of fishes (e.g. catfish, snakehead fish, perch, minnow, needlefish, etc.) and two kinds of aquatic reptiles (soft-shell turtle and turtle) exist in Nam Hinboun river.

(6) Food Security

Since the area is annually subjected to severe floods causing significant damage to rice crop, most of the villagers suffer from food shortage. The degree of food shortage among the villagers depends on flood condition and the extent of damage to paddy production. The following table shows the food shortage level in the village.

| Duration of shortage | 2 months | 3 months | 6 months | > 6 months |
|---|---|---|---|---|
| Proportion of villagers (%) | 10 | 20 | 40 | 30 |

Source: Interview survey

In this connection, non-agricultural income sources are very important for sustaining the life in the area, especially in the rainy season from May to November. According to the villagers, they substantially depend on the natural resources from Hinboun river and in the field as shown below.

Major income sources in the rainy season

No. 1: Fishing (September – December)
No. 2: Catching frog (June – September)
No. 3: Harvesting Bamboo shoot (May – October)

(7) Major Diseases

Major diseases in the area are malaria, severe diarrhea and fever (normal cold). In addition, malnutrition is also the major problem for the age group under five years old.

(8) Health Program

There is a VHW in the village but so far, no health program has been implemented. According to the staff of Provincial Public Health Service Office, there is no plan to establish RDF or to introduce IBN program into the village. The nearest health post is located in Ban Hinboun-Nua, 2 km away from B Vangkhong.

(9) Village Consensus

According to the farmers in the area, they will share the newly irrigated land in dry season among themselves and/or they will decide the land users for the irrigated lands in a village meeting. The village has prior experience in sharing their resources. In constructing the irrigation canal in 1998/1999, all of the villagers participated. For land clearing work to open up new land for cultivation, they have the intention to do it all by themselves.

(10) Religious and historic sites

There are no important and/or valuable sites in the model area from religious and historic viewpoints.

### 2.7.3 Phonthan Area

(1) Flora (Vegetation)

The forest is located in the surrounding areas of the villages, but not largely extended in the area. Of the forestlands, there are 30 ha of informal (custom) conservation forest located on the right-bank of the reservoir. Aside from this, there is no conservation and/or forest protection activity being undertaken. Existing tree species in the surrounding areas of the villages are noted below.

Tree species: Mai Dou *(Pterocarpus marcrocarpus)*, Mai Nhang (*Dipterocarpus alatus)*, Mai Phork *(Parinarium annamensia)*, Mai Deng *(Xylia kerrii)*, Mai Bak *(Anisoptera robusta)*, Mai Bok *(Irvingia malayana)*, Mai Nhoung, Mai Mampa *(Fagraea Fragrans)*, Mai Ham-Ao *(Pterospermum megalocarpum)*, etc.

(2) Fauna (Wildlife)

Large mammals and those considered as endangered species of fauna are not found in and around the present lowland paddy fields nor in the nearby villages. However, several species of wildlife, such as such as barking deer (Muntiacus muntjak), monkey (*Macaca sps.)*, *w*ild pig *(Cuon aloinus)*, jellow tree monitor (Varanus bengalensis), etc., are found in the thick forest.

(3) Upper Reach of the Reservoir

(a) Forests along the reservoir

Most parts of the areas along the reservoir are covered with forests. These forests are divided into three categories based on management condition, such as Village Conservation Forest (VCF), Private Forest (PF), and Village Forest (VF). The quality of forest also varies depending on management type and their present condition as shown below:

| Forest area | No. of trees (trees/ha) | No. of Species | Total BA <1 (m2/ha) | Total stem volume (m3/ha) |
|---|---|---|---|---|
| VCF | 450 | 14 | 55 | 840 |
| PF | 887 | 22 | 15 | 87 |
| VF | 1,700 | 7 | 22 | 166 |

Source: Forest Inventory Survey, JICA Study Team

Remarks: <1 BA: Basal Area of trees

The VCF has a low density of tree with high climax. Medium to large tree (DBH: over 20 cm) share about 50 % of the trees in the VCF. On the other hand, small tree (DBH: less than 20 cm) occupy over 90 % of the PF and VF.

