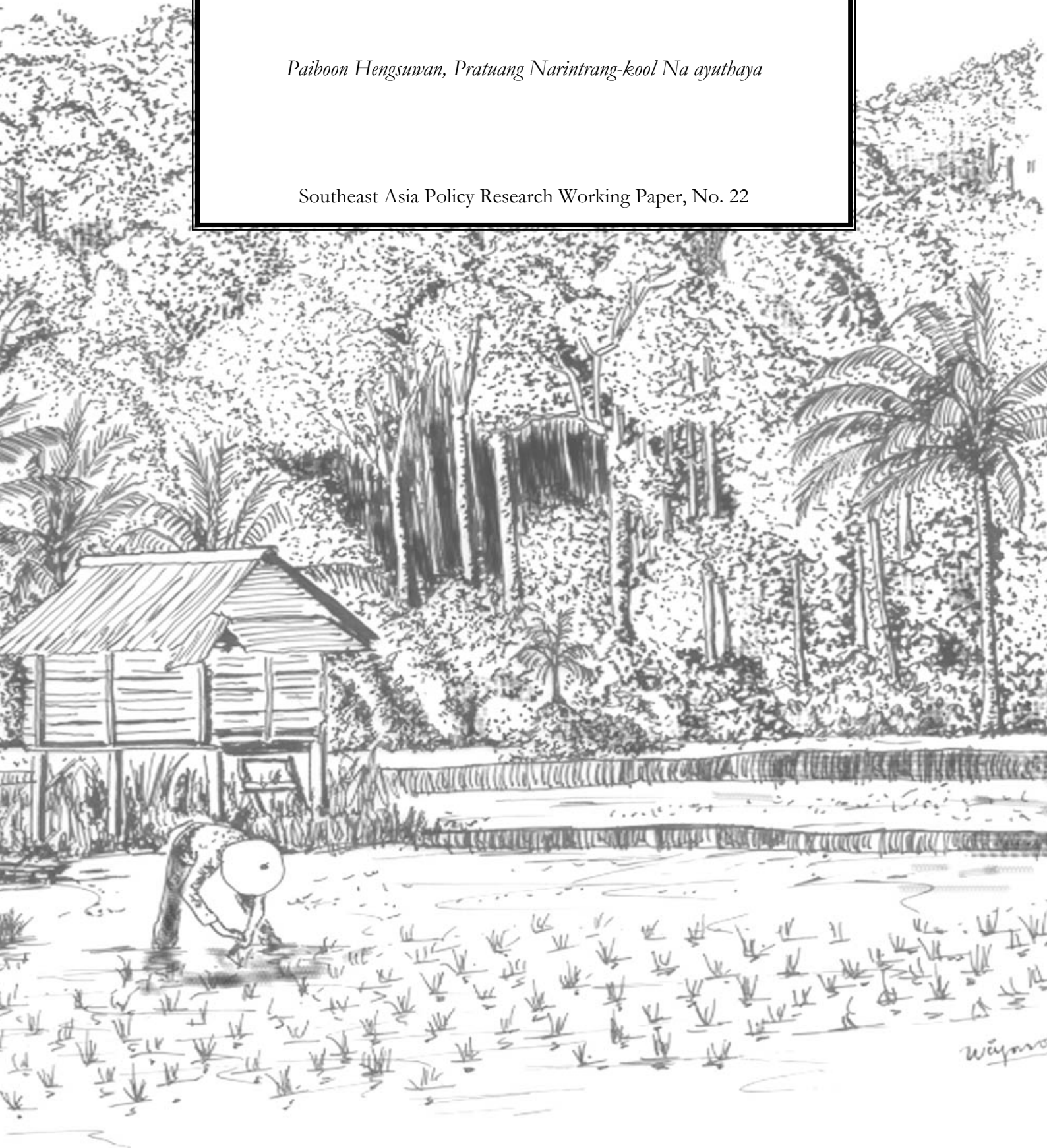


**The Farming System of Mae Lu Village in  
the Mae Chaem Watershed: Using the Policy  
Analysis Matrix Approach (PAM)**

*Paiboon Hengsuman, Pratuang Narinrang-kool Na ayuthaya*

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**The Farming System of Mae Lu Village in the Mae Chaem  
Watershed: Using the Policy Analysis Matrix Approach  
(PAM)**

