

National
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Laos
Faculty of

Analysis of the economic pattern of Lao farmers in LEAP pilot area:

**Pakou and Nambak district, Luangphabang
province, Nakhonepheng district,
Saravane province and Phonthong district,
Champasack province.**

Final report

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Executive Summary

This report describes studies of the economic patterns of farm households in two main farming systems: the lowland system, in the southern part of Laos; and the upland system in the northern part of Laos. The households studied were selected from the Laos Extension for Agriculture Project (LEAP) target districts: Nambak District and Pakou District of Louangphabang Province; Nakhonepheng District of Saravanh Province; and Phonthong District of Champassak Province.

The study was sponsored by the Laos Extension for Agriculture Project (LEAP) and the Faculty of Agriculture, Nabong Agriculture College. The study period was eight months (01.04.2004 to 30.11.2004).

Because of the limited number of households sampled (six households per village), the study cannot provide complete representation of the farm economics throughout the country. However, it does provide information on a good cross-section of the target areas.

The methodology used in this study included acquisition and analysis of data from previous study reports, preparatory work prior to field visits, plus collection and analysis of quantitative and qualitative data.

The study found that all four districts are similar in that the farmers operate under subsistence economics. There is low capital input. A significant amount of labor is needed. There is low production output, most of which is used for consumption by the farmer's own family. These factors result in a small amount of cash, insufficient for needed input for farm operations.

Agriculture income (cash plus non-cash value) per active laborer in Nambak district, Louangphabang province (northern part) was found to range from a minimum of 600,000 Kip/year which came from upland cultivation, to a maximum of 11,000,000 Kip/year which came from oranges, teak tree, lowland rice and cattle.

Agriculture income per active laborer in Nakhonepheng district, Saravanh province (southern part) was found to range from a minimum of 800,000 Kip/year which came from low land rice cultivation in poor land, to a maximum of 8,400,000 Kip/year from lowland rice cultivation in good land and cattle.

In comparison, the subsistence level is 3,000,000 Kip per person per year. Further analysis, shown in graphical form in the report, indicates that a significant proportion of the people are substantially below the subsistence level. For laborers supporting children, the proportion is even larger.

The study also uncovered the following as further major farm problems:

1. The farmer can not supply sufficient water for cropping;
2. There is a lack of appropriate technical knowledge;
3. There is a lack of capital to buy in-put such as commercial chemical fertilizers, improved varieties of seed, and animal feed;
4. There are also problems of decreasing active labor because many farmers give up their production to work in the city.
5. There is a lack of accurate data recording by farmers. These data are desirable for analyzing and improving the economic situation of the farmers.

Abbreviations

AI = Agriculture Income
AI/Act = Agriculture Income per Active Labor
Area/Act = Maximum area per Active Labor
AV = Added Value
AV/Act = Added Value per Active Labor
Act = Active labor
IC = Intermediate Consumption
IC/ha = Intermediate Consumption per hectare
FAO = Food and Agriculture Organization
Fcc = Fixed Capital Consumption
GP = Gross Product

Introduction

Approximately 80 % of the population of Laos (Lao P.D.R.) are farmers. 1.049.000 people are defined as the poor, according to recent statistics. A higher percentage (about 90 %) of the poor are farmers. In general, this number indicates that many people in Laos work on farms under conditions of insufficient income and are facing difficult economic circumstances.

The government of Lao P.D.R. has the goal of freeing the country from “least developed” status by the year 2020. The agriculture sector, which represents the main occupation in the country, is identified as a major key in helping to do this, by means of increased farmers’ income. The task of increasing farmers’ income is not an easy one, as the farmers live in a different environment, with different potential and problems (than that of the normal cash economy). Nevertheless, there are a number of factors that can be analyzed and addressed. The following are considered important in controlling and limiting the economic growth of agriculture and farmers’ incomes:

- Low level of education;
- Poor infrastructure;
- Poor marketing system;
- Poor access to appropriate farming techniques;
- Decreasing amount of land per household;
- Lack of labor; and
- Lack of capital.

Based on the topography of the country, the agriculture system in Laos is divided into four main classes: lowland, upland, plateau and highland. In reality, each farming system is controlled not only by the ecosystem but also by socio–economic forces.

This study uses the diagnostic system developed by the Laos Extension Agriculture Project. Samples of the two main classes of farming systems, lowland and upland, within three provinces of the Lao PDR., were selected for study. The study then identifies farmer problems in each farm type within the focus area according to the agro-ecology, the socio-economic conditions, the farming techniques and farm economics. The study then proceeds to define possibilities for each farm type to improve in the near future. The study also provides basic information to assist in implementing viable possibilities.

To be successful, an agricultural development project must have appropriate objectives that fit the reality of individual farmer's needs. Each farmer has different problems and potentials. Therefore, looking at only one function of the system can not be expected to provide, automatically, the right way of improvement. However, when coupled with diagnosis of the complete farm system of an individual, it might be able to help find a good way of improvement. Therefore diagnosis of the farming system is needed

The study reported on here uses a systematic diagnostic technique to examine the farming system. This methodology is to look at the farm as a system and study all functions of the system. With this methodology one can understand the agro-ecology, the social-economic conditions, farmers’ techniques and the farm economics as well as farm problems that limited their farm production and farm development. All that data which come out of this study might help to identify appropriated conditions or activities that can help farmers to improve their production relating to their need and their capacity.

Objective

- To study production conditions of farm households: Agro-ecology, Social-economic conditions and production techniques.
- To evaluate farm economic of farm households according to their production conditions.
- To identify farm households problems as well as recommendation.

Acquisition and analysis of data

1. Socio-economic of Laos

Table. 1. Laos Fact sheet

GDP per capita, 2002 (USD).	331
Geography.	
Total land area.	236,800 Km ²
Number of provinces in 1999.	18
Number of districts in 2002.	142
Number of villages 2002.	10,868
Population	
Total population (Estimate).	5,525,900
Population density in 2002.	23.3
Population grow rate.	2.8
Life expectancy at birth.	59
Population below 20 years old.	54.9 %
Population between 20 and 39 years old.	27.8 %
Population aged 40 years and above.	17.4 %
Women in the overall population in 2002.	49.5 %
Population living in rural areas in 2000.	83%
Number of households in 2002.	881,596
Household size in 1998.	6.5
Service	
Proportion of the population using public electricity.	32.2%
Proportion of the households with access to radio 1998.	52%
Proportion of the households with access to television 1998.	30%
Proportion of the households with access to car/van 1998.	4%
Proportion of households with access to motorbike.	15%
UXO	
Proportion of land contaminated by UXO.	50%
Number of provinces contaminated by UXO.	15
Proportion villages contaminated by UXO.	25%
Reported UXO related casualties in 1999.	102
UXO contaminated land cleared in 1999.	578 ha

2. Biophysical characteristics.

2.1. Location

The Lao PDR is relatively small country located in South East Asia. It is land locked, sharing border with:

Southern: Kingdom of Cambodia.

Northern: People Republic of China and Union of Myanmar.

Eastern: Socialist Republic of Vietnam.

Western: the Kingdom of Thailand.

Table.2. Neighbors and length of borders (Km).

Neighbors and length of borders (Km).		
Direction	Neighbor	Border length
North	China	505
South	Cambodia	435
East	Vietnam	2,069
North West	Myanmar	236
West	Thailand	1,835

2.2. Climate

Lao PDR is tropical country, whose climate is affected by monsoon rain from May to September. In Vientiane the average temperature ranges from minimum of 16.4° C in January to maximum of 31° C in April. The North region of the country has cooler climate. Temperature are different between mountainous and up land areas. The rainy season begins from May to October with high rainfall in August and September. Rainfall in most provinces along Mekong river valley ranges from 1,500 - 2,200 mm per year (on average). The dry season begins from November to April. The humidity in February, March and April decrease to 46.3 %. The length and the concentration of sunshine and temperature are conducive for agriculture production.

Table .3. Lao PDR climate.

	Rainfall	Temperature	Humidity	Evaporation
Average	1,853 mm/year	26.2 °c	72.5%	1,328 mm/year
Maximum	2,830 mm/year	32.5°c	90%	1,713 mm/year
Minimum	1,016 mm/year	21.9 °c	46.3%	1,112 mm/year

2.3. Topography.

Lao PDR has a land area of 236,800 square kilometers, stretching more than 1,700km from the north to south and between 100km and 400km from the east to west. Whilst Lao PDR has no direct access to the sea, it has an abundance of rivers, including a 1,865km stretch of the Mekong (Nam Khong), defining its border with Myanmar and a major part of the border with Thailand. Major stretches of the Mekong and its tributaries are navigable and provide alluvial deposits for some of the fertile plains. About two thirds of the country is mountainous, ranging from 200 to 2,820 meters high. The mountains pose difficulties for transportation and

communications, but together with the rivers they produce vast potential for irrigation and other infrastructure development projects.

2.3. Soils and Soil Classification

The soils of the Mekong flood plain are mainly derived from old alluvial deposits and in some provinces (Savannakhet and Saravane) from sandstone materials. They are usually high weathered, moderately acid, loam, sandy loam and loamy sand, example: Alisols, Acrisols, Leptosols, Cambisols and Gleysols. They have typical topsoil sand content exceeding 65 % to as high 85 %, with clay content sometimes as low as 5 %. Low organic matter content, CEC and percentage base saturation, are also typical. Extractable acidity is generally high in the Acrisols and Alisols.

Soil in the areas of rainfed lowland cultivation in the North are generally sandy loam, loam and clay loam, example: Cambisols, Fluvisols and Luvisols. Apart from the larger plains, the soil in most of the Northern area have yet to be classified and mapped. They are however, generally recognized as being more fertile than most of the central and southern regions.

Soil group, which are rich of nutrient or fertile are suitable of agriculture production are Cambisols and Fluvisols. Most soils in Laos are composed of Alisols, Leptosols and Arenosols. Their potential for agriculture use is dependent on quality improvement such as incorporating and green manure and compost.

2.4. Forest

Laos has forest cover of about 47 %, comprising a wide variety of commercial tree species suitable for sawn timber, plywood, parquet and furniture. 80 % of domestic energy consumption is based on fuel wood, and estimated 200,000 hectares of forest are cleared annually largely due to shifting cultivation and logging activities. In the effort to protect forest resources from unsustainable felling of trees, the total annual allowable cut (AAC) has been set by the tropical forest action plan to 280,000 cubic meters per annum (1991). The actual volume of timber exploitation is however higher than the annual plan, especially in the Dam construction project area.

The Ministry of Agriculture and Forestry has also implemented stopping Shifting cultivation project to prevent forest depletion due to Shifting farming practice. It will phase out slash and burn cultivation and eventually stop it completely. People in the mountainous and remote areas will be provided with a permanent occupation to gradually improve their standard of living. Permanent occupations include the different production sectors such as agriculture, livestock, forestry, handicraft and other service. Cleared areas from secondary re-growth will be used for permanent agriculture.

2.5. Land use

The Lao land use classes and vegetation types system, base on FAO recommendations were put into 6 main land use groups, subdivided into forest types and land use classes.

1. Areas of current Forest
2. Areas of Potential Forest
3. Other Wooded Areas
4. Areas of Permanent Agriculture
5. Areas with other land use
6. Water.

3. Infrastructure

3.1. Road

Being aware of the importance of infrastructure for socio-economic development, over the past years, Laos has channeled capital into improving and expanding the communications system. National and some important local roads have been repaired and reconstruct, connecting them to roads and sub-regions.

Communication and telecommunications are considered important and strategic spearheads for national development and they enhance the country's geographical protential. The government's policy is to modernize the communication and telecommunication systems facilitating and speeding up the connection between important parts of the country.

In the future, Laos will pay attention to upgrading the quality and constructing additional highway systems stretching north to south and east to west, so as to hook those of the neighboring countries. Laos will develop long term plans for national communication systems including roads, rails, rivers and air. Laos will improve and increase the number of roads to ensure that all districts and privatized economic and social areas are accessible through out all seasons.

3.2. Electricity

Since 1985 when electric power generation was recorded at 919 million KWH, there has been an erratic production of electric power depending mainly on the water level of affected reservoirs. Currently there are 4 main hydro-electric power generating plants in the country which a combine capacity of 410 MW:

1. Theun-hinboun 1 with 210 MW
2. Nam Ngum with an installed capacity of 150 MW
3. Xeset with 45 MW
- 4 Selabam with 5 MW

The government attaches high priority to hydropower in its development plan, up to year 2000 and beyond. The power development plan up to year 2000 envisions additional installed capacity of around 1,650 MW among the projects in the pipeline is Theun-hinboun 2 with 680 MW. To long term plan within the next 15 years is to install an additional 6,500 MW generating capacity.

Electricity is one of the main infrastructure for modern agriculture. Many agricultural areas including villages have been supplied with electricity except for some remote villages.

3.3. Irrigation

Irrigation is extremely important for agriculture especially for rice production or food production in Laos. The increase or drop in national rice production depended on the natural condition of rainfall in different part of the country. In the last few years, rice production was damaged by natural disasters such as flood and drought. Because of the importance of irrigation, 40-50 % of the stage agriculture budget is invested every year for this infrastructure, also to convince farmers to participate in the construction of medium and small scale of irrigation systems.

4. Direction for agriculture sector in Lao PDR.

The Government intends that national development will take place within the eight National Priority Programmers which are outlined in the Socio Economic Development Plan. They are:

- Food Production.
- Stabilization and Reduction of Shifting Cultivation.
- Commercial Production.
- Infrastructure Development.
- Improved Socio-Economic Management and Foreign Economic Relations.
- Rural Development.
- Human Resources Development and;
- Services Development.

The Ministry of Agriculture and Forestry has interests in all of these Programmers - perhaps with slightly less emphasis on national infrastructure development and national services development - and projects associated with the Ministry are likely to contribute to more than one Programme. Development and investment projects in some of these Programmes, for example in rural development, may require inputs from other Ministries in the Government. Conversely, projects in the Ministry may interact with and contribute to projects which are formally under other Ministries and agencies.

The “Agriculture and Forestry Sector Development Plan to the Year 2000” presents six programmes, which are being implemented through specific plans, projects and activities. They are:

- Food Production Programme. To achieve food-security, in terms of improving quantity, quality and availability of food. Specific targets for rice, maize, root crops, meat and fish are given. The programme is to be achieved through intensification of production on the seven large plains in the Mekong Corridor, and by expansion of cultivated areas for paddy in mountain valleys where water is available. Numerous material inputs are required and improved management systems. The programme also depends on integrated pest management, markets, credit, extension, pricing systems and many other factors.

- Commodity Production Support Programme. Develop the agro-processing sector to provide local income opportunities and increase value-added. Rice, maize, soybeans, Mung beans, peanuts, vegetables, sugarcane, tobacco, cotton, coffee, fruits and meat are mentioned.

- Stabilization/Reduction of Slash-and-Burn Cultivation Program. The target is to stabilize about 100,000 families, who will be encouraged to take up alternative on-farm and off-farm economic activities such as improved agro forestry, animal husbandry, food and cash crop production in the mountain plains, wage labor in agro-processing and trading. Credit and other forms of government assistance in land development and land management will be required.

- Irrigation Development Programme. To increase rural incomes and stabilize rice availability by expanding irrigated areas for both wet and dry season production, and to improve the operation and maintenance of existing irrigation schemes. Credit will be needed, and joint Government-community work on irrigation infrastructure and operations.

- Agriculture and Forestry Research Programme. To conduct resource surveys, prepare master plans for development (especially in the Northern Provinces), to rehabilitate existing research stations and expand research activities to new areas, and to cooperate with international research institutions.

- Human Resources Development Programme. To upgrade the technical and administrative skills of Ministry staff and to develop an effective extension service at the Provincial and District levels.

* Goals of the Agriculture and Forestry Sector

The government has clear development objectives for the agriculture and forestry sector to 2020, designed to contribute to the overarching goal of poverty alleviation:

- Ensure food security for all Lao people.

- Maintain a grow rate in agricultural output of 4-5 percent annually.
- Promote commodity production, especially for export.
- Stabilize shifting cultivation and eradicate poppy cultivation.
- Diversify and modernize the agricultural and forestry sector.
- Conserve the nature environment and protect threatened species and habitats.
- Maintain a healthy and productive forest cover as an integral part of the rural livelihood system, and generate as sustainable stream of forest products.
- Improve rural livelihoods.

Methodology of the study

1. Preparatory work before field visits

Preparatory works are included acquisition and data analysis such as maps, baseline data of the targets, identifying data, planning and making tools to collect data. (See questionnaires in annex 2).

2. Sampling method

Samples were selected according to the diversity of agro-ecology and socio-economic of Laos Extension for Agriculture Project (LEAP) in 3 proveniences: Louangphabang, Saravanh and Champasak.

With in those target, Pakou district and Nambak district of Louangphabang province were chosen to represent for economic pattern of farmers in up land area in northern part and Nakhonepheng district, Saravanh province and Phonthong district, Champasak province are represented for economic pattern of farmers in low land area in Southern part of Laos.

Each district, 4 villages were selected out according to LEAP pilots area that have about 10 villages in one district. In village level, 6 house holds were interview according to 3 classes of households in the village that are surplus rice households, sufficient rice household and insufficient rice households. To select household was cooperated with village committee to ensure that the house holds can be good sample for agricultural production in the village.

Table .4. Sampling summary.