(b) Paddy fields in the upper reach of the reservoir

About 30 ha of lowland paddy fields extend along Houay Thong. The lands are owned by 13 households

in B Phonthan and two households in other village. Some parts of the area are also subjected to flooding in the rainy season, because of rising water level of the reservoir. The general farming situation in the upper reach are summarized as follows:

| Items | Condition |
|---|---|
| 1. Paddy fields | about 30 ha |
| 2. Inundated area in rainy season | 8.5 ha |
| 3. Average yields | 0.74 ton/ha (total)<br>0.45 ton/ha (inundated)<br>0.89 ton/ha (non-inundated) |
| 4. Inundation Condition | Depth: 1 m<br>Period: 3month (Aug.- Nov.) |
| 5. Cropping season | May to November |

Source: Interview survey

(4) Wetlands

There are no important and/or valuable wetlands related with the model scheme.

(5) Watershed Condition

The watershed area of the reservoir is rather small, only about 19.2 $km^2$, and forms a gentle topographic condition with elevations varying from 150 - 180 m MSL. As for land use , lowland paddy fields extend in the watershed area along H Thong and H Pong. It is assumed that forest still remain around the paddy fields in the watershed area. However, it is also assumed that the forest has degraded by the conversion of forest to agricultural land and by fuel wood collection.

(6) Fishery Resources

It is reported that six kinds of fishes (e.g. catfish, snakehead fish, perch, carp, etc.) exist in the reservoir.

(7) Food Security

Food shortage in the area is not as severe as the other model areas. Villagers who suffer the food shortage are mainly the newly independent households, small landholders or landowners in the upper reach.

| Name of Village | Period of shortage | % of H.H |
|---|---|---|
| B. Phonthan | 3 month | 10 % |
| B. Nakham-Nai | 3 - 6 month | 18 % |
| B. Nakham-Tai | 3 - 6 month | 10% |

Source: Interview survey

As for other income source, the villagers in B. Phonthan sell their livestock (cow, pig, duck and chicken) and fish caught from the reservoir. On the other hand, those in B Nakham-Nua and Tai only get income from selling livestock.

(8) Major Diseases

Major diseases in the area are malaria, severe diarrhea and fever (normal cold). The season for malaria varies over rainy season from April to November.

(9) Health Program

The Provincial Public Health Service Office has a plan to establish RDF in the three villages in the year 2000 with support from the World Bank. However, there is no plan to introduce the IBN program into the villages. The nearest health post is located in Ban Nakham-Tai.

(10) Present Social Conflicts

In dry season of 1998, 20 ha of paddy fields in B Phonthan were irrigated by the reservoir, benefiting 23 households. Although more households in the area wanted to grow dry season rice, there is no such system as land sharing as practiced in the Pakkading area or B Vangkhong area. The farmers in B Phonthan decide the area to be irrigated before starting the dry season irrigation through a village meeting. However, the areas usually selected are those located near the irrigation canals. Therefore, some of the farmers are discontented with the present situation because of the inequitable allocation of water resources.

Although the villagers in Nakham-Nua and Nakham-Tai have land in the command area, the area benefited by the irrigation system is quite limited. They are also dissatisfied with the present situation because the benefit is concentrated to the villagers in B Phonthan.

(11) Religious and historic sites

A spiritual shrine exists in the village conservation forest (VHC) along the reservoir. The villagers in Ban Phonthan believe that the shrine is a place for God and it cannot be disturbed. The shrine is located near the reservoir edge (about 8 m from maximum water level). The shrine is a small hut made of wood, 1.5 – 2 m tall, 1 m long and 1 m wide.

# Part 2: Model Area Development

# CHAPTER 3

# DEPLOYMENT OF PARTICIPATORY APPROACH

# CHAPTER 3 Deployment of Participatory Approach

## 3.1 PCM Workshop

The PCM workshop was carried out in the three model areas selected. The primary objective of the workshop is for the participants, including farmers-beneficiaries to analyze issues and problems that hinder their own development, and identify their own development objectives and targets. On the basis of the results of these workshops, PDMs were prepared and used for confirmation of future development directions of the respective villages and communities. Furthermore, the PDMs were feed-backed to beneficiaries for reconfirmation of their intentions. The process is described in the following paragraphs.