**Paiboon Hengsuwan  
And  
Pratuang Narinrangkool Na ayuthaya**

**Chiang Mai, Thailand  
July, 1999**

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## **Preface**

The Karen village of Ban Mae Lu is a village where strangers including academic lecturers and researchers have studied about it so many times over the past ten years. At the same time there are some development projects to co-established between public health officers and the Institute of Social Research-Chiang Mai University. They have co-studied and developed the whole public health, we later have participated this development project focused on natural resources management by its community organization. We tried hard to search for the development headings and choices in natural resources management under the relation with its government and marketing system at that moment.

This research may initiate the understanding of the whole knowledge about farming system of highland karen people much more, and we hope that it would be able to improve the research useful for those villagers in the forest area and general people exactly.



## **Acknowledgement**

This research has been initiated after course training about the Application of the Policy Analysis Matrix to Natural Resources Policy 1997, with the cooperation of Alternative to Slash-and-Burn, ICRAF and the Bank of Asian Development Foundation. We would like to thank Dr. David Thomas and ICRAF who originated and kindly sponsored all budgets in this research project, and thank all ICRAF staffs that kindly help us to collect some data in social aspects which is greatly necessary in PAM analysis. In addition, we thank to all team researchers in exchanging some valuable experience until this research could be finished completely.

Furthermore, this research could not come to an end unless we received excellent cooperation from Karen people of Ban Mae Lu. We like to thank heartedly all of them hereby.

Paiboon Hengsuwan  
Pratueng Narinrangool Na ayuthaya  
June 1999

**Title:** The Farming System of Mae Lu Village in the Mae Chaem Watershed:  
Using the Policy Analysis Matrix Approach (PAM)  
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### **Abstract**

This research has analyzed the farming system of karen people at Ban Mae Lu, Mae Jaem District, Chiang Mai province. We evaluate the profit in economic aspects both in the level of producers and of general society, about 3 crops in 5 patterns of plantation; Shifting Cultivation and Land Rotation, Upland Rice, Paddy Rice, Rainfed Corn, and Rainfed Upland Soybeans in single plantation systems and mixed plantation systems in 9 patterns by using the Policy Analysis Matrix Approach (PAM) and the study of conditions and factors which are the social contexts. Those are the conservation policy and the capital marketing system that is wide spread into the community.

From this research we found that the evaluation on economic aspects of crops, there are 3 models: firstly; Rainfed Upland Soybeans bring profit both levels of producers and social so it should be promoted in its plantation. secondly; shifting cultivation and Land Rotation, Upland Rice, and Rainfed Corn do not bring any profit neither for the producers nor social level that it should not be promoted to its planting except it can be improved the productivity and its price more better, and lastly; Paddy Rice has some private profit but it does not bring social profit because it effects the environment so the rice planting should be promoted altogether with the solving of environment problems.

According to the evaluation of PAM ratios we found that there are 2 results: firstly; Upland Rice, Rainfed Corn and Rainfed Upland Soybean have negative private output profit. The government “taxed” them which made the price of the productivity too low or the input price is too high so the government should pass any policy strategy to solve this tax problem. Secondly, Upland Rice and Paddy Rice have positive private output profit. The government and social have subsidized so the output price is high or input price is low which is benefit for the villagers greatly.

However, the farming systems of the villagers still relate to the natural resources management which is under the condition of conservation policy of the government too. That is; the policy occupied the shifting cultivation of the villagers to reforest and forbid them to do nothing with their old cultivation lands. It is such limitation to pressure them and greatly effect their sustainable subsistence and enough lands to rotate. They are under the confusing of property right and land management system of the state, private right holding and public holding. They effect the villagers ability to develop the rotational cultivation to sustainable one. It is clearly seen that the villagers change their rotational lands into permanent upland fields which has some effects on soil fertilization in upper lands. They divided the rotational lands to grow corns, soybeans, and any other cash crops which are taxed every years. We can say that the villagers are being under the marketing system, no power to negotiate any things so they changed their lands to orchards, developed the rotational lands to agro-forestry, but this issue has never been studied in this area before which may reflect the progressive capability of the villagers as well. We need to further study about it actually.