Province	District	Village	House hold
Laungphabang	Pakou	Had khor	6 household(2 surplus ,2 sufficient and 2 insufficient)
		Had kham	
		Phonhom	
		Phonsavang	
	Nambak	Vanghine	6 household(2 surplus ,2 sufficient and 2 insufficient)
		Mokvaid	
		Namnga	
		Houir hok	
Saravanh	Nakhonepheng	Taphankang	6 household(2 surplus ,2 sufficient and 2 insufficient)
		Hongsaitong	
		Nakhonepheng yai	
		Nakhonesi tai	
Champasak	Phonthong	Lak 8	6 household(2 surplus ,2 sufficient and 2 insufficient)
		Lak 12	
		Saman	
		Koklumseng	
3 Provinces	4 districts	16 villages	96 house hold

3. **Data analysis method.**

Analysis is identified to 2 categories: quantitative and qualitative. Quantitative data were analyzed by computer program (Excel) and by hand, for qualitative data were analyzed by observe and summarized the synonym data.

Quantitative data are data that can be evaluated in to number such as production, productivity, labor, input, output and others. Qualitative data are the data that can not be evaluated in to numbers, those data are production history, agro-ecology characteristic, techniques, Farm problem and farmers approaches.

* **Time line**

This study took 8 month, started from April 2004 to November 2004.

01.04.2004 – 16.05.2004	Preparation
17.05.2004 – 13.08.2004	Data collecting (Field visits)
14.08.2004 – 14.10.2004	Data analysis
15.09.2004 – 30.11.2004	Reporting

* **Location**

` Laos Extension for Agriculture project (more detail in annex 1)

Output

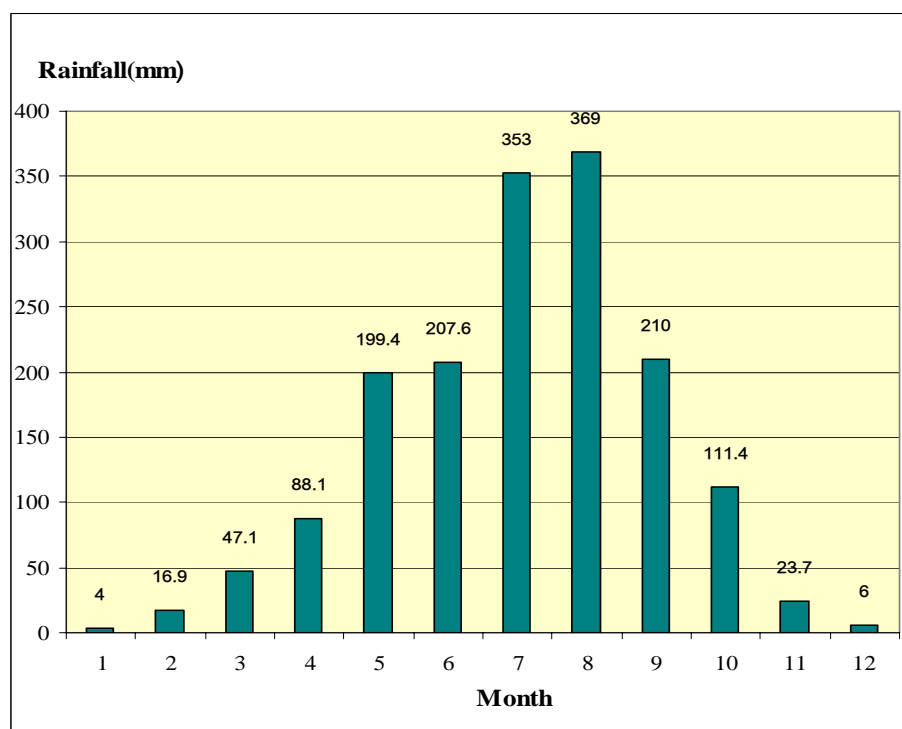
1. Nambak district, Louangphabang province

1.1. Topography

Nambak is located in North West of Laungphabang province whose sharing Northern with Koar district, Phongsaly province, Southern with Pakou district, Laungphabang, Eastern with Ngoir district, Laungphabang and Western with Nga, Udomsay province.

Average temperature is bout 25 ° C, Minimum= 20 ° C (December and January), maximum= 31 ° C (April and May).

Average rainfall in 7 years (1995—2001) is 1,636 mm. heaviest rainfall is in August and lowest rainfall is in December, January and February. Evaporation is about 254 mm/year (lowest in July). Highest humidity is 74% (average) in July, August and September and lowest is 27% in February and March.



Picture.4. Annual rainfall in 7 year of Nambak.

1.2. Socio-economic condition

Total population is about 54,379 (year2002), Female 27,375. There are 3 main ethnic minorities whose are 50% Kamu, 34 % Lao lum and 16% Lao sung. Nambak has about 175,600 ha, Forest 71% and agriculture land is about 6 %. Nambak is divided in to 9 clusters, 105 villages which about 4 villages are not access to road. The district also has about 1,584 house holds, about 17.8% access to electricity which generated from small dam and generators.

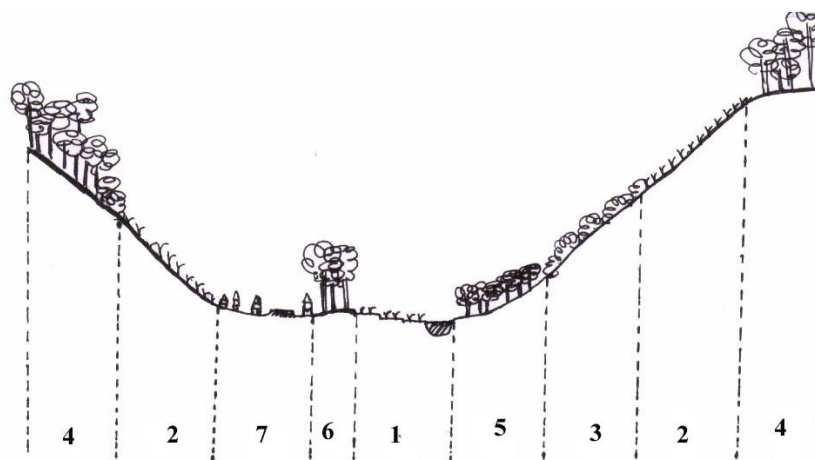
1.3. Agriculture production

Total agriculture land is about 9,884 ha, in that there are about 2,134 ha (21.6%) lowland field (mountain food), 6,860 ha (69.4%) up land field and 890 ha (9%) garden. Most of the soil is red soil (about 70,000 ha) which located in slope area, Gray soil (about 50,000 ha), Silt (30,000 ha) along river, and soil with thin layer in bare hill is about 8,000 ha.

1.4. Agricultural history

- Before 1975 most villages are settled far away from road, and growing rice in up land area for the main job, they could cultivate up to 2 ha/family in the old forest (minimum 5 year), productivity is about 3-4T/ha.
- After 1975 People moved down to live close to big road according to government direction and safe. But farmers still cultivate in the same area, which make them to invest times to reach to their fields.
- Since 1975 farmers have started to develop low land fields.
- Forest is destroyed more since 1980.
- Land allocated to villagers has been conducted by district level since the year 1990 and also road are improved.
- The year 2000 farmers started to grow commodity crop such as: Sesame and job steer but have problem about marketing.
- The same year farmers started to cultivate in dry season rice by using small irrigation and home irrigation.
- Farmer using more chemical fertilizers for dry season rice and modern equipments such as hand tractor, water plow and thresher machine since the year 2000

1.5. Agro-ecology condition



Picture. 5. Transect in Nambak, Laungphabang.

Remark: This transect are identified according to diversity of ecosystem in 4 villages: Vanghine, Mokvaird, Namnga and Hoirhok.

Zone 1: Low land

This area is low slope and flat, closes the water resources and road. Most of the soil is Clay-Silt which content high nutrition, deep layer and less stone. Farmers use this area mainly for low land rice cultivation especially in rainy season. For dry season rice and other winter crop are grew in some area because lack of irrigation. This area is also used for animal husbandry which is very good for soil fertilizing.

Zone 2: Up land rice.

This is a slope area, thin layer and mixed with stones. Soil is clay with low nutrition because of soil erosion that cause by up land cultivation (once per 2 - 3 year). The production is depended only the annual rainfall that limited the production in only rainy season. Farmers use this area for up land cropping mainly on growing rice and other crop such as maize, Job steer, sesame, banana, and root crop. High weed pressure is the major problem in this area, more over soil and nutrition erosion is really affected and reaches to low yield.

Zone 3: Bush

This is also slope area where farmers used to cultivate on up land crop, the area are covered with different type of plants, especially bush plant with the height 1-3 m . Soil is clay with thin layer but cover with a lot of plant, soil has darker color depending on types of cover. Farmers use this area mainly for cattle husbandry and will use gain for up land cultivation in next few years.

Zone 4: Forest

This area is located in higher places and also along the creek. Soil is clay with this layer and mixed with a lot of small stone and some places you can see the mother rock very well. This area has different kind of trees and bush, farmers use this area for cattle husbandry and also to provide food and wood for self consumption. Forest is also very importance to provide Non timber Forestry Product for farmers.

Zone 5: Fruit tree

This area is located along river and creek, it also close to road and houses. Soil is clay-silt with deep layer and high nutrition. Farmer use this area to grow fruit tree, mainly is orange trees. Also this is a place for animal husbandry.

Zone 6: Teak tree

This is a low slop area and flat where close to houses, river and road. This is a good area for cropping because it is a good soil and good soil moisture. Farmers use this area for growing teak trees which are good economic wood. This area is also for animal husbandry such as cow and buffalo. This area don't have weed problem but has some problem about pest, especially worms.

Zone 7: Village area

This is flat area which nearby water resource and road. Farmers use this area mainly for housing, storage product and live stock rising, especially pig and poultry. More over this is an importance place for home garden and fruit trees.

1.6. Cropping system

In general farmers are cultivate mainly in up land area and grow rice the major crop, they grow some more crop as job steer, maize and sesame for surplus but in small amount. Some farmers who have better condition can cultivate in low land rice, fruit trees and teak trees. Nambak has potential on growing orange but new modern techniques are not yet well known to farmers for instant farmers still using seed instead of crafting, no soil improvement and pest control.

Water supply is the major problem for cropping in both rainy and dry season, because of poor irrigation. Chemical fertilizers use is well known but not yet use property, pesticide is not yet popular and hand tractors are used by low land farmers.



1.6.1. Low land rice cultivation

These activities are done by richer farmers. Farmers still use traditional techniques as using tradition variety, no appropriated seed selection, soil improvement and pest control. Chemical fertilizers are well known for farmers but not yet use it property and that cause to high in put and low profit. Organic fertilizers are not yet realizable and many farmers don't see the benefit of it. Hand tractor is wanted and became very popular since the year 2000 and now is very common use.

*** Technical processing.**

Table .5. Labor calendar for lowland rice cultivation in Nambak.

Activity	1	2	3	4	5	6	7	8	9	10	11	12
Seedling					6-10							8-10
Plug&plow1						4-13						
Plug&plow2	12-45						7-14					
Transplanting	40-45						20-40					
Taking care			25-45						26-40			
Harvesting				50-60							45-55	

Remark: Rainy season rice = 
Dry season rice = 

1. Seedling preparation

Many farmers still make dry seedling, dry seedling means you put seed in to a hole directly instead of spreading seed on seed bed (Wet seedling). Dry seedling is still common here because limited of water. Average it takes 50 kg of seed to provide enough seedlings to transplant in one ha. Distance between hole to hole is about 3x3 cm and there are 5-10 seeds per hole. After seedlings has about 30 days old then farmers normally move to rice field to sit there about 30 more days before transplanting. This method of seedling takes more time and really affected to plant growing. It takes bout 5-9 working days to prepare seedlings enough for 1 ha.

Another seedling method is wet seedling method, first you have to prepare seed bed by plug and plow the soil well with water after that spared about 40 kg of seeds pre ha on the seed bed. After seedling has about 28-30 days old then it is time for transplanting.

2. Soil preparation

There are 2 times working with soil normally. First time is plugging (turn the soil up side down) which is about 10-20 cm deep, this step takes about 4-14 working days depending on equipment (buffalo or hand tractor). After that wait about 10-30 days for plant to be digested and have enough water then work with soil for the second time. This step are included turning soil up side down again 2 times and grade it flat once. This step takes 7 -13 working days and normally work it together with transplanting.

For dry season rice it needs to do only the second step because it does not have enough time to wait and soil already wet enough.

Estimate, it takes about 10-26 working days for soil preparation.

3. Transplanting.

Transplanting is done by hand and takes a lot of work, it always play the most importance role of the process because you have to transplant it fast and good. Normally farmers exchange and hire labor to help with this step, it takes about 30-40 working days/ha and finish it not more than 30 days.

Distance between hole to hole is 20-30 cm depending on soil quality and seedling health, that means transplant it closer if seedling is small and soil contains lot of sand and transplant further if seedling is big and soil is looking good (Clay-Silt). There are about -5 seedlings in each hole and about 3-5 cm deep.

4. Taking care

This step is included water management, soil fertilizing, weeding and pest control. But the most importance is to look after water to make sure the water is there and enough to keep weed away and normally cannot take a good control because there is not enough water to supply every body, especially for this type of rice field (Small bed and different height level).

Chemical fertilizers are not common use because of high value of fertilizer and most of the soil still good condition. Farmers use more chemical fertilizers mainly in dry season. For pest control, there is not really much practicing here but farmers like to deal with rats, crabs and birds.

This method takes about 20-40 working days during the time after transplanting up to before harvesting.

5. Harvesting.

After rice is mature enough then it is time to harvesting, normally farmers decided to harvest by observing the grain, if the grain get yellow and hard means it time to harvest and some farmers are depend on regular time of harvesting. Most farmers use sickle for harvesting while a few still use hand to take only grain out.

After harvest, farmer usually dry the rice about 2 days then tie it to a group and collected them in to one place then thresh them together at once. After that fill it in to bags and carry it but hand to rice storage.

In some cases if farmers do not have enough labor they usually to all step day by day (Harvest, thresh and carry home).

Because can not use modern equipment such as hand tractor and thresher machine in to this process according to topography, farmers have to invest a lot of labor in this process. Average it needs about 40--50 working days to harvest in the area of one ha.

6. Maximum area/active labor

* Total labor need of rainy season rice cultivation is about 108-172 working days

- Highest labor need/month is transplanting

- Farmers work 28 days/month

- It needs about 40 working days to transplant rice in one hectare

→ Maximum area/active labor = $28/40 = 0.7$ ha

* Total labor need of dry season rice cultivation is about 135-205 working days

- Highest labor need/month is transplanting

- Farmers work 28 days/month

- It needs about 45 working days to transplant rice in one hectare

→ Maximum area/active labor = $28/45 = 0.62$ ha

Table. 6. Labor need/ha for low land rice cultivation in Nambak.

Activity	Wet season rice			Dry season rice		
	Month	Working day (Buffalo)	Working day (tractor)	Month	Working day (Buffalo)	Working day (tractor)
Seedling	4 - 5	10	9	12	10	9
Soil preparation	5 - 7	26	11	1 - 2	45	14
Transplanting	7 - 8	40	36	1 - 2	45	45
Taking care	8 - 10	30	26	2 - 4	40	40
Harvesting	10 - 12	40	50	5 - 6	30	30
Total	9 month	146	132	7 month	170	138

* **Economic evaluation.**

Table .7. Rice economic in Nambak.

	Rainy season		Dry season	
	Buffalo	Tractor	Buffalo	Tractor
Productivity	2.3 T	2.3 T	2 T	2 T
GP/ha	2,760,000	2,760,000	2,400,000	2,400,000
IC/ha	105,000	410,000	174,000	530,000
Fcc/year	80,000	1,050,000	80,000	1,050,000
AV/ha	2,575,000	1,300,000	2,146,000	820,000
Area/Act	0.7 ha	0.7 ha	0.62	0.62
WD	146	132	170	138
AV/WD	17,000	10,000	13,000	6,000

1. **Rain season rice model by using buffalo.**

$$Y \text{ rain season (Buffalo)} = 2,655,000 x - 80,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 2,655,000 Kip
- Maximum labor/Active labor (x) = 0.7 ha.
- Fixed Capital Consumption = 80,000 Kip/year
- 1 Active labor can cultivate maximum 0.7 ha which can make value about 1,802,000 K
- Need to cultivate at least about 0.03 ha to cover the fixed capital.

2. **Rain season rice model by using small tractor**

$$Y \text{ rain season (small tractor)} = 2,350,000 x - 1,050,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 2,350,000 Kip
- Maximum labor/Active labor (x) = 0.7 ha.
- Fixed Capital Consumption = 1050,000 Kip/year
- 1 Active labor can cultivate maximum 0.7 ha which can make value about 910,000 K
- Need to cultivate at least about 0.45 ha to cover the fixed capital.

3. Dry season rice model by using buffalo.

$$Y \text{ dry season (buffalo)} = 2,226,000 x - 80,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 2,226,000 Kip *
 - Maximum labor/Active labor (x) = 0.62 ha.
 - Fixed Capital Consumption = 80,000 Kip/year
 - 1 Active labor can cultivate maximum 0.62 ha which can make value about 1,330,000 Kip
 - Need to cultivate at least about 0.038 ha to cover the fixed capital.
- * Dry season has less added value than Rain season cultivation cause by low yield (Dry season cultivation has big problem about not having enough water, more weed and pest)

4. Dry season rice model by using tractor

$$Y \text{ dry season (tractor)} = 1,870,000 x - 1,050,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 1,870,000 Kip **
 - Maximum labor/Active labor (x) = 0.62 ha.
 - Fixed Capital Consumption = 1,050,000 Kip/year
 - 1 Active labor can cultivate maximum 0.62 ha which can make value about 508,000 Kip
 - Need to cultivate at least about 0.54 ha to cover the fixed capital.
- ** Using small tractor has less added value than using buffalo because higher intermediate consumption (seed, fertilizers, gasoline)

1.6.2. Up land cultivation

Up land cultivation is the main activity of most farmers in Nambak, farmers are very familiar with it for long times since they were born. The system in general is 3 years rotation and really depended on rainfall in rainy season. Farmers grow rice as the main crop for their own consumption and grow other crop in little amount such as job steer, sesame, maize, fruit tree and root crops.