PCM Workshop

In selecting participants for the workshops, every effort was made to include a wide range of categories such as income level and age, representation of various groups such as from Lao Women's Union, Lao Youth Revolutionary Union, and other farmers' organizations including the elderly, schoolteachers through prior discussions with the village chief and the members of village authority. The members of TFT performed the role of a workshop -facilitator. They provided the technical input and lectured on the methods of PCM in the morning session of the first day. Subsequently, the analysis of existing situations in the community was carried out in the afternoon of the same day. The problem analysis was carried out on the second day, and the objective analysis on the third day. During the workshop, efforts were made to make participants understand the facilitator's language and conversation by using many visual illustrations prepared and used in the SRIDP (Strengthening and Restructuring Irrigation Development Project). This was done in order for the participants not to loose their interests and feel relaxed. Tea break, games and joking were also adopted in the workshop.

Preparation of PDM

After the completion of the workshop at the village level, the respective PDMs were prepared in each PAFSO office with the participation of TFT members, the village chief and SMSs of PAFSO who may have a stake at the subject. The process of consensus-building and formulation of the PDMs, for the respective model areas took two days. The Study team members did not directly participate in the workshop but participated as an observer in order to objectively monitor and assess capability of staff in PAFSO/DAPSO as well as farmers'.

Feedback Process to Villagers

In the final stage of the PCM workshop, the PDM designed by TFT members and village representatives was feed-backed to villagers who gathered in Pagoda. After the presentation of general outline made by the village chief, a representative of TFT explained the contents of PDM. In some areas, the district representative delivered a speech. After the feedback session, a puppet show was presented to expound on the contents of the PDM in an open stage. However, due to time limitation, main features of the show

were generalized for all three model areas. For the Vientiane Story Caravan the puppet show was presented like a musical show, which was enjoyed by the audience with keen interests. Prior to main performance, members of the caravan arranged some games in order to make audience feel familiar. Technically the sound system was of high level and it was judged that the ability of the caravan was high enough to attract the interest of the audience. In the future, this kind of performance could be an effective method for village to extension and education, specially so when the caravan will improve the contents and structure of the puppet show.

(1) Thongharb-Nakhua Area

The PCM workshop for Thongharb-Nakhua model area was conducted from the 13 Dec 1999 to 16 Dec 1999 in Ban Nakhua Nai and Ban Thongharb. The feedback meeting with the farmers was conducted on 30 Dec 1999.

The following target groups, namely (a) Rainfed paddy group, (b) Irrigated paddy group, (c) Cattle raising group and (d) Minor forest product group were identified as workshop participants. There was no direct opposition in term of setting the major target groups (paddy group). But there was minor a conflict between irrigated paddy group and farmer group in the non-irrigated lands, as well as between upstream and downstream irrigated paddy groups.

In the problem analysis, "Paddy Production is Low" was the core problem for paddy production that was identified by the participants. The situation as described by the problem tree is that rainfed paddy fields do not attain optimum yields because of floods and lack of intensive cropping. During the dry season, however, the irrigation system established by the government cannot supply enough water.

By analyzing the problems specified in the problem tree the main objective identified, by the participants to solve the core problem is to "increase paddy production". By linking the problem and causes together, the workshop identified the following approaches for solving the problems.

- *Application of appropriate technology;*
- *Improvement of government agencies and farmers relationship; and*
- *Improvement of rural infrastructure*

Only one PDM for rice promotion was elaborated during the workshop. The goal of the project is for all people in the five villages to attain rice surplus to sell, therefore the living conditions of the people in the area would be improved in relation to the development target. Another goal is for the area to be developed as a complete integrated agriculture zone with consideration to water resource and environment.

(2) Vangkhong Area

The PCM workshop for Vangkhong model area was conducted from the 29 Nov 1999 to 3 Dec 1999. The feedback meeting with the farmers was conducted on 29 Dec 1999.