# 1. Research Site

## 1.1. Village Characteristics

Ban Mae Lu, Moo 2, Tumbon Gong Kaek, Amphur Mae Chaem, Chiang Mai province, consists of five small villages: Ban Mae Lu, Ban Pa Lao, Ban Pa Here, Ban Huay Sai and Ban Huay Poo Aak. The people there, belong to Karen tribe. All five small villages are settled around the area of upper Mae Lu River basin (watershed class 1A) that is about 1,000 metres above sea level. There are 110 families in the villages-the villages have a population of 600.

The Karen people of Ban Mae Lu are accepted by the Thai government as lawful citizens and as a more than 100-year-historical community. According to history, before setting in the place, the Karens came to clear the land for planting for their subsistence, but they did not settle there permanently. However, they are changed their settlement many times around the nearby river basins are, such as the Mae Raek watershed, the Mae Moom watershed, and the Mae Kong Ka watershed. They moved back and forth in those river basins for periods until in the years 1867-1877. They settled permanently for the first time at Ban Mae Lu until the present time. Then some of them established another 4 villages i.e. Ban Huay Sai, Ban Pa Lao, Ban Pa Here and Ban Huay Poo Eak so that they could grow and look after their plants more conveniently.

The Karen's mode of production is subsistence. In addition, their type of production is called "Land Rotational Shifting Cultivation" which is based on ancient beliefs and rituals mainly for ecological conservation. However, some families learned how to grow crops from lowland people from Ban Oom Meng, Ban Tung Ya Lee, and Ban Gong Kaek who occupied the nearby lands. It can be said that in the period of early permanent settlement the land rotational shifting cultivation was a secure source of food and natural resources for the villagers.

The year 1927 was the first time the intense resource competition and social problems occurred. In our view, the underlying cause of those problems was the state system which extended into the rural community. People were allowed to legally grow opium poppies. Consequently, the state made a profit from collecting tax whereas the government officials made it from the illicit tax. Moreover, the Hmong moved into the area and grew opium poppies in the Mae Ya and the Mae Kong Ka Watershed, then they also expanded their farming land (swidden) into the Mae Lu community. As well as the Hmong, the lowlanders (city/urban people - Ban Pa Naad, Ban Lao Na Reun, Ban Yang Luang, and Ban Gong Kaek) also moved into the area.

The competition between growing opium poppies by doing shifting cultivation, and growing crops (in paddy field) seemed to become more intense. It was obvious that opium was the beneficial cash crop because it used a small area. They could accumulate a sum of money by selling opium, however, the land rotational shifting cultivation still existed for their subsistence.

Nevertheless, not every Karen could adapt to the idea and method of growing upland rice, growing rice in paddy fields and planting opium poppies at the same time, In addition, those who could do that needed to have a kind of readiness – they had to have enough stocks of rice (food), money for employing workers and the great amount of land. In other words, a few of them, especially the lowlanders, could adapt to the change and gain the profit from growing opium poppies, not everyone. Thus, while the former could draw on the resources for their own use and profit, the latter seemed to be in a disadvantageous position. The relationship between people changed from the age of subsistence cultivation to cash crop

(opium) which caused not only the wide gap between the rich and the poor, but the former took advantage of the latter.

The state has closely dominated the situation in the community for 30 years. The Forest Protection and Preservation unit C.M.26 was established in 1963, and the Watershed Conservation unit 17 in 1966 at Mae Meng, not far from Ban Mae Lu. These two governmental units were set up to rehabilitate and protect the forest by employing villagers to plant pinetrees on the land used previously to grow opium poppies-thus reducing the opium land. In order to collect a sum of money, the villagers turned to hiring themselves out for planting pine trees instead of growing opium poppies and upland rice.

Later, in 1981-1985 the Mae Chaem Watershed Project, supported by USAID, was established to discourage the villagers from growing opium poppies, and encourage them to grow cash crop in terraced fields. The project also cooperated with the state to issue the title document (STK.) to dwellings (houses) and land (paddy fields). The lowland people gained more opportunities because the Karens, living on the steep slope, had little capital to create terraced fields. The project tried to reduce the land use of rotational shifting cultivation, and support the permanent cultivation. However, at the time, the villagers decided not to join such a project-they still grew opium but didn't grow soybeans because of their little yields.