New techniques of mixed cropping has not yet well know in here, farmers don't spent much in their in put but spent a lot of labor to cultivate it, average it needs at least 290 working days to cultivate in one ha.

There are many problems for the system, the biggest problem is about soil nutrient decreasing, ever since 3 year rotation soil can not improved it self early enough in 3 years, so that reach to low productivity and high weed pressure.

* **Technical processes.**

Table. 9. Up land cultivation calendar in Nambak.

Activity	1	2	3	4	5	6	7	8	9	10	11	12
Cut	30-40											
Burn/clean				30-40								
Plant				5-10	40-45							
Weeding 1						30						
Weeding 2							45					
Weeding 3								25				
Harvesting								15-22		50-58		

Remark: Rice = 
 Other crops = 

1. Cutting

Farmers own about 2-3 plot of land, they normally cultivate in their own land, that why they have to come back to the same plot every 2-3 years. Cutting is done by hands, and takes about 30-40 working days per ha depending on type of forest, if old forest will takes less labor but young forest will takes more labor.

2. Burning

This step doesn't take long, farmers normally burn their field together at once to ensure that the fire won't destroy each other crop. It takes 1-2 WD/ha

3. Cleaning

This is to clean the field after be burned. Farmers like to collect wood that not burned to make fenced, field house and also fire wood. For some plants and weed that not well burned they will have to collect it and re burns it again. Normally it needs about 27 WD/ha depending on how well of the first burning.

4. Planting.

Farmers start to plant rice at the beginning of May by putting some seeds in to a hole (over 10 seeds/hole), distance between hole to hole is about 20-30 cm. Planting is limited by the time because if you plant late rice won't grow well together, so farmers have to do it fast and normally finish planting in 3 days/ha. It takes about 20 -30 WD/ha. About sesame, farmers like to plant it before planting rice by spreading over the prepared field and take some off when it germinated. Job steer are planted together with rice or later after planting rice with the distance 80-100 cm pre hole and 3-4 seed/hole.

5. Taking care.

This probably is the hardest step of up land cultivation. Farmers must weed at least 3 times per production cycle and have to deal with killing rats and birds who are the main enemy. Each time of weeding takes about 40-50 working days/ha to weed well and some times farmers have to weed for the fourth time before harvesting. Together only for weeding it needs 120-140 WD/ha.

Weeding step is the most importance to get high productivity but unfortunately that many farmers can not weed enough because most up land farmers are poor and don't have enough labor. Weeds are grown more in the young forest fields and re grow very fast, so farmers have to weed during June to August.

6. Harvesting.

Rice harvesting started at the end of September and finished not later than November. For other up land crop, harvesting started in August up to December: Sesame harvest in August and Job's-tear harvest in November to December.

Rice harvesting are included cutting, drying, threshing and carrying to storage, all this process takes about 50 working days/ha. Some farmers still harvest only grain by hand to a basket then carry home in the same days.

7. Maximum area/active labor

Total labor need of upland cultivation is about 260-305 working days

- Highest labor need/month is weeding
 - Farmers work 28 days/month
 - It needs about 45 working days to weed in one hectare
- Maximum area/active labor = $28/45 = 0.62$ ha

* Economic evaluation.

Table.10. Up land cultivation economic of Nambak.

Productivity	1.6 T
GP/ha	1,800,000
IC/ha	37,000
Fcc/act	28,000
AV/ha	1,735,000
Area/Act	0.6ha
AV/WD	6,000

Y up land = 1,870,000 x - 1,050,000
--

For this model we can see that:

- Added value not included Fixed Capital Consumption = 1,763,000 Kip
- Maximum labor/Active labor (x) = 0.62 ha.
- Fixed Capital Consumption = 40,000 Kip/year
- 1 Active labor can cultivate maximum 0.62 ha which can make value about 1,068,000 Kip
- Need to cultivate at least about 0.026 ha to cover the fixed capital.





1.6.3. Teak tree

Teak tree is one of industry plant which is high demand in every market. Middle man normally come to buy wood from farmers then sell it to Vietnam, China and Thailand. The farm price is 10.000 Kip per 10 cm round. To get a tree with 80 cm round, it takes about 10-15 years depending on where the tree is grown, for example if the tree is grown in dry area it might takes 15 years to get 80 cm round.

Farmers plant the trees in wet area, especially along river and creek, close to residents where easy to look after and close to road.

* Technical processes.

Table 11. Teak tree cultivation calendar in Nambak.

Activity	Year 0	Year1	2	3	4	5	15
Seeding							
Planting							
Taking care							
Harvesting							

From the year 6 to the year 15 are no weeding needed but only cutting some branches and cleaning which takes about 20 WD

Seedling takes 20 WD/ha (Watering 20mn/day and seed bed preparation is about 3 days).

Field preparation take 20 WD and plating take about 100 WD (25 plants/day)

Weeding take about 280 WD (Weeding takes 70 WD/ha/year)

* Estimate 440 WD/16 years

1. Seedling preparation.

Sob teak seed in regular water for 2 days then ferment for 3 days. After that spread seeds on seed bed which is well prepared. Cover the seed with sand about 1-2 cm deed than well watered. After seedlings get 4 leaves farmers like to transplant in to another bed which is also well prepared. Distance between hole to hole is about 20x20 cm and when seedling is about 1 year old then it is time to plant in to the filed.

2. Field preparation and plating.

Before planting farmer have to clear the field by cutting all plants and burn it well, after that make hole about 30cm wide, 20 cm deep and 2x2 m from hole to hole. Farmers always plant the tree in the beginning of rainy season, so there is not much work to water the tree after planting.

3. Taking care.

Normally there are 2 times weeding per year and farmers have to weed only the first 4 years after the trees are big enough then weed won't be able to grow. No pest control and fertilizing are normally done.

4. Maximum area/active labor.

Total labor need teak tree operation in one hectare is about 440WD/16Y
= 28 WD/Y

- Highest labor need/month is weeding
 - Farmers work 28 days/month
 - It needs about 35 working days to weed in one hectare
- Maximum area/active labor = $28/35 = 0.8$ ha

* Economic evaluation

If farmer could sell all the trees in the year 15 after planting and each tree is 80 cm round, death rate is 0 % and no input cost with the area of 1 ha they will get:

$$GP = 2,500 \times 80,000$$

$$GP = 200,000,000 \text{ Kip/16 years}$$

$$GP/\text{year} = 12,500,000 \text{ Kip}$$

Table12. Teak tree plating economic in Nambak.

Productivity	2500 plants/ha
GP/ha/year	12,500,000
IC/ha	0
Fcc/act	20,000
AV/ha	12,480,000
Area/Act	0.8ha
AV/WD	37.000

Y teak tree	=	12,500,000 x - 50,000
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For this model we can see that:

- Added value not included Fixed Capital Consumption = 12,500,000 Kip
- Maximum labor/Active labor (x) = 0.8 ha.
- Fixed Capital Consumption = 50,000 Kip/year
- 1 Active labor can cultivate maximum 0.8 ha which can make value about 9,960,000 Kip.
- Need to cultivate at least about 0.004 ha to cover the fixed capital.

1.6.4. Orange trees.

Orange is an economic fruit that farmers in Nambak like to grow. According to good temperature and type of soil orange can grow here very well and produce good tasty fruits than any where else in the country, totally there is about 380 ha of land along river have been planted and can produce oranges about 6,000 Tons/year.

Farmers are not yet familiar with new modern techniques such as crafting, variety selection, soil fertilizing and pest control, and all that cause to low yields and good quality of orange fruits.

* **Technical processes**

Table. 13. Orange planting calendar in Nambak.

	Year 0	Year 1	Year 5	Year 6	Year 20	Year 25	Year 30
Seeding	■						
Planting		■					
Taking care		■	■	■	■	■	■
Harvesting				■	■	■	■

This is to estimate labor need from seedling to the end of the production in one ha.

- Seedling step takes about 20 WD (water seed bed 20mn/days and seed bed preparation is bout 3 WD).
- Field preparation and tree planting take 32 WD (clear land 20 WD and plant 50 trees/WD).
- Weeding takes about 3,150 WD (105 WD/year)

Total 3,202 WD/31 years.

1. Seedling.

Farmers use traditional variety which selected from big and nice looking fruits. After prepared seed bed they spread seed on the bed and cover it with good soil and water the bed well. After the seed get 10 cm height then they move the seedling to another seed bed and transplant in the length of 20 x20 cm then wait until seedlings has 1 year old to plant to field.

2. Soil preparation and planting.

Soil preparation is done before just right rainy season, normally started in May to June. After clearing the land by slash and burn then farmers dig hole 30x30 cm, between hole to hole is 3-4 m and plant the tree in June to July.

3. Taking care.

Normally farmers hire people to weed 2-3 times/year during February, May and November. No fertilizing and pest control.

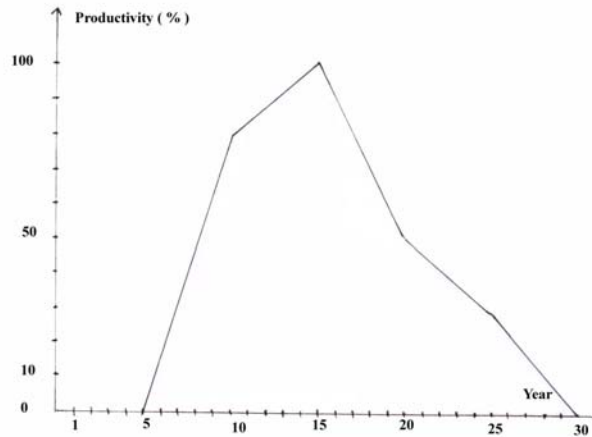
4. Harvesting.

Trees started to give fruits in the 6th year and will stop giving fruits in the 30th year. Harvesting is done by hand, farmers normally don not have to do this job because it is done by middle man who came to buy the fruit every year. Picking time is between September to December with the price average 200 Kip/fruit.

5. Maximum area/active labor.

Total labor orange operation in one hectare is about 105WD/Y

- Highest labor need/month is weeding
 - Farmers work 28 days/month
 - It needs about 32 working days to weed in one hectare
- Maximum area/active labor = $28/32 = 0.8$ ha



Picture.10 . Orange product in Nambak.

* **Economic evaluation**

If no hiring people and 0% death rate, price of one fruit is 150 Kip, we can estimate:

$$GP = 8,218,750 \times 150 = 1,232,812,500 \text{ Kip/31years}$$

$$GP/\text{year} = 39,768,000 \text{ Kip}$$

Table.14. Orange planting economic in Nambak.

Productivity	625 plants/ha (265,120 fruits)
GP/ha	39,700,000
IC/ha	0
Fcc/act	50,000
AV/ha	39,650,000
Area/Act	0.8ha
AV/WD	12.000

Y teak tree = 39,700,000 x - 50,000

For this model we can see that:

- Added value not included Fixed Capital Consumption = 12,500,000 Kip
- Maximum labor/Active labor (x) = 0.8 ha.
- Fixed Capital Consumption = 50,000 Kip/year
- 1 Active labor can cultivate maximum 0.8 ha which can make value about 31,760,000 Kip/year
- Need to cultivate at least about 0.002 ha to cover the fixed capital.

1.6.5. Cropping system comparing.

Table .15. Economic comparing of cropping system in Nambak. (x10000 Kip)

	Rain fed rice		Irrigated rice		Teak tree	Orange	Up land rice
	Buffalo	Tractor	Buffalo	Tractor			
GP	276	276	240	240	1250	3970	160
IC	10.5	41	17.4	53	-Æ	Æ	3.7
Fcc/year	8	105	8	105	2	50	2.8
AV	257.5	130	214.6	82	1248	3965	153.5
AV/Act	85.8	43.3	71.5	27.3	416	1321	51
AV/WD	1.7	1	1.3	0.6	44.5	38.5	0.5

1.7. Live stock system

In general, live stock rising are minor activity after cropping and relate closely to cropping system. Live stock is for own consumption, laboring and money saving. Farmers commonly raise cow, buffalo, pig, chicken and duck. mainly and some have goats and fish ponds.

Most of system is un keep and half keep system including cattle and poultry. Feeding is related to cropping system, farmers depend on what they have left from harvesting like: Fine rice bran, rice husk and broken rice and also depend on nature resource.

1.7.1. Cattle rising.

* Technical processes

It is half keep and half un keep system. In dry season farmers do not keep animals, they free them on their rice field right after harvesting and also free them in bush and other place because not many people can cultivate in this time. But in rainy season farmers have to tie their animal to ensure that their animal do not destroy each other field. So there are many problem of raising cattle in rainy season, and the biggest problem is limited of pasture field.

Rainy season , farmers spend about 2 hours /day to feed 1 head, estimate 60 hours/season or $60/8 = 7.5$ working days. Maximum head/Act = $28/7.5 = 4$ heads

Dry season , farmers spend about 30 minutes/day to feed 1 head, estimate 60 hours/season or $15/8 = 2$ working days. Maximum head/Act = $28/2 = 14$ heads

* **Economic evaluation**

Table .16. Economic of raising cattle in Nambak.

	Cow	Buffalo
GP/mother	1,205,000	838,000
IC/mother	20.000	25.000
Fcc/year	0	0
AV/mother	1,185,000	813,000
Maximum head/Act	4 heads in rain season 14 heads in dry seasons	4 heads in rain season 14 heads in dry seasons
WD	57	57
AV/WD	21,000	14,000

1. Cow model

$$Y_{\text{cow}} = 1,185,000 \times - 0$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 1,185,000 Kip
- Maximum head/Active labor (x) = 14 in dry season
4 in rainy season
- Fixed Capital Consumption = 0
- 1 Active labor can raise maximum 14 heads in dry season which can make value about 16,590,000 Kip/year
- 1 Active labor can raise maximum 4 heads in rainy season which can make value about 4,740,000 Kip/year

2. Buffalo model

$$Y_{\text{Buffalo}} = 813,000 \times - 0$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 813,000 Kip
- Maximum head/Active labor (x) = 14 in dry season
4 in rainy season
- Fixed Capital Consumption = 0
- 1 Active labor can raise maximum 14 heads in dry season which can make value about 11,381,000 Kip/year
- 1 Active labor can raise maximum 4 heads in rainy season which can make value about 3,252,000 Kip/year

1.7.2. Poultry raising

* Technical processes

Chicken and duck are very popular for all farmers because they are easy to raise and eat less feeds. Farmers like to free them around their houses and rice fields where they can look after and easy to get, usually farmers keep their animals well in animal house at night to ensure security.

Poultry are the main protein source for farmers, they normally sell to market if they have many but every body always have some at home. Farmers do not feed enough and do not care about quality if the feed, they normally use fine rice bran and broken rice for feeding. Vaccination is not well practice here even many died.

Estimate labor for feeding 10 mn/day/head, or 5 hours/month

Labor need per month = $5/8=0.62$ WD

Maximum head/ active labor = $28/0.62 = 45$ heads

* Economic evaluation

Table .17. Economic of raising chicken in Nambak.

	Chicken
GP	290,000
IC	73,000
Fcc	50,000
AV	167,000
Maximum heads/Act	45
WD/year	7
AV/WD	31,000

Y Chicken = 217,000 x - 50,000

For this model we can see that:

- Added value not included Fixed Capital Consumption = 217,000 Kip
- Maximum head/Active labor (x) = 45
- Fixed Capital Consumption = 50,000
- 1 Active labor can raise maximum 45 heads which can make value about 7,515,000 Kip/year

1.7.3. Pig rising.

* Technical processes

In general there are 2 systems: free and half free system. Free system (un keep) is done mainly in ethic minority group because their tradition, they like to free their pig around their houses and their field but looking after very well to ensure animal security.

Farmers feed twice a day, they normally use fine rice bran and rice husk for the main feed, sometimes feed are mixed with broken rice. Another feed is wild vegetable and any thing that left form kitchen.

There are 3 purpose of raising pig:

- Raise small pig to sell.
- Raise mother pig to sell small pig.
- Raise mother pig to sell small pig and fattening small pig to sell.

Most farmers now like to buy small pig from market for fattening, especially after harvesting because in that time they have more rice bran.

Estimate labor for feeding 1 hour/day/head, or 30 hours/month

Labor need per month = $30/8=3.7$ WD

Maximum head/ active labor = $28/3.7 = 7$ heads

* Economic evaluation

Table .18. Economic of raising pig in Nambak.

GP	470,000
IC	236,000
Fcc	30,000
AV	204.000
Maximum heads/Act	7
WD/year	44
AV/WD	5,000

Y Pig	=	234,000 x - 30,000
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For this model we can see that:

- Added value not included Fixed Capital Consumption = 234,000 Kip
- Maximum head/Active labor (x) = 7
- Fixed Capital Consumption = 30,000
- 1 Active labor can raise maximum 7 heads which can make value about 1,428,000 Kip/year

1.8. Farming system

Farming system is the combination of Land, Capital and Labor according to agro ecology and socio-economic conditions. Another word is the combination of cropping and lives stock system, and according to those two system in Nambak we can indentify many combinations as:

- Rainy season rice 1-2 ha + Dry season rice 0.5-1 ha + Orange 1 ha + Teak tree 1-2 ha + Cattle 5-10 heads + Pig 5-8 heads + Poultry over 10 pieces

- Rainy season rice 0.5-1 ha + Orange 0.4-0.8 ha + Cattle 2-5 heads + Pig 2-3 heads + Poultry 10-20 pieces

- Rainy season rice 0.5-1 ha + Up land cultivation 0.3-1 ha + Cattle 1-2 heads + Pig 1-2heads + Poultry 10-20 pieces

- Up land cultivation 0.8-1.5 ha + Pig 1-2heads + Poultry 5-10 pieces

- Up land cultivation 0.3-0.8 ha + Poultry 3-5 pieces

- Up land cultivation 0.3-0.5 ha + Poultry 1-2 pieces

: Farm household are identified to 4 types according to cropping and lives stocks system which related to farm management and agriculture income

Table .20. Farm type in Nambak.