The following beneficiary groups, namely (a) Rainfed paddy group, (b) Cattle raising group, (c) River fishing group and (d) Gardening – vegetable group were represented. There was no potential opponent as rainfed paddy group and cattle raising group are composed of the same people.

In the problem analysis, the core problem identified by the workshop is **"People do not have enough rice to eat"**. The situation is that the villagers who are fulltime farmers are experiencing rice deficiency for about 3 to 4 months in a year. This is due to floods from the Hinboun River and the low agriculture productivity due to low investment and low technology application. The causes of the problems identified by the workshop were:

*There is regular flood occurrence destroying the production and yield of paddy since 1985;*
*Agriculture extension is lacking;*
*Fertilizers, pesticide and mechanical equipment are not available or too expensive;*
*There is no land clearing and irrigation facilities are not installed yet; and*
*Population is increasing*

By analyzing the problems specified in the problem tree, the participants identified that the main objective to solve the core problems is to "develop paddy production". By linking the problem and causes, the workshop identified the following approaches for solving the problems:

*Agriculture extension improvement;*
*Open new land for production; and*
*Irrigation development.*

Two design matrices were elaborated for Vangkhong. The first matrix "Rice Promotion" is elaborated to solve the problem of rice deficiency in the village. The second, "Animal Husbandry Promotion" has been elaborated with the aim to generate additional income for the villagers.

(3) Phonthan Area

The PCM workshop for Phonthan model area was conducted from the 6 Dec 1999 to the 10 Dec 1999. The feedback meeting with the farmers was conducted on 28 Dec 1999.

The following target groups, namely (a) Rainfed paddy group, (b) Irrigated paddy group, (c) Cattle raising group and (d) Cash crops group were represented. The opponents to the paddy groups and cash crops group are the cattle-raising group as cattle are raised freely without enclosure in the area. There is also conflict between irrigated paddy group and farmer group who do not have irrigated land.

In the problem analysis relating to paddy production, the core problem identified by the workshop is **"there is not enough water for production"**. The situation described by the participants is that

during the wet season there are short intervals of drought that hamper the yield of rainfed paddy, and there is not enough irrigation water to supplement wet season production and the expanded irrigated paddy production in the dry season. Therefore, there is low agriculture productivity that is mostly related to the low input of agriculture supplies, limited irrigation water, and low technology application including water management and cropping technique. The causes of the problems identified by the workshop were:

*The irrigation system is not functioning according to design standard;*
*Farmers are lacking labor for intensive production;*
*Farmers are lacking funds;*
*Farmers are lacking technical support;*
*Farmers do not use mechanical equipment; and*
*Farmers are lacking improved seed, fertilizers and pesticide*

As to the problems related to livestock production, the core problem identified for livestock production is **"Villagers traditionally graze their animals in open fields"**. The situation defined by the participants (TFT members and chiefs of villages) is that cattle are raised freely without enclosure near some water pond far away from the village. The animals are not taken cared of or vaccinated, hence are attacked by disease or being stolen. In the village, small animals (pig and poultry) are also raised freely without any pigsty and hen house. Therefore, villagers could not catch them easily to get them vaccinated. Small animals are also subject to diseases that often kill them, thus decreasing their population and discouraging people to breed and raise them. The causes related to the above problem are:

*Animal care and disease prevention is lacking;*
*Villagers are lacking knowledge in animal raising;*
*There is no animal raising organization;*
*There is not enough grazing land for cattle; and*
*Villagers lack of funds*

By analyzing the problems specified in the paddy production problem tree, the participants identified that the main objective to solve the core problem is to "improve the management of water resource and paddy production". By linking the problem and causes together, the workshop identified the following approaches in solving the problems:

*Irrigation improvement;*
*Revitalization of farmers funds and capital; and*
*Farmer support improvement.:*

By analyzing the problems specified in the animal husbandry problem tree, the participants have identified that the main objective to solve the core problem is to "encourage the villagers to raise their animal according to appropriate technique". By linking the problems and causes together, the workshop identified the following approaches in solving the problems:

*Disease prevention ;*
*Knowledge development in animal raising ; and*
*Revitalization of village funds for animal raising.*

In the workshop, two PDMs were prepared, one for rice production promotion project and another for animal husbandry promotion project in order to increase income of villagers.