During 1987-1988, the soldiers came into the area to close down the opium fields. Also, there was the CARE project (NGO) cooperating with the Mae Chaem watershed project and supporting the villagers to grow fruit trees; nevertheless, few people joined this project.

The state pressure that most affected the villagers; land use and forest was they stipulated that Ban Mae Lu community was in the area of the watershed class 1A in 1989. Later on in 1992-1993 the Watershed conservation unit 17 forbade the villagers to do rotational shifting cultivation and try to evacuate the inhabitants from the forest. Such a deed is based on the mode of thinking that there is no coexistence of people and forest. They believed that people destroy the forest so people deserved to be separated from the forest. However, the state received critical remarks that they lacked cultural sensitivity. The villagers conserve the natural resources and ecological system more potentially if supported by the state and other outside organizations.

In conclusion, Karens have begun more and more to lose a sustainable source of food and natural resources under the state's pressure and forest conservation policy that has forbidden the rotational shifting cultivation, just allowing the villagers to cultivate in the fixed lands since 1992.

## **1.2. Village Access and Interactions**

### **1.2.1. Market Access**

Road building is an example among other development projects which bring resources from outside to its community. The Mae Chaem Basin Project accompanied with the 17th Watershed Management Division had built the road into the village in 1982-1983. It is a rough laterite road 10 kilometres from the main road on the Mae Chaem-Hod route. It made travelling to and contacting the outside community more conveniently. So transportation is convenient. The villagers use this road to travel to Mae Chaem and Chom Thong and other areas. They have been travelling on foot, by motorcycle and other vehicles of the development project and others people have travelled here, but there have not been any local buses until now. There are many destinations such as contacting the government agencies in the district, going to the market to buy food and household goods, visiting their relatives, going to hospital for their treatments, taking agricultural products for saleing or

retailing in the market. However, they don't travel very often. There are some native merchants from the lowland who bring useful goods for selling in the village. The Karen from Mae Lu are able to reach the market infrequently and at a disadvantage, when compared to the lowland people.

### **1.2.2 Labor**

The important form or strategy of Karen labor management is the attending and working in advance without wages or labor exchange arrangements. It is so important for villagers to have their own folk lore for their own survival. It is a way of mobilizing laborers to work. It is more successful if the laborers are from the same family. It is found that the villagers attend work in advance in some activities such as crop plantations and paddy fields. The labor exchange net of the Karen in Mae Lu has expanded to the community nearby, for example, to the Karen in the Mae Raek basin. Rice harvesting is the most significant activity. The labor exchange net has declined. The number of laborers who are mobilized, has decreased. Because the villagers have many more activities, especially planting economical crops such as soy beans. So the villagers have had enough time to help each other or ask for help from other villagers. It causes the labor exchange to exist only within its community for example, between the Mae Lu and the Pa Lau villages. They hire many more laborers. The Mae Lu community seems to manage the labor effectively. They still do labor exchange in crop plantation for their own use, whereas they hire labor for commercial use.

At present there are both labor exchange and hiring in the community. The hired labor does not occupy all of the labor exchange. Only 10% of the households hire labor. A small proportion of those have good economic status. So they can grow a large amount of commercial crops, and hire labor for planting in paddy field, and crop plantations too.

The daily hiring rate for labor is, men 100 baht/women 80 baht. There are about 10-15% of households that get wages, to increase their incomes by working as employees in crop plantation, soy bean growing or Chinese onion planting in the village and other further villages.

Besides being laborers in the agricultural sector, there are some villagers who work as employees in other sectors. Before 1992, there were only 2 villagers who went to work outside but after 1992 the government passed the bill that rotational shifting cultivation was prohibited by law. Since then there were about 40 young men who tried hard to find some jobs in Chiang Mai. There were permanent jobs and temporary jobs during the postharvesting such as forest fire control, goods delivery and security guards.