Type	Labor management	Capital and tools	Cropping	Live stock	Rate
1	- Family - Exchange - Hired	Have more capital	Rain fed - Irrigated rice. teak tree & orange	Cattle 2 ,many of Pig and poultry	18 %
2	- Family - Exchange - Hired	Enough capital	- Rain fed rice	Cattle 1- 3 Pig 2 and poultry > 10	13%
3	- Family - Exchange	Less capital	- Rain fed rice - Up land rice	Cattle 1 - 2 , Poultry 3 - 5 and Pig 1 - 2	32%
4	- Family - Exchange - Sell labor	Less capital	Up land rice	Poultry 3 - 5	37 %

Farm type 1:

Farmers who have about 0.5-0.8 ha/active labor, and can make added value about 11,000,000-12,000,000 Kip/year. They can cultivate on two season rice, fruit tree and teak tree. They have cattle 2-5 mothers, 3-5 pigs and more than 10 poultry. These farmers have more capital, they have other job beside agriculture such as trading, Rice milling, truck running, etc. They have better means of production but don not want to produce more because they agriculture is hard work, they prefer to do other occupation make more income, agriculture is to provide consumption need.

Farm type 2 :

Farmers who have about 0.3-0.8ha/active labor, and can make added value about 3,000,000-5,000,000 Kip/year. They can cultivate on only rainy season rice and some fruit tree. They have cattle 1-3 mothers, 2-3 pigs and more than 10 poultry. These farmers have enough capital and work only on agriculture to have enough for house hold consumption. They do not want to try new thing and cultivate more because they afraid of any risky constraint might cause them to worse condition.

To ensure marketing and provide them enough technical knowledge can reduce constraints and help them to cultivate more sufficiency.

Farm type 3 :

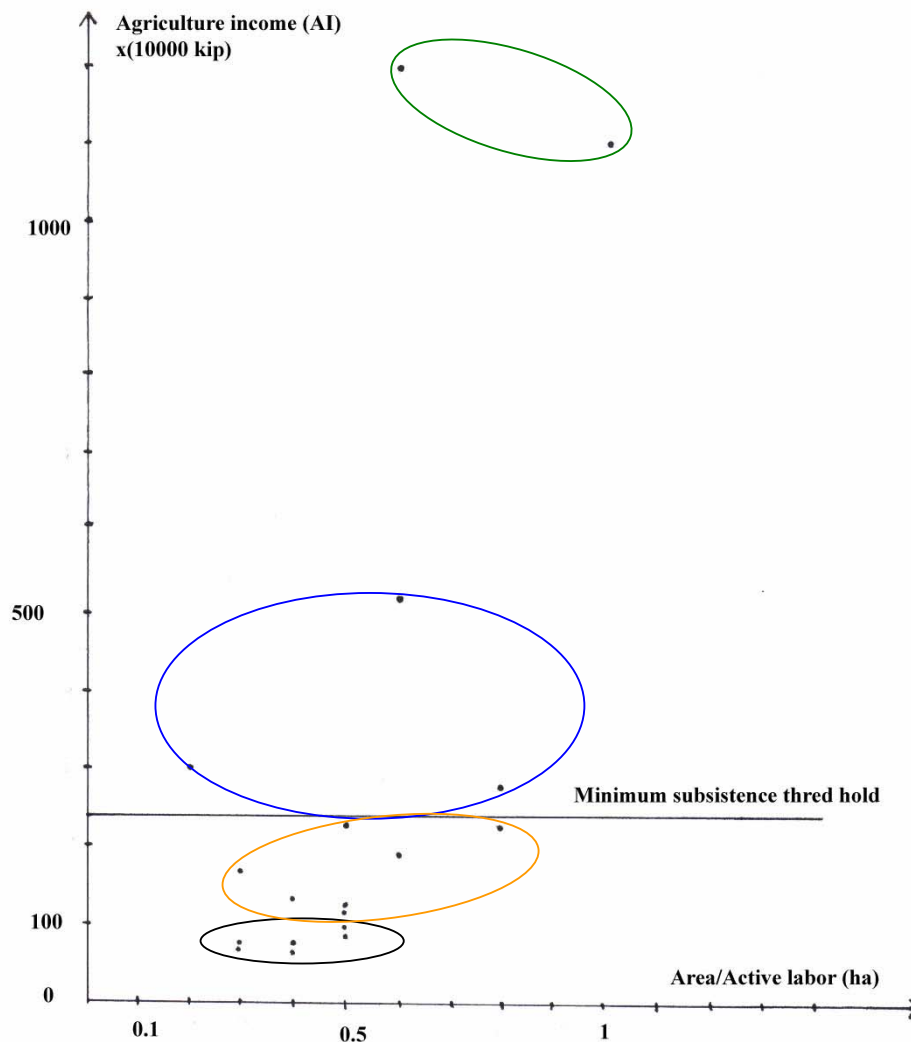
Farmers who have about 0.3-0.6ha/active labor, and can make added value about 1,200,000-2,000,000 Kip/year. They can cultivate on only little area of rainy season rice and concentrate mainly on up land cultivation. They have cattle 1-2 mothers, 1-2 pigs and more than 3-5 poultry. These farmers do not have enough capital and can not be over subsistence line, they have to sell their labor to gain some more income and selling non timber forest products.

These farmers do not have enough good land so it is hard to promote cropping for them while promoting live stock raising do not work because farmers need annual income and live stock raising usually cost more than cropping. Although, Financing is needed and providing technical knowledge and ensure marketing are very inimportance.

Farm type 4 :

Farmers who have about 0.2-0.5ha/active labor, and can make added value about 700,000-1,000,000 Kip/year. They are up land cultivated farmers, they do not have cattle and can not raise pig, and some have couple of chicken in their house. These farmers do not have capital, all they have are their labor, and they can not make enough income by agriculture so they have to sell their labor more than they have to concentrate in their fields. NTFPs are the main source to provide food and extra income.

According to lack of land, labor and capital, it is hard to help this type of farmers. We should consider to introduce them new job that more sustainable and can make better income.



Picture.7. Farming system model in Nambak

1.9. Problem analysis.

1. High production area

This is hardly to solve this problem, Nambak district has high topography which make difficulty for mechanism, transportation, irrigation and pest controls. Farmers invested so much labor for transport their product from field to home and road.

2. Lack of water

Water is limited factor that affect to production, especially rice operating, that's why most farmers can grow rice only in rainy season, even that rice production in rainy season still not enough water according to rainfall in the season.

Lack of water reach to less divert of cropping and low yield of dry season rice.

3. Not enough appropriated technical knowledge

Many farmers still use tradition techniques such as using low yield variety, no crafting for fruit tree, natural soil improvement, do not control pest, not well animal vaccination ,disease control, and do not feed animal enough

4. Not well market management

One reason why farmers do not try to operate new crop or increase farm capacity even though they can be able to do that is that farmers do not have enough information about marketing. That information are market demand and good prices, yet to encourage farmers we need good market that can be guarantee for both prices and product quantity

1.10. Recommendation

1. Provide appropriated technical knowledge for cropping

- * Organic fertilizers: Compost, Bio- compost, animal manure, green composted.
- * Mixed cropping
- * Crafting fruit tree
- * Seed selection and introduce new cash crop

2. Provide appropriated technical knowledge for live stock rising

- * Animal feed: Keep rice straw to be cattle feed in rainy season in both dry straw and silage.
- * Improve natural pasture by planting pasture grass and legumes
- * Encourage on vaccination, feeding and nursery mainly for cattle, poultry and pig

3. Improve market management and economic calculation in house hold level

Good market will ensure farmers income from selling their products and economic calculation is providing information for farmers to make decision.

4. More research and experimentations

- Experiment new crop for dry area
- Study on drip irrigation
- Experiment on modern orange garden
- Focus on organic fertilizers
- Study on new vocational such as handicraft and agriculture processing

5. Extension services

To build capacity for farmers it need extensionist to work closely with, to provide appropriated information and right on the time, extension service would help all of farmers including those who have low education background. In term of low education of many farmers, the way to work with them should included training, field practicing and consultation.

2. Pakou district, Louangphabang province

2.1. Topography

Pakou district in one of 11 districts in the Louangphabang province, sharing Northern border with Nambak and Ngoir district Louangphabang province, Southern part with Louangphabang and Chomephet district of Louangphabang province, Eastern part with Oudomsay province and Western part with Pakseang district, Louangphabang province.

Average temperature is 25 Celsius, lowest temperature is average 20 Celsius in December and January and highest temperature is 31 degree Celsius in April and May.

2.2. Socio-economic conditions

Pakou district has national road (13th North) pass through from South to North which is convenience to trading and communication/transportation. The district is divided in to 65 villages, 202 house holds with the total population of 22,757 people (female 11,337 people). Lao lum contents 11 villages, while 15 villages are Lao therng 12 villages are Lao sung and 27 villages are mixed.

There are 55 schools (2 secondary schools), 1 hospital, 1 pharmacy. Villages that access to clean water are 34 villages, have toilet 29 villages, tempo 29 places and library 3 places.

2.3. Agriculture productions

Total agricultural land are 4,882 ha, which most of the land are used for up land cultivation (1,900 ha). There are about 940 ha low land area used to grow rice in rainy season but about 144 ha can be cultivated in dry season. Beside growing rice farmers grow maize about 150 ha, root crop 112 ha, Job steer 105 ha, Sesame 100 ha, pine apple 47 ha, lemon 30 ha and other tree about 110 ha.

Live stocks are 3,800 buffalos, 3,600 cows, 7,400 pigs, 570 horses, 1,200 goats, poultry 38,000 and 370 fish ponds.

The district authority has planed to ensure food security by extend the agriculture land and capacity for example to extend about 150 ha of rice field in the year 2005 in 15 villages and to pay more attention on growing maize, Job steer, Sesame, Peanut, Onion, and other cash crops. Beside of cropping the authority are planed to focus on building more vaccinator network in village level to prevent and control diseases.

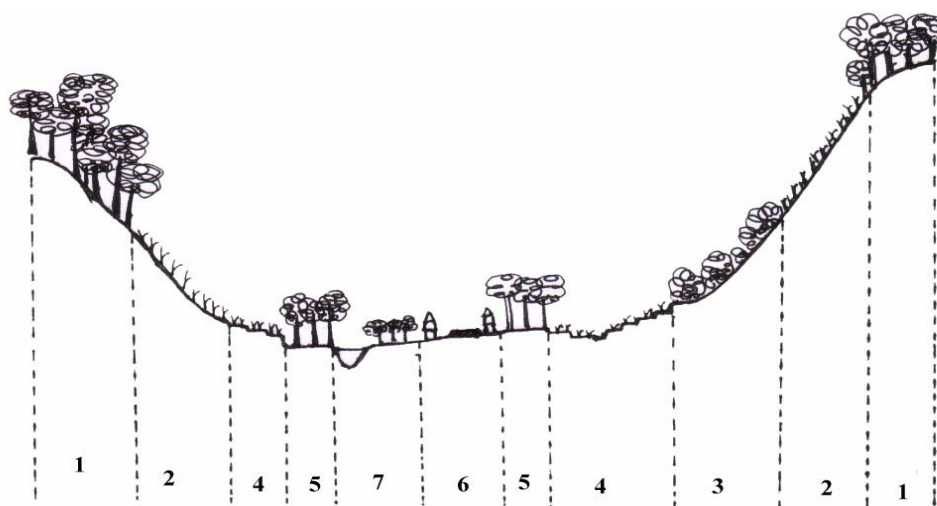
To reduce up land cultivation area is planed to reduce at least 70% in 9 villages and 50% in 15 villages that cultivate more than 50 ha.

2.4. Agriculture history

- Because there are no informal records so the background of the village is unclear.
- 1975 after independence of the country, people moved back to their home town according to government direction.
- Combination of small villages and resettled of people in high land down to low land are begin in the year 1990
- After set up the village authority, Land using are responsible and manage by villagers and village committee with direction from district authority
- Since the year 1990, up land cultivation area is limited according to land allocated and forest protection. Farmers are allowed to cultivate or own the land about 2-3 plots which reduce rice productivity from 3.6 T/ha down to about 1.2 T/ha, farmers have to responsible for impact of your cattle to production, that's why now farmers do not raise many cattle like in the past.

- After 1980, roads are improved, transportation is easier which make trading grew up, farmers started to grow more than their selves consumption, and stopped growing some crop that cheaper in the market such as cotton and tobacco.
- Year 2000 Farmers grew lots of Job steer and sesame according to commodity cropping but the market are too small and the goods were not good quality (not dry and nice), the companies whose made contract with farmers can not do as they promised, the price was down and could not even buy from farmers. That's why now farmers do not grow many Job steer and Sesame.
- After access to electricity in the year 2003 (some area), farmers started to use more modern equipments for growing rice and rice processing such as water plump and rice miller, more over they can access to information by radio and television
- Access to clear water (supported by the Lao Red cross) since 1994

2.5. Agro-ecology condition



Picture. 5. Transect in Pakou district, Laungphabang.

Remark: This transect are identified according to diversity of ecosystem in 4 villages: Had khor, Had ya, Phonhom and Phonsavang.

Zone 1: Forest

This is high and slope area which is far way from farmers' residences, the area is not suitable for cropping according to thin layer of soil and high percent of rock content. Plants that commonly grow in this area are big tree and bamboo. Forest is the main natural resources to provide farmers food such as bamboo shoot and mushroom, more over to provide fuel and tools for house hold consumption, forest is also used for animal husbandry especially cows, buffalo and goats.

Zone 2: Up land cultivation

Up land cultivation is the main occupation of farmers in Pakou district according to lack of low land and tradition. Farmers grow rice in this area mainly for their consumption need and grow other crop such as Job steer, corn, banana, papaya, chili, egg plant, Sesame, etc mixed with the rice field. This area is high and slope which is clay mixed with small stone, lack of organic matter, thin layer and low nutrition. High weed pressure and rat is the biggest problem in this area.

Zone 3: Bush

This area is hilly which used to cultivated before, normally farmers come back to cultivate after 2-3 years and during that time the area become the bush. soil is dark clay depending on organic matter that cover the soil, plants that grow in this area are various kind of bush plant, grasses and small trees with 1-3 Metter high. This area is used mainly for animal husbandry.

Zone 4: Low land rice cultivation

This area is flat and low slope in mountain feed, farmers invested lots of labor to develop the land to rice beds. The soil is clay and clay-sand, layer between 10-40 cm with good organic matter which came from animal manure and rice straw. Water management is depended on natural water resource such as rainfall, river and creek. Rice fields that close to those water resources can be cultivate well in both rainy and dry season.

Zone 5: Teak tree garden

This is flat area close to residence, long river bank and the road which is convenience to look after the tree and to sell to market. Soil is clay with good soil nutrient and moisture. Farmer use this area mainly for teak tree planting and animal husbandry which help to improve soil nutrition to rice field in lower part.

Zone 6: Village

This is flat area close to roads and river, farmers use this area for living because of water accessing and communication, this area also use for products storage, home garden, animal husbandry (Chicken, duck, pigs), keep cattle in the evening and various kind of fruit trees

Zone 7: Fruit tree

This is flat area close to roads and river, farmers use this area to grow various kinds of fruit trees because this area has good soil nutrient and moisture farmers like to grow lemon and banana, also, this area is providing feed for cattle mainly in dry season.

2.6. Cropping system

2.6.1. Upland cultivation



Up land cultivation is the major activity of most farmers in Pakou like Nambak according to lack of low land, the cultivation is rotation system in 2-3 year cycle. Farmers grow many crops in the one area but main crop is sticky rice, beside rice farmers grow other crop which concern with market demand and personal interested of farmers.

Problem of up land cultivation are high weed pressure, in average it need about 270 working days to weed well in one hectare. Productivity is low according to low soil nutrient and lack of water, in average yield is about 1.5 T/ha

*** Technical processes**

Table. 19. Up land cultivation calendar in Pakou.

	1	2	3	4	5	6	7	8	9	10	11	12
Cut	25-40											
Burn & clean				22-40								
Planting				5-10	25-30							
Weeding 1						40						
Weeding 2							40					
Weeding 3								32				
Harvesting										40-50		15-20

Remark: Rice = 
 Other crops = 

1. Cutting

Cutting process started from land observing then starts to clear the area by using hand tools, first cut the big trees then bushes. This process takes about 40 WD/ha.

2. Burn and clean

After cutting, and dry enough, farmers will make appointments with their neighboring to burn their fields together, after that farmers use wood that not burn well to make fence, field station and to use as wood fuel, for jungle that not burn well they will collect to one place and re burn. It take about 28 WD/ha

3. Planting

First farmers digging a small hole by hand tool (a stick with metal point) than put some ice seed to fill in the hole (10-30 seed/hole) with out cover the hole with soil. This process normally done in 2-3 days, farmers exchange labor in this process, it takes about 25 WD/ha.

4. Taking care

This is the limited activity of labor supplying, according to 2-3 year rotation system the soil can not improve its self nutrition and the condition reach to well grow of various kind of grass and bush plant. All this make difficult situation for farmer to work harder to weed enough in the season. Farmer normally weed about 3 times, and each time take over 30 WD, in the average it takes about 115 WD/ha.

5. Harvesting

This last process includes harvesting, carrying, threshing and storage. After harvesting, some farmers thresh the rice right away little by little but some farmers thresh all at once. After threshing farmers fill the grain in rice bags then carry by hand to their home. This process takes about 60 WD/ha.

5. Maximum area/ Active labor

Total labor need of upland cultivation is about 244-302 working days

- Highest labor need/month is weeding
 - Farmers work 28 days/month
 - It needs about 40 working days to weed in one hectare
- Maximum area/active labor = $28/40 = 0.7$ ha

*** Economic evaluation.**

Table.20. Up land cultivation economic of Pakou.