### 3.1.2 Verification of PDM

The project design matrix (PDM) formulated as an output of the PCM Workshop activities in the three model areas, is considered as a hope or an expectation of the rural people. Although the study team recognized the PDMs as urgent and earnest need of the people, the PDMs have been fully verified and examined so as to formulate a justifiable development plan including its alternative, taking into consideration availability of physical and human resource, topography, soil condition and water quality, climatic condition, impact on the environment, financial and human capacity of the implementing agencies. The important point in the said verification works is to clearly indicate to the beneficial villagers that their hope or expectation will not be always realized through judgment of experts with transparency who should have appropriate technical level and know-how.

Tables 3-1 to 3-4 summarize the PDMs and the result of their verification in which further examination was carried out from viewpoint that capacity building not only of beneficial farmers but also of governmental officers who are responsible for supporting the farmers is urgent issue and necessity. In relation to development of infrastructure, it was considered also to educate and train technical staff in PAFSO as SMS. In the series of the said verification works, the following points were basically focused:

- The scope of infrastructure development such as irrigation related facility and road as well as agricultural production facility including storage or warehouse shall be an extent to be covered by the local condition;

- In connection with training of farmers as one of basic supporting activity for increasing paddy productivity and promoting animal husbandry as well as fisheries, priority shall be given to identify and select a contact farmer, taking into consideration that kind of training course and number of trainee is limited under the existing training system;

- In the future on the basis of cost sharing principle for the supporting services by the beneficial farmers, possibility to introduce a combination of an incentive to be given to the support staff and a target-performance management, shall be focused;

## Table 3-1 Verification of Project Design Matrix (Thongharb-Nakhua)

Rice Promotion Project

(Monetary Unit : 1,000Kip)

| Project Goal | Project Component | Project Cost and Share | | | | Repayment for APB (per household) | | Observation |
|---|---|---|---|---|---|---|---|---|
| | | Total | Govern ment | Farmer | | Beneficiary | Annual | |
| | | | | Individual | APB Loan* | | | |
| 1. Farmer Supporting System | 1. Training on Extension (Yearly) | 15,000 | 100% | - | - | 453 | - | Kind of training course & number of participant are limited. Priority for selection of contact farmer. In future, on the basis of cost bearing principle by beneficiary, incentive shall be given to support staff by introducing target-performance management system. |
| 2. Promotion of Agricultural Finance | 1. Provision of Produc'n Loan (Yearly) | | | | | | - | In either cash or kind, APB loan must be provided in time. Simplification of supply system for input (thru APB/FSC) is needed. In early part, attention should be paid on capacity building as one of TFT activities. |
| | - Fertilizer and Pesticide | 115,600 | - | - | 100% | 453 | 12.8 | |
| | - Land Preparation | 156,000 | - | - | 100% | 453 | 17.2 | |
| | - Certified Seed | 46,800 | - | - | 100% | 453 | 5.2 | |
| | - Fuel | 88,000 | - | - | 100% | 453 | 9.7 | |
| 2. Establishment of Production Group | 1. Loan for Buying/Selling Group | 5,000 | - | - | 100% | 453 | 8.4 | Construction of new facility is not expected having benefit to meet with cost. Basically marketing of farm products is dealt with by private sector, but it is desirable for public sector to extend initial know-how. |
| | 2. Construction of Rice Storage | 200,000 | 50% | 50% | - | 453 | - | |
| | 3. Drying Floor | 70,000 | 50% | 50% | - | 453 | - | |
| | 4. New Market | 25,000 | 50% | 50% | - | 453 | - | |
| 5. Improvement of Infrastructure | 1. Rehabilitation & Improvement | | | | | | | Total capacity of pumps is to irrigate 400 ha, which can meet with farmers' demand of 260 ha. However, available water resource during dry season limits irrigable area of 137 ha in maximum. In order to attain the target irrigable area, introduction of crops with smaller consumptive water use than paddy. In case to develop 137 ha in dry season paddy under irrigation, investment cost of 6.5 billion Kip is too much. |
| - Thongharb : 100ha | - Construction of 4 weirs | 6,500,000 | 85% | 15% | | | | |
| - Nakhua Nai : 80ha | - Repair of Diesel Pumps | | | | | | | |
| - Nakha Nok : 50ha | - Construction of Canal & Structure | | | | | | | |
| - Nahin : 30ha | - Access Road (Thongharb/Nakhua) | | | | | | | |
| - Access Road | 2. Land Reclamation | | | | | | | |
| * Thongharb2 km | - Nam Dua Village : 30ha | 54,000 | - | 40% | 60% | 78 | 101.3 | |
| * Nahin 2 km | 3. Strengthening of WUG | | - | | - | | - | |
| | - Training on Water Management | 5,700 | 100% | | | | - | |
| | - Establishment of VDF | | | | | | | |