The Karen have been working as employees with Phuping Forest Fire Control on Doi Suthep more and more. That is there were 15 people in 1993, 20 in 1994, 23 in 1995, 27 in 1996 and about 30 people in 1997. Wages increased from 72 baht in 1993 to 110 baht a day in 1995. Most of the employees were young men who worked during the post time of rice harvesting. Eventhough they earned money from Fire Control Division which was the main source of income for their families. They were exploited by selfish staff because they had to buy food at very unreasonable prices on credit. This happened because the Fire Control Division gave them their wages very late.

Working as delivery men and security guards, was permanent and successful, so they did not come back to work on the plantation or paddy field. This group consists of villagers who have small farms, those who have enough farms or fields, and did not lack laborers in their family. There are about 16-20 men like this. However, for Karen men this is a strategy to adapt themselves to any oppressed economic circumstances facing one them in the short term. It is just a way to adapt within their own family.

### **1.2.3. Education**

In the past, most of the villagers didn't have any education from government system. But new generation Karens have begun to have their education from the state agency. There are some contributions such as ordination and study at Wat Srisoda Temple in Chiang Mai city and leaving the monkhood when they have fulfilled their education at Matayom 3 (grade 9) or extended to matayom 6 (grade 12). As for the Catholics, they would go to Pa Tueng school (where is located very far from Mae Lu), and is only to Pratom 6 (grade 6). Some of those students may continue their education at a school in Mae Chaem town until Matayom 3. But there are two nearer schools, at the Gong kaek school and its branch at the Mae Lu, it is conducted to Pratom 4 (grade 4). In 1995, there were some Mae Lu students who graduated from M. 3 (grade 9) at Gong Kaek school. Now there are about 20 students from Mae Lu who Studying at the Gong Kaek School.

The villagers believe in the importance of education for their children. Because it prepares them for a better way of life in the situation. For example, the villagers will have a better chance to find a good job in the city. So the villagers will find any opportunity to extend their children education both in the government school system, the Bhuddhist ordination, and from the Charistian organization. However, there is not an equal opportunity for everybody.

### **1.2.4. Recent and current project or programs active in the village**

During 1981-1986 the government started its development foundation. The villagers were not forced to change their old way of life. The government emphasized on building new infrastructure and providing them with new career in order to improve their way of life. Since 1987 the government has tried to restraint the village to limit their land use of rotational shifting cultivation. And encouraged the villagers to use support the permanent agricultural system and grow cash crops selling. The Mae Chaem Project and the 17th Watershed Management Division have tried to persuad the villagers to have a permanent residence. These projects had been promoted the villagers cash crops to lowland people and put in bourdaries on the land in order for the villagers to receive the Bill of Right in land use. Also, they directed the villages to put a bourdary on their own land. But, repeated Plantation on the same piece of land year after year can cause lacks of soil fertilization, and land erosion. The villagers found that their own cultivation method is better, the villagers need at least 3 pieces of land to do a rotational planting. Thus, these projects have been managed under the lacking of proper information and don't have enough understanding of the villagers conditions and problems. In the past (1984-1989), CARE Mae Chaem Organization didn't have a significant role in the community. But, now it has an important role in most of the effective activities. The main one is to deal with the current issue in supporting the villagers in planting fruit trees, reducing rotational cultivation, planting cash crops in a permanent farm, also the CARE work in coordination with government agency to reduce conflict that may have arisen among the villagers. But problem in resource management is still in existing. Eventhough, some agencies have ended their project.

The resource management problem occurs increasingly. The Karen folk way has taken off from a primitive economic system into capitalism.

As the result of the marketing and commercial exchange system have emerged into its society. They have produced their crops for selling and just for increasing their assets. So the villagers need to produce can become complicated. In contrast, it has made such an unstable food supply and decrease its resources.