Productivity	1.5 T
GP/ha	2,180,000
IC/ha	60,000
Fcc/act	40,000
AV/ha	2,080,000
Area/Act	0.7 ha
WD	273
AV/WD	7,500

Y up land = $2,120,000 \times - 40,000$
--



For this model we can see that:

- Added value not included Fixed Capital Consumption = 2,120,000 Kip
- Maximum labor/Active labor (x) = 0.7 ha.
- Fixed Capital Consumption = 40,000 Kip/year
- 1 Active labor can cultivate maximum 0.7 ha which can make value about 1,456,000 Kip
- Need to cultivate at least about 0.02 ha to cover the fixed capital.

2.6.2. Low land rice cultivation

Table .21. Labor calendar for lowland rice cultivation in Pakou.

Activity	1	2	3	4	5	6	7	8	9	10	11	12
Seedling					4-10							3-10
Plug&plow1					5-20							
Plug&plow2	10-30					7-20						
Transplanting	45-50						40-45					
Taking care			35-40					20-35				
Harvesting					45-60						40-50	

Remark: Rainy season rice = 
 Dry season rice = 

1. Seedling preparation

This process start with seeding which be done in 2 kinds as dry seeding and wet seedling, dry seeding is the method for dry area that has problem of water supplying, this method is to put seed directly to the soil like up land rice planting. For wet seedling is to spread seed in to seed bed that well prepared (fine soil and wet), average it takes 3 WD/ha for dry seeding and 8 WD/ ha for wet seedling.

2. Soil preparation

There are 2 times for soil plug and plow, many farmers use small tractor for this process while less people still use buffalo. It's takes about 32 WD/ha by using buffalo and about 15 WD/ha by using small tractor

3. Transplanting

Transplanting is limited activity for all the process according to season, farmers need to transplant all the seed as fast as they can to reach the time. Normally farmers do not transplant late than 20 days, average it takes about 44 WD/ha. The distance between hole to hole is about 20-30 cm. while 2-3 cm deep and there are about 3-5 seedling/hole.

4. Taking care

This process includes water management, weeding, fertilizing and pest control. Normally farmers do not fertilize the rainy season rice but fertilize some in the dry season rice. Pest control is done by mechanical way while chemical pesticide is not common used. It takes about 20-30 WD/ha

5. Harvesting

Harvesting is done by hand using sickle for the main tool (about 33 WD/ha), after harvesting, farmers normally dry the grain in 1-2 day before threshing process. Total it takes about 70 WD for harvesting process.

* Dry season rice can be cultivated in the area that close to water resource only, more over it often low yield according to more weed and pest, and lack of soil fertilizing.

6. Maximum area/active labor

* Total labor need of rainy season rice cultivation is about 116-180 working days
 - Highest labor need/month is transplanting
 - Farmers work 28 days/month
 - It needs about 45 working days to transplant rice in one hectare
 → Maximum area/active labor = $28/45 = 0.62$ ha

* Total labor need of dry season rice cultivation is about 138-190 working days
 - Highest labor need/month is transplanting
 - Farmers work 28 days/month
 - It needs about 50 working days to transplant rice in one hectare
 → Maximum area/active labor = $28/50 = 0.56$ ha

* Economic evaluation.

Table .22. Rice economic in Pakou.

	Rainy season		Dry season	
	Buffalo	Tractor	Buffalo	Tractor
Productivity	2.9 T	2.9 T	2.6 T	2.6 T
GP/ha	3,480,000	3,480,000	3,120,000	3,120,000
IC/ha	168,000	425,000	482,000	625,000
Fcc/year	100,000	1,100,000	100,000	1,100,000
AV/ha	3,212,000	1,955,000	2,538,000	1,587,000
Area/Act	0.62 ha	0.62 ha	0.56 ha	0.56 ha
WD	160	140	174	150
AV/WD	20,000	14,000	14,000	10,000

1. Rain season rice model by using buffalo.

$$Y \text{ rain season (Buffalo)} = 3,312,000 \times - 100,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 3,312,000 Kip
- Maximum labor/Active labor (x) = 0.62 ha.
- Fixed Capital Consumption = 100,000 Kip/year
- 1 Active labor can cultivate maximum 0.62 ha which can make value about 1,935,000 K
- Need to cultivate at least about 0.03 ha to cover the fixed capital.

2. Rain season rice model by using small tractor

$$Y_{\text{rain season (small tractor)}} = 3,055,000x - 1,100,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 3,055,000 Kip
- Maximum labor/Active labor (x) = 0.62 ha.
- Fixed Capital Consumption = 1100,000 Kip/year
- 1 Active labor can cultivate maximum 0.62 ha which can make value about 1,212,000 K
- Need to cultivate at least about 0.38 ha to cover the fixed capital consumption cost.

3. Dry season rice model by using buffalo.

$$Y_{\text{dry season (buffalo)}} = 2,638,000x - 100,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 2,638,000 Kip
- Maximum labor/Active labor (x) = 0.56 ha.
- Fixed Capital Consumption = 100,000 Kip/year
- 1 Active labor can cultivate maximum 0.56 ha which can make value about 1,421,000 Kip
- Need to cultivate at least about 0.04 ha to cover the fixed capital.

4. Dry season rice model by using tractor

$$Y_{\text{dry season (tractor)}} = 2,687,000x - 1,100,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 2,687,000 Kip
- Maximum labor/Active labor (x) = 0.56 ha.
- Fixed Capital Consumption = 1,100,000 Kip/year
- 1 Active labor can cultivate maximum 0.56 ha which can make value about 887,000 Kip
- Need to cultivate at least about 0.42 ha to cover the fixed capital.

1.6.3. Lemon operation

Lemon is fruit tree that well grown in Pakou especially along river bank, normally the tree starts to give fruit in the 2nd year after planting and end of the production is 9th

*** Technical processes**

1. Seedling preparation

Farmers are familiar with crafting techniques, first they select lemon branches that has center about 1 cm, then peel off the peel round the branch about 2.5 wide, clean and cover with soil mixed with coconut cover and the last step is to cover again well with plastic bag. Seedling by seed is not well used because of it take longer to give fruit. It takes about 7 WD/ha (625 seedling)

2. Planting

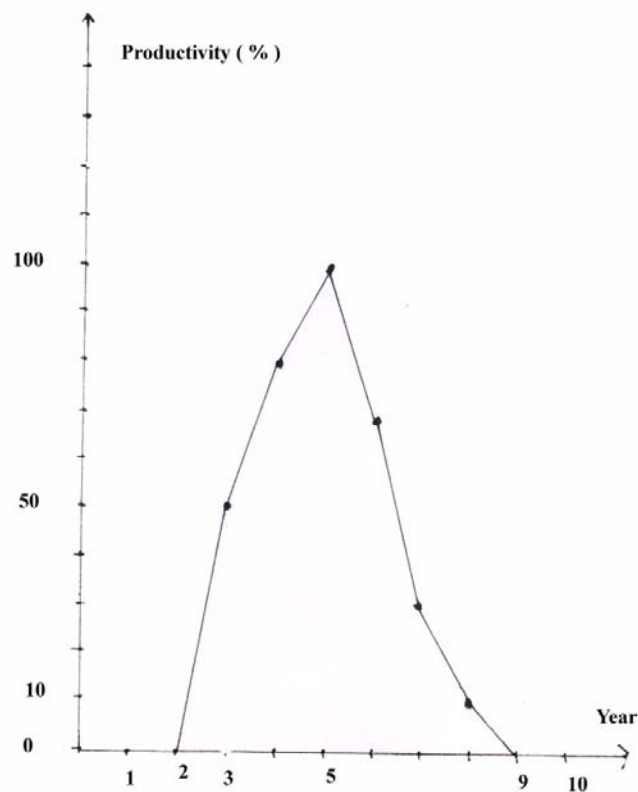
After seedlings have 1 years old or after seedling have dark root (dark yellow or brown) than farmers will cut the seedling from the tree and plant in to field. Farmers usually plant 4x4 m, 30 cm deep in the hole 15x15 size. After planting farmers water the seedling well. It takes about 30 WD/ha for field preparation and planting.

3. Taking care

Weeding is be done 1/month in rainy season and about 2-3 times in dry season. It take about 40 WD to weed in one ha per time. Farmers d not cut lemon branches because those branches will be seedling and they believe that cutting branches will reduce productivity. Average it takes about 300 WD for weeding/year

4. Harvesting

Lemon gives most of the fruits in June to September and give flower all year long. After the trees have about 3 years they start to give fruits, highest yield will be in the 5th year and stop giving fruit in the 9th year. Total products are about 26 T/ha/life cycle. Harvesting is normally done by middle men .



Picture.10. Product of lemon in a cycle

5. Maximum area/active labor

- * Total labor need of rainy season rice cultivation is about 300 working days
- Highest labor need/month is weeding
- Farmers work 28 days/month
- It needs about 35 working days to transplant rice in one hectare
- Maximum area/active labor = $28/35 = 0.8$ ha

* Economic evaluation

Productivity	3T
GP/ha	4,360,000
IC/ha	20,000
Fcc/act	50,000
AV/ha	4,290,000
Area/Act	0.8
WD	300
AV/WD	14,000 Kip

Y lemon = 4,340,000 x - 50,000

For this model we can see that:

- Added value not included Fixed Capital Consumption = 4,340,000 Kip
- Maximum labor/Active labor (x) = 0.8 ha.
- Fixed Capital Consumption = 50,000 Kip/year
- 1 Active labor can cultivate maximum 0.8 ha which can make value about 3,432,000 Kip/year
- Need to cultivate at least about 0.012 ha to cover the fixed capital.

2.7. Live stocks systems

Live stock rising is second priority for farmers, farmers raise animal mainly for their own consumption and to use for cultivating and to save as money. Cattle, pigs and chicken are the famous animals as well as goats and fish.

This system is un keep and half keep and half un keep system. Feed came from farm waste from cropping system such as rice bran and broken rice while concentrate feed is used very little. Vaccination is not regularly practice which reaches to high death rate.

2.7.1. Cattle

Cattle are the main source of labor for cropping operation, but raising cattle in the present is more difficult because of limited of natural pasture field and socio-economic factor (lost animal, cattle get in to rice field, etc). So far farmers do not make feed for cattle such as dry rice straw, straw silage..., Vaccination is done regularly 1/year.

Rainy season , farmers spend about 2 hours /day to feed 1 head, estimate 60 hours/season or $60/8 = 7.5$ working days. Maximum head/Act = $28/7.5 = 4$ heads

Dry season , farmers spend about 30 minutes/day to feed 1 head, estimate 60 hours/season or $15/8 = 2$ working days. Maximum head/Act = $28/2 = 14$ heads

*** Economic evaluation**

Table .24. Economic of raising cattle in Pakou.

	Cow	Buffalo
GP/mother	1,315,000	1,234,000
IC/mother	50,000	50,000
Fcc/year	0	0
AV/mother	1,265,000	1,184,000
Maximum head/Act	4 heads in rain season 14 heads in dry seasons	4 heads in rain season 14 heads in dry seasons
WD	57	57
AV/WD	22,000	20,000

1. Cow model

$$Y_{\text{cow}} = 1,265,000 x - 0$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 1,265,000 Kip
- Maximum head/Active labor (x) = 14 in dry season
4 in rainy season
- Fixed Capital Consumption = 0
- 1 Active labor can raise maximum 14 heads in dry season which can make value about 17,710,000 Kip/year
- 1 Active labor can raise maximum 4 heads in rainy season which can make value about 5,060,000 Kip/year

2. Buffalo model

$$Y_{\text{Buffalo}} = 1,184,000 x - 0$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 1,184,000 Kip
- Maximum head/Active labor (x) = 14 in dry season
4 in rainy season
- Fixed Capital Consumption = 0
- 1 Active labor can raise maximum 14 heads in dry season which can make value about 16,576,000 Kip/year
- 1 Active labor can raise maximum 4 heads in rainy season which can make value about 4,763,000 Kip/year

2.7.2. Pig rising.

* Technical processes

There are 2 systems: Keep and half keep system. Feed are from left over food from house hold and from their cropping system. Farmers used rice bran as the main feed and mixed with vegetable and some broken rice. Concentrate feed is used little to feed small pig at the beginning while vaccination is done not regularly.

Labor calculation is base on labor to feed one pig

Estimate labor for feeding 1 hour/day/head, or 30 hours/month

Labor need per month = $30/8=3.7$ WD

Maximum head/ active labor = $28/3.7 = 7$ heads

* **Economic evaluation**

Table .25. Economic of raising pig in Pakou.

GP	688,000
IC	318,000
Fcc	20,000
AV	350,000
Maximum heads/Act	7
WD/year	44
AV/WD	8,000

$Y \text{ Pig} = 370,000 \times 20,000$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 370,000 Kip
- Maximum head/Active labor (x) = 7
- Fixed Capital Consumption = 20,000
- 1 Active labor can raise maximum 7 heads which can make value about 2,450,000 Kip/year

1.7.2. Poultry raising

* **Technical processes**

Poultry rising is tradition for farmers, they like to raise chickens and ducks around where they live and work, that's why we can see these animal around their houses and rice fields. Farmers do not feed enough, they let the animal find food them selves and feed a little in the morning and evening, normally use broken rice as the major feed. At night, farmers keep them in the animal house to prevent from wild lives and people.

Estimate labor for feeding 10 mn/day/head, or 5 hours/month

Labor need per month = $5/8=0.62$ WD

Maximum head/ active labor = $28/0.62 = 45$ heads

* **Economic evaluation**

Table .17. Economic of raising chicken in Nambak.

	Chicken
GP	223,000
IC	100,000
Fcc	20,000
AV	113,000
Maximum heads/Act	45
WD/year	7
AV/WD	16,000

$Y \text{ Chicken} = 123,000 \times 20,000$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 123,000 Kip
- Maximum head/Active labor (x) = 45
- Fixed Capital Consumption = 20,000
- 1 Active labor can raise maximum 45 heads which can make value about 5,535,000 Kip/year

2.8. Farming system

Farming system is the combination of Land, Capital and Labor according to agro ecology and socio-economic conditions. Another word is the combination of cropping and lives stock system, and according to those two systems in Pakou we can identify many combinations as:

- Rainy season rice 1 ha + Dry season rice 0.5-1 ha + Lemon 0.5-0.8 ha + Teak tree 1-2 ha + Cattle 5-10 heads + Pig 5-8 heads + Poultry over 20-30 Pieces
- Rainy season rice 1 ha Lemon 0.2-0.6 ha + Cattle 2-5 heads + Pig 2-3 heads + Poultry over 10-20 Pieces
- Rainy season rice 0.5-1 ha + Up land cultivation 0.3-0.5 ha + Cattle 1-2 heads + Pig 1-2 heads + Poultry 10-20 pieces
- Up land cultivation 1-1.5 ha + Pig 1-2 heads + Poultry 5-10 pieces

Farm household are identified to 4 types according to cropping and lives stocks system which related to farm management and agriculture income

Table .20. Farm type in Pakou.

Type	Labor management	Capital and tools	Cropping	Live stock	Rate
1	- Family - Exchange - Hired	Have more capital	Rain fed - Irrigated rice. teak tree & lemon	Cattle 3-5 pig 2-6 poultry 20-30	9 %
2	- Family - Exchange - Hired	Enough capital	- Rain fed rice - up land rice	Cattle 2-3 Pig 2 and poultry 5-10	27 %
3	- Family - Exchange - selling labor	Less capital	- Up land rice	Cattle 1 - 2 , Poultry 3 - 5 and Pig 1 - 2	36 %
4	- Family - Exchange - Selling labor	No	Up land rice	Poultry 3 - 5	28 %

Farm type 1:

Farmers who have about 0.7 ha/active labor, and can make added value about 7,000,000-9,000,000 Kip/year. They can cultivate on two season rice, lemon, bananas and teak tree. They have cattle 3-5 mothers, 2-5 pigs and more than 10 poultry. These farmers have more capital, they have other job beside agriculture such as trading, Rice milling, truck running and making Lao whiskey which money came from selling fruits, rice and cattle. These types of farmers have suitable land and capital but still lack of appropriated knowledge such as farm business and marketing.