Note : APB Loan Condition Short-term (Seasonal) : Interest=10%/year、Repayment Period=6 months (Single Installment)
Medium-term(Investment) : Interest=7%/year、Repayment Period=5 years

## Table 3-2 Verification of Project Design Matrix (Vangkhong Area)

### 1. Rice Promotion Project

(Monetary Unit : 1,000 Kip)

| Project Goal | Project Component | Project Cost and Share | | | | Repayment for APB (per household) | | Observation |
|---|---|---|---|---|---|---|---|---|
| | | Total | Government | Farmer | | Beneficiary | Annual | |
| | | | | Individual | APB Loan* | | | |
| 1. Improvement of Paddy Productivity | 1. Training on Paddy Cultivation<br><br>2. Irrigation Facility<br>2.1 Main facility (Pump & discharge box)<br>2.2 Canal construction<br>2.3 Land reclamation | 8,000 | 100% | - | - | 47 | - | Kind of training course & number of participant are limited. Priority for selection of contact farmer.<br>In future, on the basis of cost bearing principle by beneficiary, incentive shall be given to support staff by introducing target-performance management system. |
| 2. Secure Paddy Field<br>- Rainfed : 110ha<br>- Irrigated : 60ha | | 828,000<br>300,000<br>90,000 | 100%<br>65%<br>- | -<br>5%<br>30% | -<br>30%<br>70% | 47<br>47<br>47 | -<br>467.0<br>326.9 | Maximum irrigable area is 18 ha by existing pump station<br>In order to attain project goal, alternative study is needed |

### 2. Animal Husbandry Promotion Project

(Monetary Unit: 1,000 Kip)

| Project Goal | Project Component | Project Cost and Share | | | | Repayment for APB (per household) | | Observation |
|---|---|---|---|---|---|---|---|---|
| | | Total | Government | Farmer | | Beneficiary | Annual | |
| | | | | Individual | APB Loan* | | | |
| 1. Increase Livestock No. (5 years)<br>- Cattle : by 75%<br>- Pig : by 50%<br>- Poultry : by 260% | 1. Training on Livestock/Fishery<br>2. Storage for Drug | 3,000<br>2,000 | 100%<br>100% | -<br>- | -<br>- | 47<br>47 | -<br>- | Priority be given for small animal husbandry, expecting benefit in short-term<br>Feed crop production for semi-intensive farming<br>Self-sufficiency within the area |
| 2. Cultural Fishery<br>- Fish Pond<br>- Fish Corf | 1. Construction of Fish Pond 4 places<br>2. Fish Corf<br>3. Procurement of Fingering | 24,000<br>8,000<br>1,500 | -<br>-<br>- | 30%<br>70%<br>30% | 70%<br>30%<br>70% | 47<br>47<br>47 | 87<br>12<br>5 | Maximum utilization of existing pond<br>Farmer should produce fingerings and low investment cost |

注 : APB Loan Condition Short-tem (Seasonal) : Interet=10%／year、Repayment Period=6 month (Single Installment)
Medium-term (Investment) : Interest=7%／year, Repayment Period=5 years