### **1.2.5. Land use-related local organizations**

The villagers are not allowed to do rotational shifting cultivation and are limited to have farms in fixed area. So the tacking of land use make them have small ones but have been used condensely without leaving. They planted crops in the same pieces of land repeatedly. The state has the control of the land used but never be able to solve the villagers problems. The power and land management method of community have been sanctioned by the government. After 1992, the land management was under such conditions of the government administration. But to the way of negotiation; the community tried hard to prevent being under control with their resources management. They adapted, just for building strenght in their society and resisted on any outside circumstance (government and marketing system). According to the stability and self-determining of its community, it has been found that the villagers have adjusted the relation with outside factors by bringing up some ideas to be used. For example, they have done forest conservation in the way of state satisfaction. They parceled an due to community forest principles. The village committee and villagers have divided their lands into conservation forest, food-supplied forest, farming area, village setting area in 1994, and push Tambol Council to have more powerful and capable role in resource management by marking out the village clearly between the Mae Lu village and the Gong Kaek village. It has significant shown that its community is able to manage all resources (land, forest, water supply) which they might have in their own responsibility. Because there were some quarrels in water using between Mae Lue villagers that their village is located upstream and Gong Kaek villagers that their village is located downstream of Mae Lu River, so the villagers used the Tambol Council as a stage in dealing with and setting up rules to solve the problems. It is wide opened for villagers to participate in resource management much more. In 1993, teenagers were grouped what is called "Karen Love Forsest Group and supported from 17<sup>th</sup> Watershed Management Division, they built fire protecting tracks which is the coordination with government. The teenage group has expanded its working net into another villages nearby. (There have been some other social activities, in addition to forest conservation, for example; Aids Prevention Program, Career Promotion Program)

## **1.3. Overall village land use status and trends**

### **1.3.1. Paddy lands**

The Mae Lu village is located in a high mountain. There are little plain. They had made use of paddy lands for a very long time, until its permanent village setting. Now, they can not make any more paddy lands. From the survey (except the Huay Sai village), we have found that there are 37 land holders (34.58%) for 52 pieces of land. They hold about 1.5 piece of land per family and there are 241.75 rai of paddy lands so they are holding an average of 6.5 rai per family.

All the paddy lands are located near stream and not to far from its village. They use local irrigation of the Karen in doing paddy fields. The small dam is built to obstruct the river and they make some canals to head of its water into their rice field. The building and the management are supported with cooperation of their relatives and the villagers who use the same stream or the river. The cooperation among the villagers are the most important and valuable asset.

### **1.3.2. Rotational Shifting Cultivation**

In the past, villagers didn't separate their cultivated lands from the forest lands. They believe that both man and environment could help each other. The management in land using

and conserving the fertilization of forest should cope with altogether, within the right to use it of the community.

There were much better conditions to do cultivation in the past. The amount of lands were enough to fallow, because of its small population and further the government did not control or force villagers as it does nowadays. In the survey, we found that each family has its cultivated land either more or less, it depends on labor capacity to exceed. The villagers could do rotational shifting cultivation almost 7-8 pieces. That means the fallow period would be extended about 7-8 years, it was a better condition, fertilized for soil and made them gain more produce consistently.

Nowadays, the way of life and thinking of villagers about the relation between cultivated land and forest land have been shivered by state authority, such authority as sanctioned land management of its community, it forces the villagers to separate the land for cultivation and forest significantly, limits cultivation area and forest management. The private right in land use is overlapped the community right system.

It is found that villagers marked out their own land use increasingly but they still hold on the principle to land use right that someone can make profit from the land which is fallowed uselessly. That person must pass his case in a village meeting and its members to approve of his request. So the community has controlled land using but such a case like this rarely occurred today, because its rotational shifting area is limited.

From 107 families (except the Huay Sai village), there is only one family that does not have any rotational shifting lands (but still occupies 7 rai of paddy lands). There are 189 pieces of rice field, with an average of 1.8 piece per family and 1,054.75 rai with an average of 10 rai a family. The size of each piece is about 5.6 rai.

In addition, rotational shifting cultivation now has its fallow period only 1-2 years because they are allowed to mark out the land only 2 pieces, whereas it was 7-8 years in the old day. As the result, it affects in food stability because rice produce has been decreased and there will not be enough rice to consume all year. Villagers are under pressure to do rotational shifting cultivation so the villagers who marked out some bigger pieces of land, they have been divided into many small pieces ones. Then, they do rotational shifting cultivation within that big piece of land trickily. The villagers also try to find the way out such as plant some cash crops, do rice field on the same land repeatedly, use some chemical to get rid of weeds, add chemical fertilizer for more produce, find a job in a city. They have their own fighting without surrender.