Farm type 2:

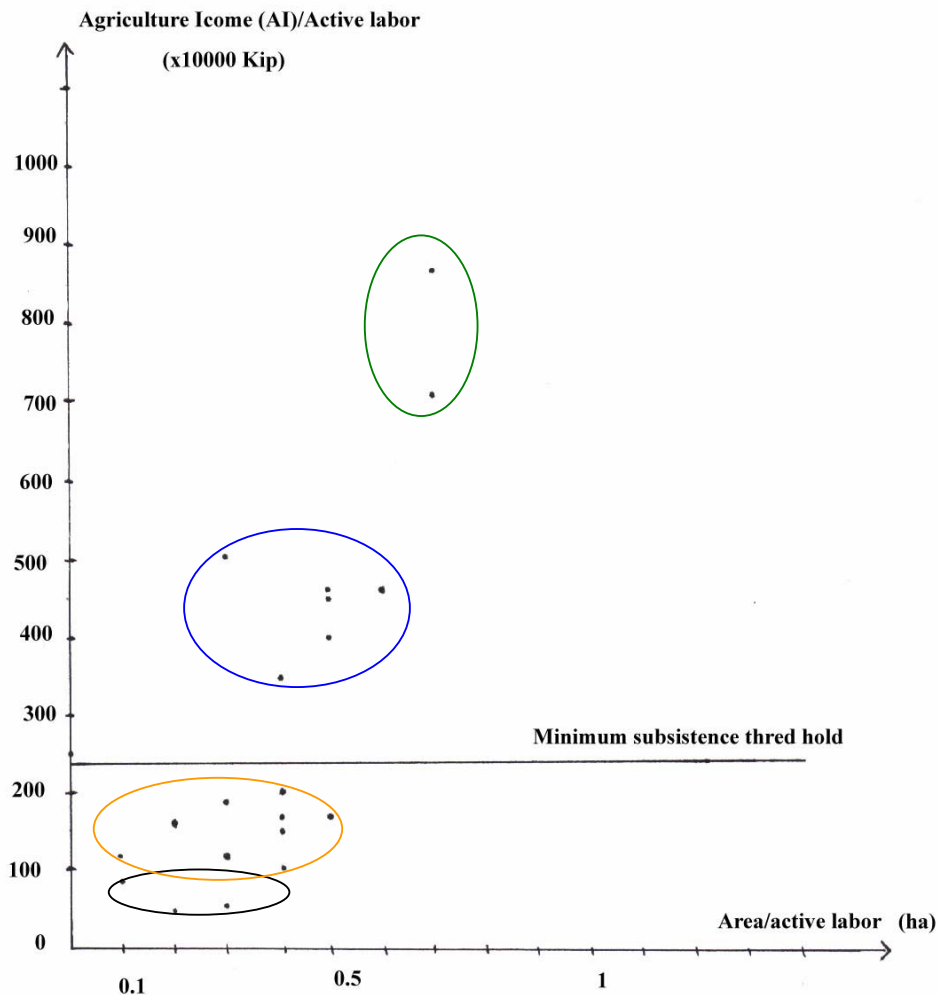
Farmers who have about 0.3-0.6 ha/active labor, and can make added value about 3,500,000 -5,100,000 Kip/year. Farm operations are the combination of rainy season rice cultivation and some of up land cultivation. They have cattle 2-3 mothers, 1-2 pigs and 5-10 poultry. Some house holds cultivate on fruit tree in the area of 0.1-0.2 ha/Act. Main activities for these farmers are rice cultivation, fruit tree and will cultivate on up land if they do not have enough for own consumption. They have problem about lack of capital and good land.

Farm type 3:

Farmers who have about 0.3-0.5 ha/active labor, and can make added value about 1,100,000 -1,900,000 Kip/year. Farm operations are up land cultivation. They have 3-5 poultry. Family labor is the main resource for their farm operation and also exchange labor with neighboring. In general they can not earn enough from their farm operation, they normally work in other job beside farming such as fishing, Non timber forestry products and selling labor. These farmers have problem of lack of capital and labor.

Farm type 4:

Farmers who have about 0.1-0.4 ha/active labor, and can make added value about 520,000 -1,000,000 Kip/year. The major farm operation is up land cultivation. They have 2-3 poultry. These farmers do not have enough labor to take care their crop and their live stock while they can not produce enough for their consumption need either. They work on other jobs more than work on rice field according to low value of up land cultivation and labor need for the cultivation. Non timber forestry products are the main food resource for these farmers.



Picture.7. Farming system model in Pakou

2.9. Problem analysis.

1. Lack of appropriated technical knowledge

- * Vaccination
- * Animal feed (Dry grass, Dry rice straw, silage, etc.)
- * Animal houses
- * Soil improvement (Organic fertilizers)

2. Lack of water

Water is limited factor that affected to production, especially rice operating while only small areas are irrigated. Irrigation system in upper rice field are depended on natural creek which is often dry in dry season.

3. Not well market management

Farmers are lack of marketing information such as market demand, prices, lack of transportation access, more over, no record of farm operation are done which bring to incorrect economic calculation . All this factors limited farm development

2.10. Recommendation

1. Provide appropriated technical knowledge

- * Organic fertilizers: Animal manure, bio-compost, green compost, compost and cover soil with legumes.
- * Mixed cropping system
- * Integrated Pest management
- * Crafting
- * Animal feed

To promote on keeping left over rice straw in the form of dry straw and silage, because there is problem of limited of land, making feed for cattle might solve that problem

- * Built more vaccinators and improve their capacity.

2. Improve marketing

- * Introduce how to evaluate farm operation
- * Ensure market supply and prices
- * Provide information on market demand and prices down to farm level regularly.

3. Micro- finance

To provide special loan to really insufficient farmers, building village fund (saving fund) that manage by village committee. The fund should be low interest and should have special policy for the one that too poor,

4. Research and Experimentation

- * Research on resistance crop in dry area
- * Research on drip irrigation and family irrigation
- * Sustainable occupation: Sustainable agriculture, handicraft...

5. Extend more extension service

This is to ensure that all farmers get enough help and access to recent information and technical knowledge.

6. Improve infrastructure

Mainly to improve irrigation and road

3. Nakhonepheng district, Saravanh province

3.1. Topography

Nakhonepheng is a district of Saravanh province which has the national road 13th South pass through from North to South. It shares border with:

- Northern with Savannakhet province
- Southern with Khongsedon district, Saravanh province
- Eastern with Vapy district, Saravanh province
- Western with Thailand

Average rainfall is about 1,430 mm/year

3.2. Socio-economic condition

Nakhonepheng is divided in to 3 zones, 92 villages. Total population is about 139,400 people. Main occupation is rice farmers which can cultivate only ion rainy season. Total area of the district is 139,000 ha which are about 9,027 ha agriculture land, 34,788 ha conservative forest, 687 ha consumption forest and other land types.

3.3. Production condition

Farmer plant rice mainly in rainy season with the area of rice fields about 8,600 ha. According to lack of water not many crop can be plant either especially in dry season except where farmer have fish ponds. Any way some crops can be grow during rainy season such as in the year 2003:

- Cotton = 50 ha
- Tobacco = 40 ha
- Corn = 175 ha
- Banana = 15 ha
- Cucumber = 25 ha
- Sweet potato = 37 ha
- Other crop = 68 ha

Chemical fertilizers are used commonly for both vegetable and rice for 2,627T/year 2003; also small tractors are very famous (703 small tractors)

Besides cropping, Animal husbandry are also main activity for farm operating:

- Buffalo = 11,980
- Cow = 15,540
- Pig = 11,510
- Goats = 550
- Poultry = 146,710

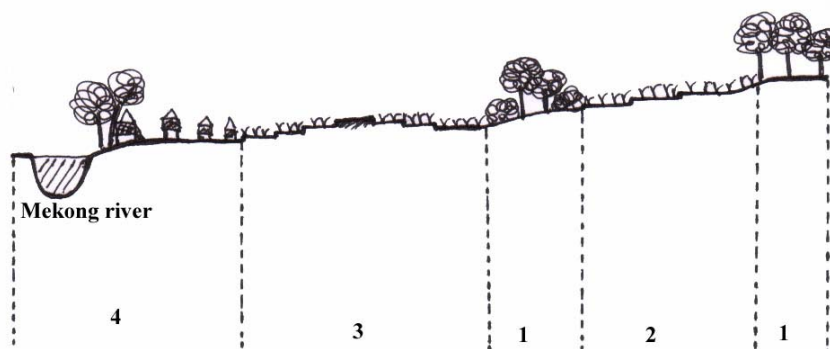
The district authorities have planned to build up irrigation system to ensure food security. Also to build up capacity of officers especially cropping, forestry and live stock specialist.

3.4. Production condition

- Many people are origin from Thailand who moved to Laos in 18th century, and they were rice farmers.
- After the independence of the country in 1975, people moved back to their home town according to direction and Lao government of organizing authority system. People came back to their land and developed the land for farm operating mainly for growing rice in the traditional way.

- Since the year 1990 Farmers have changed some tradition techniques such as using improved variety, using chemical fertilizers, using small tractors and modern tools instead of using animal for farm operating. For animal husbandry, vaccination was introduced by the district level.
- 1995, Agriculture promotion bank promote on using chemical fertilizers by providing cheap fertilizers to farmers.
- Since 1990 animal herd have been reduced according to less natural pasture fields and limited of property land. Before one household might own more than 5 ha of land but in the present one house hold owns not more than 5 ha.

3.5. Agro-ecology conditions



Picture.8. Transect of Nakhonepheng district, Saravanh province.

Remark: This transect are identified according to diversity of ecosystem in 4 villages: Taphankang, Hongsaithong, Nakhone pheng yai and Nakhonesi Tai

Zone 1: Low land

The forest is mixed with various big trees and bushes, Forest is the resource to provide wood fuel, equipments and food for farmers, unfortunately that those resources have been reduced and not rich like before according to the time of war, slash and burn cultivation and poor forest management in the past. Now the forest is conserved and managed by village authority and people. This area is also used for animal husbandry and cemetery

Zone 2: Upper Low land rice field

This rice fields are located in upper flat land which far away from roads and residence. Soil is sand and sandy- loam with very low moisture content and soil nutrition. Rice yield is very low according to lack of fertilizers and water. This area can be cultivated in only rainy season, and use for animal husbandry in dry season.

Zone 3: Lower Low land rice field

This is flat area which located in lower part, farmers developed the land to rice fields and been used for hundred years, Soil is loamy sand and sandy loam with quite low nutrition. This area also can be cultivated in only rainy season because of no irrigation system. Some area that access to water (fish ponds) can grow some vegetable. This area use for animal husbandry in dry season.

Zone 4: Village area

This is upper land, close to road and river, farmers use for living, storage their products, home garden, animal husbandry (Poultry and pig) keeping cattle and grow fruit trees. Animal manure are washed by the rain to lower low land rice field which can improved the soil nutrition.

3.6. Cropping system

3.6.1. low land rice cultivation

Rice cultivation can be practice in only rainy season according to lack of irrigation, even in rainy season, water supplying is the major problem. Unfortunately that most of the soil has high percent of sand which is not good for cropping. Framers use chemical fertilizers as the main key to improve rice production while cattle are became less according to limited of property land which reduce organic source of improving soil nutrition.

Since 2000 tradition variety are disappear while improve variety are in place according to higher yield and market demand, most of the variety are 120 days old.

*** Technical processing.**

Table .5. Labor calendar for lowland rice cultivation in Nambak

Activity	1	2	3	4	5	6	7	8	9	10	11	12
Seedling						4-10						
Plug&plow1						4-15						
Plug&plow2							6-20					
Transplanting							45-50					
Taking care									30-35			
Harvesting											45-55	

Total labor need is about 134-185 WD/ha

1. Seedling preparation

This process start with seed bed preparation, farmers make seed bed by pwrking on the soil well and fill with water about 3-5 cm from the soil surface. The seed are prepared by soaking in water for 2 days and ferment in 3 days after that spread seed in the prepared seed bed. It takes about 4- 10 WD/ha

2. Soil preparation

There are 2 times of soil preparation, the first time is to break to soil up side down then after 20-30 days, re break the soil well again with lots of water then flat the soil. It takes about 30 WD/ha by using buffalo and about 15 WD/ha by using small tractor.

3. Transplanting

Normally farmers transplant when they have enough water in their rice fields. They plant about 20-30 from hole to hole and 2-3 cm deep while there are about 3-5 seedling per hole. It takes about 35 WD/ha

4. Taking care

This process is included fertilizing, water management, weeding and pest control. Farmer use about 100-200 Kg of chemical fertilizers per hectare while chemical pesticide not regularly used. Weeding is not the big problem unless that farmers can not cover the field surface with water. It takes about 30-35 WD/ha.

5. Harvesting

When the rice grain is right enough by observing the color and rice shell, normally start to harvest in November. After harvesting, farmers dry the grain in about 1-2 days then they normally thresh all in the same time by using big thresher or small home thresher. Farmers use hand tractor to carry rice from rice field to their rice storage. It takes about 45-55 WD/ha.

6. Maximum area/active labor

* Total labor need of rainy season rice cultivation is about 124-185 working days

- Highest labor need/month is transplanting

- Farmers work 28 days/month

- It needs about 50 working days to transplant rice in one hectare

→ Maximum area/active labor = $28/50 = 0.56$ ha

*** Economic evaluation.**

Table .7. Rice economic in Nakhonepheng.

	Rainy season	
	Buffalo	Tractor
Productivity	2 T	2 T
GP/ha	2,400,000	2,400,000
IC/ha	632,000	850,000
Fcc/year	86,000	1,080,000
AV/ha	1,682,000	470,000
Area/Act	0.56 ha	0.56 ha
WD	164	140
AV/WD	10,000	3,000

1. Rain season rice model by using buffalo.

$$\text{Y rain season (Buffalo)} = 1,768,000 \times - 86,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 1,768,000 Kip
- Maximum labor/Active labor (x) = 0.56 ha.
- Fixed Capital Consumption = 86,000 Kip/year
- 1 Active labor can cultivate maximum 0.56 ha which can make value about 934,000 K
- Need to cultivate at least about 0.06 ha to cover the fixed capital.

2. Rain season rice model by using small tractor

$$\text{Y rain season (small tractor)} = 1,550,000 \times - 1,080,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 1,550,000 Kip
- Maximum labor/Active labor (x) = 0.56 ha.
- Fixed Capital Consumption = 1,080,000 Kip/year
- 1 Active labor can cultivate maximum 0.56 ha which can make value about 263,000 K
- Need to cultivate at least about 0.7 ha to cover the fixed capital.

3.7. Live stock system

3.7.1. Cattle rising

Cow and buffalo are the famous animals, farmers half keep and half free their animal. In rainy season farmers tie their animal to prevent their rice field and in dry season farmers untie their animal and free them in to rice fields but any way in both season farmers normally bring their animal home in the night time.

So far farmers do not keep feed for their cattle, all feed are depended on natural pasture field and rice fields, vaccination is practiced regularly

Rainy season , farmers spend about 2 hours /day to feed 1 head, estimate 60 hours/season or $60/8 = 7.5$ working days. Maximum head/Act = $28/7.5 = 4$ heads

Dry season , farmers spend about 30 minutes/day to feed 1 head, estimate 60 hours/season or $15/8 = 2$ working days. Maximum head/Act = $28/2 = 14$ heads

* **Economic evaluation**

Table .16. Economic of raising cattle in Nakhonepheng.

	Cow	Buffalo
GP/mother	1,470,000	1,600,000
IC/mother	50,000	50,000
Fcc/year	0	0
AV/mother	1,420,000	1,550,000
Maximum head/Act	4 heads in rain season 14 heads in dry seasons	4 heads in rain season 14 heads in dry seasons
WD	57	57
AV/WD	24,000	27,000

1. Cow model

$$Y_{\text{cow}} = 1,420,000 \times - 0$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 1,420,000 Kip
- Maximum head/Active labor (x) = 14 in dry season
4 in rainy season
- Fixed Capital Consumption = 0
- 1 Active labor can raise maximum 14 heads in dry season which can make value about 19,880,000 Kip/year
- 1 Active labor can raise maximum 4 heads in rainy season which can make value about 5,680,000 Kip/year

2. Buffalo model

$$Y_{\text{Buffalo}} = 1,550,000 \times - 0$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 1,550,000 Kip
- Maximum head/Active labor (x) = 14 in dry season
4 in rainy season
- Fixed Capital Consumption = 0
- 1 Active labor can raise maximum 14 heads in dry season which can make value about 21,740,000 Kip/year
- 1 Active labor can raise maximum 4 heads in rainy season which can make value about 6,200,000 Kip/year

3.7.2. Poultry raising

* Technical processes

The operating is based on natural feed resource and house hold feed such as rice bran and broken rice. Farmers normally free them in the day time around houses and rice fields and keep them well in the night time. Death rate is high especially for chicks because of not taking care enough and no vaccination is done correctly and regularly. Most disease is appearing between the times of 2 seasons.

Estimate labor for feeding 10 mn/day/head, or 5 hours/month

Labor need per month = $5/8=0.62$ WD

Maximum head/ active labor = $28/0.62 = 45$ heads

* Economic evaluation

Table .17. Economic of raising chicken in Nakhonepheng.

	Chicken
GP	358,000
IC	146,000
Fcc	30,000
AV	182,000
Maximum heads/Act	45
WD/year	7
AV/WD	26,000

Y Chicken = 212,000 x - 30,000

For this model we can see that:

- Added value not included Fixed Capital Consumption = 212,000 Kip
- Maximum head/Active labor (x) = 45
- Fixed Capital Consumption = 30,000
- 1 Active labor can raise maximum 45 heads which can make value about 8,190,000 Kip/year

3.7.3. Pig raising

The system here are un free and half free system. Many farmers keep pigs in quite good pig house nearby their residences, Rice bran is the main feed for both small and big pig, beside rice bran, wild vegetables and left over food from house hold are also major feed while concentrate feed is used very little to fattening small pig and unhealthy pig. Most pigs are sold in the time of lack of rice bran (Rainy season). Vaccination is not yet regularly used especially for short term production.

Estimate labor for feeding 1 hour/day/head, or 30 hours/month

Labor need per month = $30/8=3.7$ WD

Maximum head/ active labor = $28/3.7 = 7$ heads

* **Economic evaluation**

Table .18. Economic of raising pig in Nakhonepheng.

GP	800,000
IC	439,000
Fcc/year	40,000
AV	321,000
Maximum heads/Act	7
WD/year	44
AV/WD	7,000

Y Pig	=	361,000 x -40,000
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For this model we can see that:

- Added value not included Fixed Capital Consumption = 3361,000 Kip
- Maximum head/Active labor (x) = 7
- Fixed Capital Consumption = 40,000
- 1 Active labor can raise maximum 7 which can make value about 2,247,000 Kip/year

1.8. Farming system

Farming system is the combination of Land, Capital and Labor according to agro ecology and socio-economic conditions. Another word is the combination of cropping and lives stock system, and according to those two system in Nakhonepheng we can identify many combinations as:

- Lower low land rice 2-4.5ha +Cattle 3-5+ Pig 3-4 +Poultry 20-30
- Upper low land rice 2-4.5ha +Cattle 1-3+ Pig 1-2 +Poultry 10-20
- Upper low land rice 0.6-1.5 ha +Poultry 5-10

Farm household are identified to 4 types according to cropping and lives stocks system which related to farm management and agriculture income

Table .20. Farm type in Nakhonepheng.