## Table 3-3 Verification of Project Design Matrix (Phonthan Area)

### 1. Rice Promotion Project

(Monetary Unit : 1,000 Kip)

| Project Goal | Project Component | Project Cost and Share | | | | Repayment for APB (per household) | | Observation |
|---|---|---|---|---|---|---|---|---|
| | | Total | Government | Farmer | | Beneficiary | Annual | |
| | | | | Individual | APB Loan* | | | |
| 1. Improvement of Extension Services | 1. Training on extension activities (every year) | 8,000 | 100% | - | - | 145 | - | Kind of training course & number of participant are limited. Priority for selection of contact farmer. In future, on the basis of cost bearing principle by beneficiary, incentive shall be given to support staff by introducing target-performance management system. |
| 2. Improvement of Farmer Supporting System | 1. Supply of Certified Seed | 10,000 | 100% | - | | 145 | - | APB loan (cash/kind) must be delivered in time Simplification of supply system of input (APB/FSC) Capacity building of related staff as part of TFT activity is important. |
| | 2. Establishment of Village Drug Fund | 2,500 | - | 100% | - | 145 | - | |
| | 3. Supply of Dry Season Crop Loan (every year) | 161,500 | - | - | 100% | 145 | 55.7 | |
| 3. Irrigation Improvement - Dry Season : 100ha - Supplement : 200ha | 1. Rehabilitation/Improvement of Existing Facility | | | | | | | While farmers' target is 100 ha in dry season, maximum area is 90 ha after increase of reservoir capacity. If supplemental water is released in wet season, dry season irrigable area become smaller. It is needed to properly operate reservoir by WUG. |
| | - Heightening of Dyke | 560,000 | 60% | 30% | 10% | 145 | 94.2 | |
| | - Rehabilitation of Spillway/Intake Facility | 170,000 | 60% | 30% | 10% | 145 | 28.6 | |
| | - Construction of Canal/Structure | 260,000 | 60% | 30% | 10% | 145 | 43.7 | |
| | 2. Strengthening of WUG | | | | | | | |
| | - Training on Water Management | 13,000 | 75% | 25% | - | 145 | - | |
| | - Establishment of VDF | 60,000 | - | 100% | - | 145 | - | |
| 3. Development of Market | 1. Loan to Buying/Selling Group | 5,000 | - | - | 100% | 145 | 8.4 | Construction of new facility is not expected having benefit to meet with cost. Basically marketing of farm products is dealt with by private sector, but it is desirable for public sector to extend initial know-how. |
| | 2. Construction of Rice Storage | 200,000 | 50% | 50% | - | 145 | - | |
| | 3. Construction of Drying Bed | 70,000 | 50% | 50% | - | 145 | - | |
| | 4. Construction of New Market | 25,000 | 50% | 50% | - | 145 | - | |

Note : APB Loan Condition Short-term (Seasonal) : Interest=10%／year, Repayment Period=6 months (Single Installment)
Medium-term (Investment) : Interest=7%/year, Repayment Period=5 years (Annual Amortization)

Table 3-4 Verification of Project Design Matrix (Phonthan Area)

## 2. Animal Husbandry Promotion Project

(Monetary Unit : 1,000 Kip)