Type	Labor management	Capital and tools	Cropping	Live stock	Rate
1	- Family - Hired	More capital	Rain fed 0.7-1.5 ha/Act Vegetable garden	Cattle 3-5 Pig 3-4 and poultry 20-30	14%
2	- Family	Enough capital	- Upper rain fed rice 0.5-1.2 ha/Act	Cattle 1- 3 Pig 1-2 and poultry 10-20	50%
3	- Family - Selling labor	Less capital	- Upper Rain fed rice 0.2-0.8 ha/Act	Poultry 5-10	36%

Farm type 1:

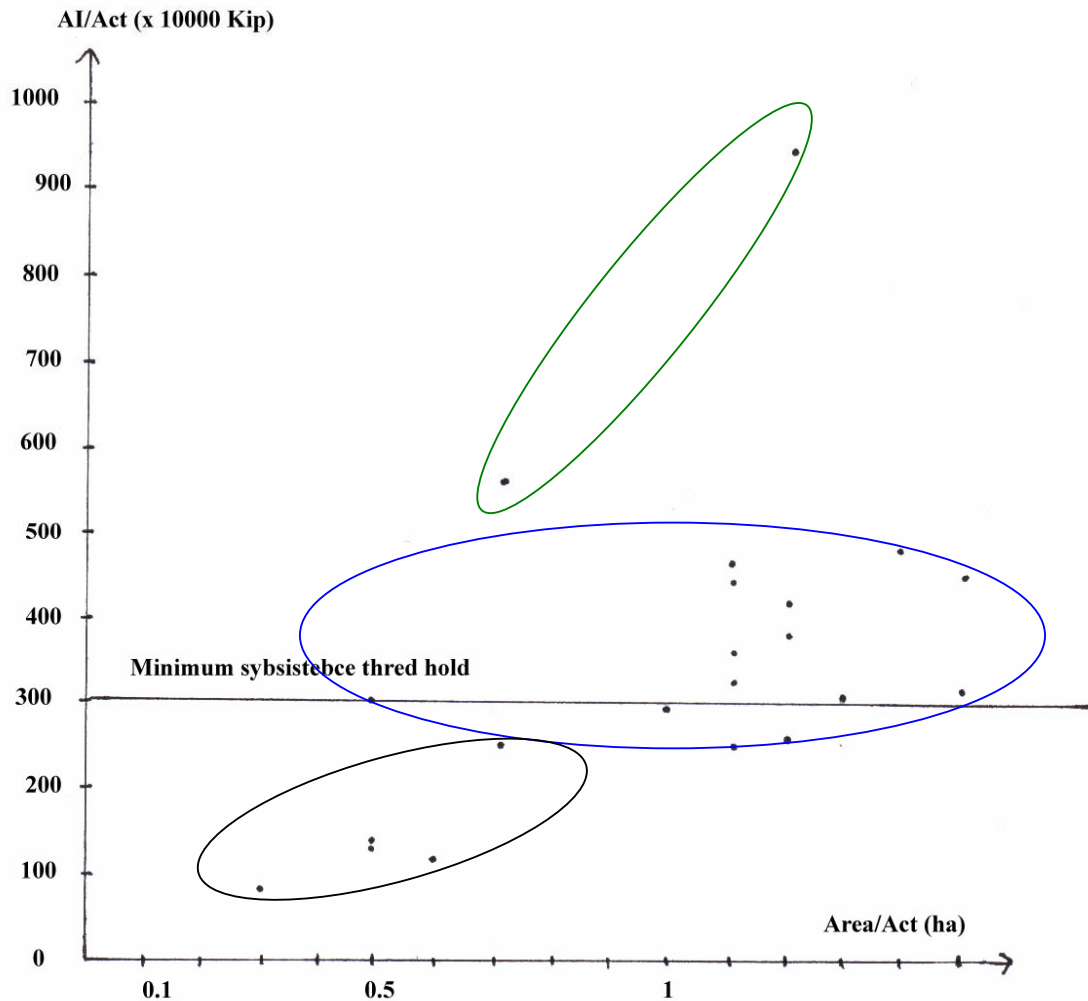
Farmers who have about 0.7-1.5 ha/active labor, and can make added value about 6,000,000-9,500,000 Kip/year. They can cultivate on rainy season rice and vegetable gardening. They have cattle 3-5 mothers, 3-4 pigs and more than 10 poultry. These farmers have more capital, they have tractor, rice thresher and rice miller which come from their farm operation: selling rice and castles. This type of farmers have land but lack of labor and water, they repair their houses, trading and relax during the dry season.

Farm type 2:

Farmers who have about 0.7-1.2 ha/active labor, and can make added value about 3,100,000-4,600,000 Kip/year. They can cultivate on rainy season rice in upper rice field, they have cattle 2-3 mothers, 1-3 pigs and 5-10 poultry. These farmers have limited capital, they can not provide enough fertilizers for their rice production. In dry season farmers usually do not operate their farm according to lack of water, they repair their houses and work in the town and Thailand

Farm type 3:

Farmers who have about 0.3-0.8 ha/active labor, and can make added value about 900,000-2,700,000 Kip/year. They can cultivate on rainy season rice in upper rice field, they have no cattle and pig, they have about 3-5 poultry. These farmers have limited capital, land and labor, they can not generate income enough to reach their consumption need that's why they use their time to sell their labor daily in the community, town and Thailand. Some house hold waste their land yearly because the active labor are in the town, many house hold rent land, buffalo for their farm operation and some get loan from their community in high interest.



Picture.9. Farming system model in Nakhonepheng

3.9. Problem analysis

1. Cropping

- Lack of water (there is no irrigation)
- Poor soil nutrient and structure (sandy soil)
- Lack of organic fertilizers use

2. Livestock

- Animal feed (Not good feed, do not feed enough and no feed storages)
- Animal vaccination is not practice regularly
- Animal breeding is not well practice

3. Marketing

- Not well price control for season product (Low price of vegetable in dry season, price go down when there is more supply)
- Not good infrastructure such as road
- Marketing is done by middle man mostly

4. Labor

Again according to low income from agriculture production, many farmers especially youth and active labor are moved to town to sell their labor mainly in to Thai land. The problem is many household are lack of labor to operate their farms, more over to take care their children and parent.

3.10. Recommendation

1. Cropping

- Improve soil structure and soil nutrient by using organic fertilizers such as animal manure, compost, bio-compost and green compost. More over to plan legumes is the key in both soil improving and animal feed.
- Provide water for cropping by digging ponds, small dam... or set up drip irrigation.
- For farmers who has good and suitable land should plant more crop during dry season

2. Live stock

- Storage animal feed mainly for cattle such as dry feed and silage for example rice straw and grass
- Develop pasture field for cattle
- Vaccine regularly especially poultry
- Improve animal breeding by select good varieties.

3. Other

Infrastructure such as irrigation and road should develop while product price controls should be considered as the major key to rise up farm capacity and to secure farmer income. To provide knowledge on farm economic is also importance to encourage farmers to improve their farm operation more sufficiency. Research institution should focus mainly on cheap drip irrigation, organic fertilizers and resistance cash crop to give farmers more choices.

4. Phonthong district, Champasak province

4.1. Topography

Phonthong district is locate in Southern of Champasak province which has borders with

- 72 km with Thailand in North and West
- 50 km with Saysomboune district and Pakse district, Champasak province in East
- 36 km with Champasak district, Champasak province in South

4.2. Socio-economic condition

Phonthong district is in the urban area which close to Thai border and Pakse district which is the city of Champasak province. This condition is the potential for marketing. The road to access to main market in Pakse and Thailand is good condition accept some villages near Mekong river such as Saman ,Koklumseng, Mourng, Sakmeungtai, Sakmeung nuer, etc that can only travel in

dry season. The district has about 82,250 people, female 41,300 people. Total area of the district is about 56,759 ha, forest 29,559 ha, agriculture land is about 56,759 ha and the less is used by various purposes.

4.3. Production condition

House hold farming is the main occupation in the district while irrigation system is very limited. Farmers operate on rainy season rice mainly with average productivity of 3.4 T/ha and dry season rice only 66 ha with productivity of 4.3 T. Total low land rice fields is about 24,638 ha and beside that other crops such as long bean, cucumber, corn, root crop are cover about 550 ha

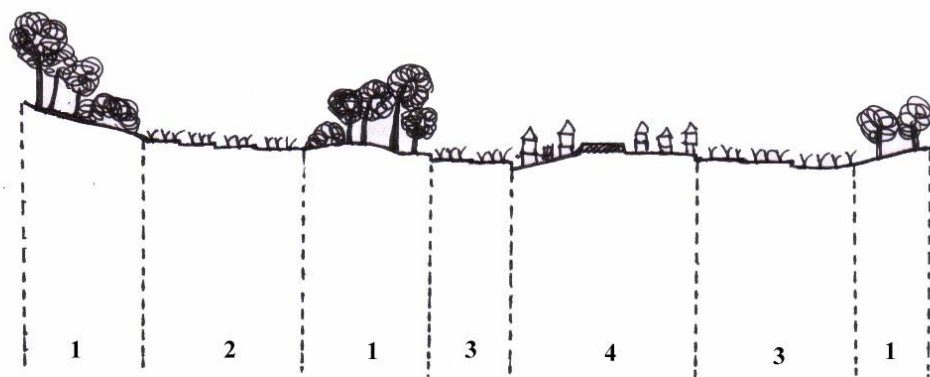
Live stock is second priority, total number of livestock in the district are: Cow=20,700, buffalo=22,400, pigs=11,000, horse=30, goat=380 and poultry = 980,000

The district authority planed to extend rice field 600 ha in the year 2010 and increase ice productivity, together to promote on commodity crops and live stock operations such as pig and poultry.

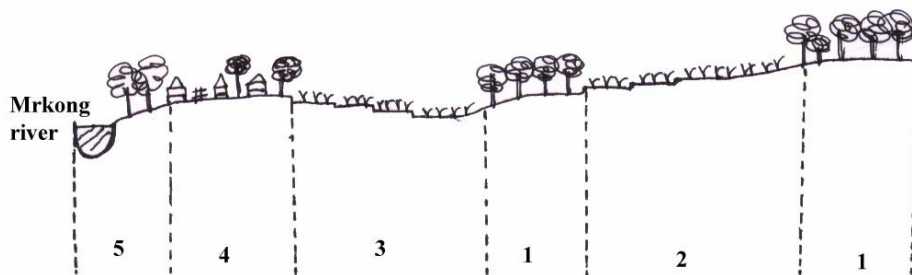
4.4. Production history

- There were only about 20 families back to 50 years ago, people also operate on rice production mainly and have many cattle because that time the forest is very rich and pasture fields are not limited.
- Land relocation and forest conservation was organized since 1975, people also moved back to their home town which made higher demand for land, people who wanted to own land had to buy or exchange. Again Land relocation to manage by the village committee is done since 2000, the land management and forest conservation now are manage by villagers through village authority.
- Forest was destroy a lot during the year 1970-1980 because of home construction and rice field developing
- Since 1990 cattle herd was reduced according to increasing of crop operation and limited of natural pasture fields
- Farers sold many cattle to buy hand tractors since 1995 and very common since 2002

4.4. Agro-ecology condition in Phonthong



Picture.10. Transect 1, Phonthong district
(Not access to Mekong River but located along the main road)



Picture.11. Transect 2, Phonthong district
(Not access to main road but located along the Mekong River)

Remark: This transect are identified according to diversity of ecosystem in 4 villages: Koklumseng, Saman, Lak 8 and Lak 12.

Zone.1. Forest

The forest is conserved and managed by the village committee, the area is used for cattle husbandry mainly in rainy season, used as cemetery and tempo. The soil is sandy or sandy loam, plants that grow in this area are trees such as Mai sard, Mai Phoa, bamboos and others. In general the forest is not really wealthy, big trees were gone during the time of logging and home construction.

Zone.2. Upper low land rice field

This rice fields are located in upper part of the area compare to main road, the soil is sand and loamy sand with low nutrient and moisture. Because of that farmers used a lot chemical fertilizers to increase rice productivity. This area is used to keep cattle during the dry season, which can improve the soil structure and nutrient but unfortunately that cattle are reduced while small tractors are instead.

Zone.3. Lower low land rice field

This rice fields are located in lower part compare to main road, soil is sandy loam and loamy sand with quite good soil nutrient and moisture. This area is used for rice operating mainly in rainy season and can grow vegetable in dry season only for the area that nearby Mekong River or access to irrigation. Soil improvement is done by freeing cattle during dry season, nutrient erosion from upper area and rice straw digestibility. This area has potential to operate on cash crop if the irrigation system is ensured as well as marketing.

Zone.4. Residence

This area is located along the road or Mekong River, people used this area mainly for living, trading, storage their products, animal husbandry (Chicken, ducks, pigs), keep cattle and home garden. The soil is sandy loam or loamy sand with quite good soil nutrient.

4.6. Cropping system

4.6.1. Low land rice cultivation

Rice cultivation is the main activity for income generation of farmers but can cultivate only in rainy season according to lack irrigation. Only 270 households that can cultivate on dry season rice. Rice cultivation now use improved variety, chemical fertilizers well as small tractor and rice thresher. Average there are about 200-800 kg/ha of chemical fertilizers used annually. Productivity of rainy season rice is about 2.4 T/ha while dry season rice is about 4 T (Average from 24 samples)

*** Technical processes**

Table. 34. Low land rice cultivation calendar, Phonthong district.

Activity	1	2	3	4	5	6	7	8	9	10	11	12
Seedling	5-10					3-10 ————						
Plug&plow1						6-14 ————						
Plug&plow 2		14-25					8-15 ————					
Transplanting		45-50					40-45 ————					
Taking care			30-35				25-30 ————				
Harvesting				50-55						45-50 ————	

Remark: Rainy season rice = —————
 Dry season rice =

Total labor need for rainy season rice is 127-164 WD/ha

Total labor need for dry season rice is 144 - 175 WD/ha

1. Seeding + Seed bed preparation

Soak seed in water for 2 days and ferment for 3 days, after the seed germination, spread seed on the seed bed that fine prepared with water 2-3 cm height. This process takes about 4-10 WD depending on seed bed preparation. Farmers start to seed in May for rainy season and in January for dry season, normally farmers use 120 days old varieties.

2. Soil preparation

Soil preparation for rainy season rice starts at the beginning of rainy season, after turn over the soil one time then stay the soil in water about 20-30 days then turn the soil 1 time and break the soil 2 more time, finally flat the soil once before transplanting. Average it takes about 14-30 WD/ha for rainy season. Dry season rice's soil preparation start with flow the field with water at the beginning of January then turn the soil at the end of January, after that break the soil well then flat the field before transplanting, it takes about 14-25 WD/ha.

3. Transplanting.

Distance between hole to hole is 20-30 cm, 2-3 cm deep and 3-5 seedlings per hole. Transplanting is done by hand and takes a lot of work, it always play the most importance role of the process because you have to transplant it fast and good. Normally farmers exchange and hire labor to help with this step, it takes about 40-45 working days/ha for rainy season rice and about 45-55 WD/ha for dry season rice.

4. Taking care

This process includes water management, fertilizing, weeding and pest control. Any way all this steps in this process are not done regularly especially pest control and weeding. Water management is done daily and weeding is done where ever needed (Weed will grow more if the field is not cover with water). Average it takes about 25-30 WD/ ha for rainy season rice and about 30-35 WD/ha for dry season rice.

5. Harvesting.

After rice is mutual enough then it is time to harvesting, normally farmers decided to harvest by observing the grain, if the grain get yellow and hard means it time to harvest and some farmers are depend on regular time of harvesting. Rice harvest is done by hand only and threshes by machine. It takes about 45-55 WD/ha. The process is includes rice harvesting, threshing and carry to storage.

6. Maximum area/active labor

* Total labor need of rainy season rice cultivation is about 127-164 working days

- Highest labor need/month is transplanting

- Farmers work 28 days/month

- It needs about 45 working days to transplant rice in one hectare

→ Maximum area/active labor = $28/45 = 0.62$ ha

* Total labor need of dry season rice cultivation is about 144-175 working days

- Highest labor need/month is transplanting

- Farmers work 28 days/month

- It needs about 45 working days to transplant rice in one hectare

→ Maximum area/active labor = $28/50 = 0.56$ ha

* Economic evaluation.

Table .35. Rice economic in Phonthong

	Rainy season		Dry season	
	Buffalo	Tractor	Buffalo	Tractor
Productivity	2.4 T	2.4 T	4 T	4 T
GP/ha	2,880,000	2,880,000	4,800,000	4,800,000
IC/ha	380,000	580,000	1,000,000	1,294,000
Fcc/year	93,000	1,050,000	93,000	1,050,000
AV/ha	2,407,000	1,250,000	3,797,000	2,456,000
Area/Act	0.62 ha	0.62 ha	0.56 ha	0.56 ha
WD	146	132	170	138
AV/WD	17,000	10,000	13,000	6,000

1. Rain season rice model by using buffalo.

$$\text{Y rain season (Buffalo)} = 2,500,000 \times - 93,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 2,500,000 Kip
- Maximum labor/Active labor (x) = 0.62 ha.
- Fixed Capital Consumption = 93,000 Kip/year
- 1 Active labor can cultivate maximum 0.62 ha which can make value about 1,492,000 K
- Need to cultivate at least about 0.04 ha to cover the fixed capital consumption cost.

2. Rain season rice model by using small tractor

$$\text{Y rain season (small tractor)} = 2,300,000 \times - 1,050,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 2,300,000 Kip
- Maximum labor/Active labor (x) = 0.62 ha.
- Fixed Capital Consumption = 1,050,000 Kip/year
- 1 Active labor can cultivate maximum 0.62 ha which can make value about 700,000 K
- Need to cultivate at least about 0.45 ha to cover the fixed capital.

3. Dry season rice model by using buffalo.

$$\text{Y dry season (buffalo)} = 3,800,000 \times - 93,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 3,800,000 Kip
- Maximum labor/Active labor (x) = 0.56 ha.
- Fixed Capital Consumption = 93,000 Kip/year
- 1 Active labor can cultivate maximum 0.56 ha which can make value about 2,075,000 Kip
- Need to cultivate at least about 0.03 ha to cover the fixed capital.

4. Dry season rice model by using tractor

$$\text{Y dry season (tractor)} = 3,500,000 \times - 1,050,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 3,500,000 Kip
- Maximum labor/Active labor (x) = 0.56 ha.
- Fixed Capital Consumption = 1,050,000 Kip/year
- 1 Active labor can cultivate maximum 0.56 ha which can make value about 1,375,000 Kip
- Need to cultivate at least about 0.3 ha to cover the fixed capital.

4.7. Live stock system

4.7.1. Cattle

Cattle raising especially cow and buffalo are half free system, farmers free their animal in dry season on their rice fields and tie their animal in rainy season in forest, bush and around rice field. In the evening farmers always keep their animal near their house. Cattle raising has problem about lack of land in rainy season while feed storage is not practice. Vaccination is done regularly once a year.

Rainy season , farmers spend about 2 hours /day to feed 1 head, estimate 60 hours/season or $60/8 = 7.5$ working days. Maximum head/Act = $28/7.5 = 4$ heads

Dry season , farmers spend about 30 minutes/day to feed 1 head, estimate 60 hours/season or $15/8 = 2$ working days. Maximum head/Act = $28/2 = 14$ heads

* Economic evaluation

Table .36. Economic of raising cattle in Phonthong.

	Cow	Buffalo
GP/mother	1,500,000	1,750,000
IC/mother	50,000	50,000
Fcc/year	0	0
AV/mother	1,450,000	1,700,000
Maximum head/Act	4 heads in rain season 14 heads in dry seasons	4 heads in rain season 14 heads in dry seasons
WD	57	57
AV/WD	25,000	29,000

1. Cow model

$$Y_{\text{cow}} = 1,450,000x - 0$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 1,450,000 Kip
- Maximum head/Active labor (x) = 14 in dry season
4 in rainy season
- Fixed Capital Consumption = 0
- 1 Active labor can raise maximum 14 heads in dry season which can make value about 20,300,000 Kip/year
- 1 Active labor can raise maximum 4 heads in rainy season which can make value about 5,800,000 Kip/year

2. Buffalo model

$$Y_{\text{Buffalo}} = 1,700,000 x - 0$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 1,700,000 Kip
- Maximum head/Active labor (x) = 14 in dry season
4 in rainy season
- Fixed Capital Consumption = 0
- 1 Active labor can raise maximum 14 heads in dry season which can make value about 23,800,000 Kip/year
- 1 Active labor can raise maximum 4 heads in rainy season which can make value about 6,800,000 Kip/year

4.7.2. Pig rising.

* Technical processes

Pig raising is the activity mainly for after rice harvesting because most of the feed is come from rice production such as rice bran , broken rice and rice husk, farmers who has rice mill will have more potential to raise more pigs and can raise all year long. Farmers commonly raise mixed variety pig which is the combination between improves and traditional variety, Vaccination is known but not well practice. Pig raising here is un free system.

Estimate labor for feeding 1 hour/day/head, or 30 hours/month

Labor need per month = $30/8=3.7$ WD

Maximum head/ active labor = $28/3.7 = 7$ heads

* Economic evaluation

Table .37. Economic of raising pig in Phonthong.

GP	700,000
IC	338,000
Fcc	40,000
AV	322,000
Maximum heads/Act	7
WD/year	44
AV/WD	7,000

$$Y_{\text{Pig}} = 362,000 x - 40,000$$

For this model we can see that:

- Added value not included Fixed Capital Consumption = 362,000 Kip
- Maximum head/Active labor (x) = 7
- Fixed Capital Consumption = 40,000
- 1 Active labor can raise maximum 7 which can make value about 2,254,000 Kip/year

4.7.3. Poultry raising

* Technical processes

Poultry are the main protein source for farmers, the system is free system which only be kept during the night time. Normally farmers free their animal around their houses and rice fields. Feeding is done daily twice a day in the morning and evening with very little feed of broken rice 200-500 g/herd/time and rice bran 500-1000 g/herd/time Vaccination is not well practice while nursery is not well practice either.

Estimate labor for feeding 10 mn/day/head, or 5 hours/month

Labor need per month = $5/8=0.62$ WD

Maximum head/ active labor = $28/0.62 = 45$ heads

* Economic evaluation

Table .38. Economic of raising chicken in Phonthong.

	Chicken
GP	402,000
IC	204,000
Fcc	20,000
AV	178,000
Maximum heads/Act	45
WD/year	7
AV/WD	25,000

Y Chicken = 198,000 x - 30,000

For this model we can see that:

- Added value not included Fixed Capital Consumption = 198,000 Kip
- Maximum head/Active labor (x) = 45
- Fixed Capital Consumption = 30,000
- 1 Active labor can raise maximum 45 heads which can make value about 8,910,000 Kip/year

4.8. Farming system

Farming system is the combination of Land, Capital and Labor according to agro ecology and socio-economic conditions. Another word is the combination of cropping and lives stock system, and according to those two systems in Phonthong district we can identify many combinations as:

- Rainy season rice 3-6 ha + dry season rice 0.5-1 ha + garden 0.1-0.2 ha + Cattle 8-10 + Pig5-8 + Poultry over 10
- Rainy season rice 2-3ha+Dry season rice 0.2-0.4 ha +Cattle2-5+Pig 2-3+Poultry10- 20
- Rainy season rice 1-1.5 ha + Cattle 2-5+ Pig 2-3 + Poultry 10-20
- Rainy season rice 1-1.5 ha + Poultry 5-10

Table .39. Farm type in Phonthong district.

Type	Labor management	Capital and tools	Cropping	Live stock	Rate
1	- Family - Hired	Have more capital	Rain fed - Irrigated rice in lower field and garden	Cattle 3-5 Pig 3-4 and poultry over 10 pieces	17 %
2	- Family	Enough capital	- Rain fed rice in upper field	Cattle 2-3 Pig 2 and poultry 10-20	61%
3	- Family - Selling labor	Less capital - Rent land - Get loan	- Rain fed rice	Poultry 3 - 5	22%

Farm type 1:

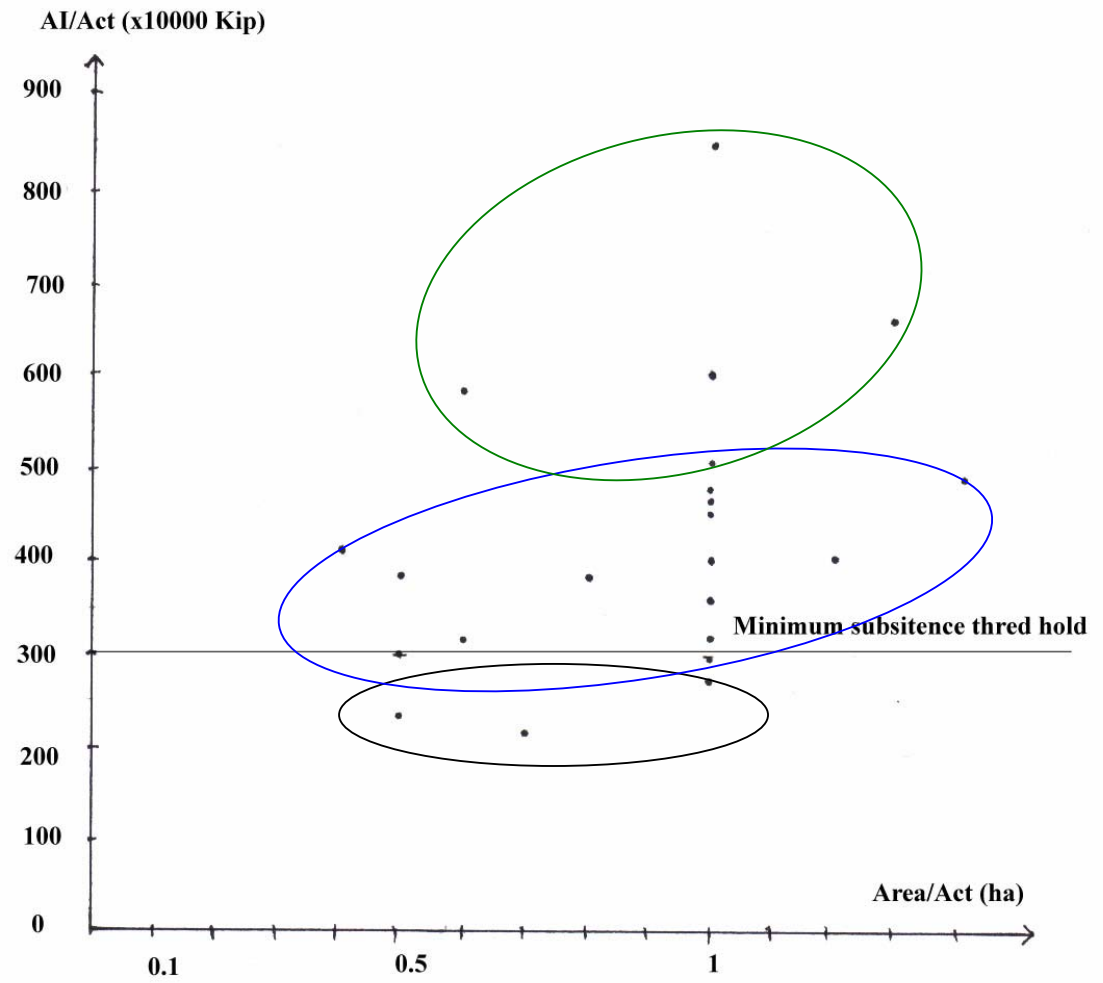
Farmers who have about 1-1.8 ha/active labor, and can make added value about 6,000,000-8,500,000 Kip/year. They can cultivate low land rice with the area of 1-1.5 ha/Act and gardening in the area of 0.1 ha/Act. They have cattle 5-8 mothers, 3-6 pigs and more than 10 poultry. These farmers have more capital, they have tractor, rice thresher and rice miller which come from their farm operation: selling rice and castles. These farmers have land and their land is quite good land but their labor are limited, they can not cultivate in dry season because irrigation is not yet setting up. Besides farm operating, trading is one of the main activities.

Farm type 2:

Farmers who have about 0.4-1.2 ha/active labor, and can make added value about 3,000,000-4,700,000 Kip/year. They can cultivate on rainy season rice in upper rice field with the area 0.4-1.2 ha/Act, they have cattle 2-4 mothers, 2-3 pigs and 5-10 poultry. These farmers have limited capital, they can not provide enough fertilizers for their rice production which bring to low income from agriculture. These are sensitive for any changes of their farm income according to lack of capital. They weave, selling labor, fishing and trading besides farm operating especially during dry season.

Farm type 3:

Farmers who have about 0.4-1 ha/active labor, and can make added value about 2,200,000-2,800,000 Kip/year. They can cultivate on rainy season rice in upper rice field with the area of 0.4-1 ha/Act, some of them have no land but they rent neighbor land, some get loan from individual trader, they have no cattle and pig, they have about 3-5 poultry. These farmers have limited capital, land and labor, they can not generate income enough to reach their consumption need, and they spend most of their time to sell their labor daily in the community, town and Thailand. The result is they can not look after their farm operation which brings to low out put and low income from agriculture.



icture.12.

Farming system model in Phonthong

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4.9. Problem analysis.

1. Cropping

- Not good soil (low nutrient and high sand content)
- Not good soil improvement such as using mainly chemical fertilizers while organic fertilizers are not used commonly. Soil improvement is depend on only chemical fertilizers, burning rice straw and annual manure from cattle in dry season but unfortunately that cattle hers has been reduced according to small tractor, limited of land and natural pasture field
- Not enough water accesses

2. Livestock husbandry

- Lack of technical knowledge on animal fed storage especially for cattle, according to lack of pasture field in the rainy season
- Animal feed does not have enough nutrition, more over farmers do not feed enough especially poultry and pig
- Vaccination and diseases control are not practice regularly and corrected especially poultry.

3. Infrastructure

Can not supply water enough for farm demand especially in dry season, more over road to access to main market in some area are still not good, can travel only in dry season.

4. Lack of Active Labor

Again as the above description, many active labors gave up their farm operation and become workers in the town and Thailand, the problem now that many house hold do not have enough labor take care their family and their farm operation and the worst is that some house hold sold their land and their cattle, and they live depend on only income from their works in town.

4.10. Recommendation

1. Cropping

- Improve soil structure and soil nutrient by using organic fertilizers such as making compost from rice straw instead of only burning it. Making bio-compost, collect animal manure such as pig, poultry and cattle manure and carry in to rice field, etc.
- Fruit tree such as dragon fruit is paying a great potential but good irrigation must be considered
- Study on possibility to set up drip irrigation or water plum to some area that access to water sources.

2. Live stock

- Storage cattle feed such as rice straw, make it in to dry feed or silage, more over should improve natural pasture fields by growing grass and legumes.
- Should feed pig and poultry good food and enough to ensure fast growing because more time that farmers take before consuming is more in-put of their farm operation which brings to low profit.
- Extend vaccination nets by training more village extension workers, should try to convince farmers to pay more attention on vaccination to ensure low death rate.

3. Improve infrastructures

- Build more irrigation and study on house hold irrigations (small scale) and drip irrigation.
- Improve main road to ensure that every villages can access to main markets.

4. Farm economic analysis

Farm economic analysis especially economic calculations will help farmers to know how much they gained from their farm operations and to understand their problems as well as to find out solutions. The result that came out also to help farmers to make decision on changing or improving their farm operation.

Criticism

After study of the farm economic in 4 districts of LEAP pilot area, I can evaluate some weakness, strength as well as potential:

1. Agro-ecology

Nambak district and Pakou district are limited of low land, but the soil is good for cropping (Low land fields), while Nakhonepheng district and Phonthong district are not limited of low land for cropping but the soil is low nutrient and content too much sand which is not really good condition for cropping. The entire districts have the same problem about providing enough water for their cropping especially in dry season.

2. Production history

In Nambak district and Pakou district, farmers used to cultivate in up land area and have big herd of cattle (over 10 pieces per house hold) mainly the for own consumption but during the war and after the independence of the country farmers cultivate not only for own consumption but also to sell to market, they cultivate on more cash crops such as Sesame, Job steer, orange, lemon as well as developed area for low land rice cultivation. Nakhonepheng district and Phonthong district in 50 years ago cultivate on low land rice mainly but in smaller area compare to present because in that time the soil was good, they raised more cattle because they can free in the forest, after the independence, population were grown, the area of cultivation was extended and the land for cattle husbandry was limited that's why now farmers do not have big herd of cattle and cultivate on low land rice. Unfortunately that the soil now lost it wealth according to decreasing of cattle, rice cultivation now use a lot of chemical fertilizers but still not meet the consumption need.

3. Farming system

Farming in Nambak district and Pakou district have more activities such as up land cultivation(rice, sesame, job steer), low land rice cultivation (rice, sesame, job steer), fruit tree operation (orange, lemon and banana) and vegetable gardening while Nakhonepheng district and Phonthong district have mainly only low land rice cultivation and vegetable gardening. Rice cultivation in Northern part uses less chemical fertilizers than Southern part according to good soil condition (low land). Animal husbandry especially cattle are very similar but in Northern part there are more available natural pasture fields such as bush and up land fields. Farmers in Northern part still exchange labor to other while in Southern part do not.

4. Agriculture income

Highest income in Nambak district come from cattle, orange, teak tree and lowland rice while income Pakou district come from cattle, lowland rice and lemond. In the other side, highest income in Nakhonepheng district and Phonthong district generate from cattle and low land rice in lower rice field that can be cultivated in 2 seasons. The lowest income generating activity in Nambak district and Pakou district is up land rice cultivation while in Nakhonepheng district and Phonthong district is low land rice cultivation in upper rice fields.

Conclusion

After the study of analysis of the economic pattern of Lao farmers in LEAP pilot area we can understand that, most farmers operate their farm in subsistence level. Subsistence agriculture spend little in-put, take a lot of labor (family and echange) with not really appropriated techniques which bring to low out and low profit. Most of product use for own consumption while cash income are very little.

The lowest income is in Pakou district, Louangphabang province, 520,000 Kip/year/Active labor which come from up land rice cultivation and poultry while the highest income is in Nambak district, Louangphabang province, 11,700,000 Kip/year/Active which come from Orange, teak tree, Lowland rice cultivation and cattle. The key activity for income generating in Nambak district and Pakou district are fruit tree garden (Orange, lemon and banana), low land field and cattle while cattle and good low land rice field are the key for Nakhonepheng district and Phonthong district.

In Northern part (Nambak district and Pakou district) are limited of low land fields. Up land farmers can not generate enough income to meet their consumption need, their lives are depended so much on natural resources such as Non Timbers Forestry Products, Fishery, and hunting. In Southern part (Nakhonepheng district and Phonthong district) have low land enough but unfortunately that the soil is not good condition (sandy or sandy-loam), more over water supplying especially in upper rice field is the limited factor for rice cultivation. Farmers who has inappropriate rice field can not generate enough income, they have to sell their labor in the community, town or aboard to Thailand, they can not access to forest because of the forest conservation and they live far from the forest.

The differences between farm type 1 and 4 in Laungphabang is the better agriculture land such as low land rice field, teak tree garden, orange garden for example, the second indicator is the number of cattle. Farm type one indicated by number of cattle and buffalo and lower rice field.

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