| Project Goal | Project Component | Project Cost and Share | | | | Repayment for Apb (per household) | | Observation |
|---|---|---|---|---|---|---|---|---|
| | | Total | Government | Farmer | | Beneficary | Annual | |
| | | | | Individual | APB Loan* | | | |
| 1. Increase of Number of Animal (for 5 years)<br>- Cattle : 75%<br>- Pig : 50%<br>- Poultry : 260% | 1. Training on Livestock/Fishery | | | | | | | Kind of training course & number of participant are limited. Priority for selection of contact farmer.<br>In future, on the basis of cost bearing principle by beneficiary, incentive shall be given to support staff by introducing target-performance management system.<br>Priority be given for small animal husbandry, expecting benefit in short-term<br>Feed crop production for semi-intensive farming<br>Self-sufficiency within the area<br>Due to delay in developing grazing land and breeding method for cattle, short-term effect can not be expected from viewpoint of supporting system.<br>(It is possible to introduce new breed of pig and poultry) |
| | - Farmers' Training | 3,000 | 50% | 50% | - | 145 | - | |
| | - Training of Model Farmers | 5,000 | 50% | 50% | - | 145 | - | |
| | - Demonstration of Model Farmers | 660 | 50% | 50% | - | 145 | - | |
| | 2. Arrangement for Disease Control | | | | | | | |
| | - Construction of Drug Storage | 1,600 | 80% | 20% | - | 145 | - | |
| | - Establishment of Village Drug Fund | 6,000 | - | 30% | 70% | 145 | 7.1 | |
| | 3. Cattle Breeding | | | | | | - | |
| | - Improvement of Grazing Zone | 15,000 | 20% | 70% | 10% | 145 | 2.5 | |
| | - Introduction of New Breed | 3,000 | 100% | - | - | 145 | - | |
| 2. Development of Cultural Fishery<br>- Fish Pond<br>- Fish Corf | 1. Household Fish Pond | 10,000 | - | 30% | 70% | 145 | 11.8 | Fish corf in reservoir is justifiable from cost and urgency.<br>Farmer should produce fingerings and minimize investment cost |
| | 2. Fish Corf in reservoir | 1,200 | - | 30% | 70% | 145 | 1.4 | |
| | 3. Production of Fingerings | 1,000 | - | 100% | - | 145 | - | |

Note : APB Loan Condition Short-term (Seasonal) : Interest=10%／year, Repayment Period=6 months (Single Installment)
Medium-term (Investment) : Interest=7%/year, Repayment Period=5 years (Annual Amortization)

- The immediate target to be considered is to simplify supply system and procedure both in APB finance and agricultural input supply by FSC;

- Since the only significance of cattle breeding is decreasing due to introduction of mechanical power in plowing farmland, while the breeding place is also diminishing in the flat land, promotion of small and medium animal husbandry shall be prioritized; and

- In the promotion of fisheries, priority shall be given not to establish new advanced system, but to utilize the existing facilities, and farmers shall produce necessary fingerlings by themselves.

### 3.2 RRA Survey

Aside from the PCM Workshop in the three model areas, the Study team members who are in-charge of agronomy/farm management, support system and environment, carried out a detailed RRA survey. The survey was done separately for the agronomy and software aspect, and the environmental aspect. The respondents in the survey were selected from those villagers who have sufficient knowledge and information about their village/community, including a village chief, members of village authority, an elder, an exemplary farmer, a village middlemen and so on.

Survey Method: By using a questionnaire prepared by the respective team members, a "hearing" method was applied. In the hearing process, participation is limited to Study team member, counterparts, a translator and a villager without PAFSO/DAFSO staff concerned, so as to provide the atmosphere in which the respondent feel free to express his opinion without any interest and bias. The interview work was carried out mainly by the team members of agronomy/farm management, support system and environment however, the contents of questionnaire cover most of the aspects of the Study. The hearing activity sometimes took one full day for one object, including breaks and joking.

Analysis/Evaluation of Results: After the hearing survey, every information described in the field note was transferred and summarized into the standard format, for which necessary analysis and evaluation was made. Through comparative analysis on the output from both the agronomic aspect and the environmental aspect, it become possible to obtain the results with higher accuracy, because modification was made by implementing additional survey, when the two outputs reveal inconsistency.

Applicability of the Survey Method: Out of various methods used in the said survey, the following items shall be applied in subsequent and similar surveys.

Evaluation by Non-Numerical Indicator: Sometimes numerical information given by respondent is doubtful in its reliability, therefore, has to be re-phrased to make the question easier for respondent to reply, specifically on items as number of household with self-sufficiency of rice, number of months under self-sufficiency in one household, etc. It has become clear that villagers can reply more easily to qualitative interview on subjects familiar with villagers, and then shifting to more detailed interview

involving numeral quantification.

PRA type RRA Survey: While it is rather difficult to stay in one village for long time from viewpoints of the overall study schedule and security of team members, it is considered that more detailed and real intention and motive of villagers were obtained in their reply, by frequent visit to the objective village in close contact with villagers, occasionally having a meal together, through which villagers took off their worries to the team members.