### ***1.3.3. Permanent upland fields***

The pressure of growing population and being permitted to do their rotational shifting cultivation with in limited area, it affects the fallow period (as mentioned above); villagers have adjusted in the family by planting rice repeatedly on the same piece of land. This occurs after the authority has controlled over the land use since 1992. These were only 3-5 cases but now 41 families (except the Huay Sai village) or 38% over 266.5 rai or 25% of the whole rotational shifting cultivation system.

The villagers have learnt about weeds controlling method from Hmong villagers. They mix salt with water and spray over the land after ploughing it to control the growing of weeds. They will use weed pesticide if only they can not control it. They sometimes divide the land into two parts, one for growing rice, the other for growing corn, and the following year they switch these crops growing. However, it is the same piece of land. They do cultivation repeatedly, but only switch its crops.

The important crop is soy bean. The government agency promoted this kind of bean to villagers instead of opium before the year 1982, but it did not succeed because of its high



cost and needed more labors. Later, their opium farmings had been destroyed and prohibited by law. So they had to give up its growing. The villagers of the Mae Lu and the Huay Sai had marked up lands which is located onward the south of the Huay Sai village for their soy bean farmings in the rainy season. Most of these villagers are wealthy, they have got enough rice for eat. The number was about 15 villagers and a few of them tried to grow soy bean in their paddy lands during dry season.

Now, soy bean planting still exists with wide area of the Huay Sai village. Planting its cash crops in a wide area need much more water, it affects to people in the lowland and downstream. It causes some conflicts among lowland people, the Gong kaek and the Mae Lu villegers. (It will be mentioned later on the subject of Past Current land-use Conflicts). At the moment, villagers have aloan of money with amount of 16,000 baht (cash 8,000 baht and materials cost 8,000 baht) from Mae Chaem Agricultural Cooperative Store with its interest rate 12 percent a year. Among those debtors are 12 people from the Mae Lu, 6 from the Huay Soi, 1 from the Huay Pu Aau and Pa Lau.

There are at least 2 objectives in growing fruit trees. It firstly aims at increasing income; they grow some commercial fruit trees for selling such as lychee, mangoes etc. The second one is aiming at to show the ownership of marking lands. If they do not do any significant cultivation in a piece of land where is marked, it might be occupied by other people or even it is proposed to be a part of forest area by the Forestry Department. It is such a risk for villagers so they planted some trees and fruits. It is a strategy to preserve their right in land use.

It is found that there are only 6 families (except the Huay Sai village) who developed their land-use into fruit farms. There are 20 rai of lychee and mangoes to produce its fruits for selling. There are also some other fruits for consuming such as bananas etc. However, they have not received its produce from their farms yet.

#### ***1.3.4. Forest Land***

The Mae Lu community has applied the “Community Forest” concept for adapting their primitive way of life. It is approved and permitted to live in the forest land. They divided land into its community management and the Gong Kaek village clearly. It is overall 14,375 rai (23 kilometre squares). It split lands into conservation area, household supply and village setting significantly. The conservation area is so fertilized, located in high mountain where is the Mae Lu watershed. It is a graveyard and a place for making a merit such as spiritual ceremony. The conservation area is containing of 5,000 rai (8 kilometre squares). The household supplied area consists of rotational shifting lands and part of community forest in which villagers can find foods, herbs, firewoods, wood for building house etc. Apart from this, they reserve some pieces of land for its community expanding and marking out the land use in the future. The area of this purpose is about 8,750 rai (14 kilometre squares).

From the survey, it is found that forest land is the stable source of food supply and its ecological system significantly. Eventhough, getting food from the forest does not respond their need in money. It is being used to respond there earning for survival.

During a year, the villagers found almost 36 kinds of plant food from the jungle. Among these foods, there are 11 varieties provided which grown up all year round, 13 varieties produced during the dry season, 5 different foods are produced during both dry season and at the begining of rainy season, and 5 different foods are produced during both dry season and at the begining of rainy season, and 5 different plants produced some foods only during the rainy season.

The adaptation of its community by fetching the outside factors, is the strategy to gain more power in negotiating with the government authority. It is the fact that villagers have

some specific area being under their control, responsibility and able to manage themselves. It is shown that they keep out their lands from watershed class 1A ranking area which must have been under the state control. Even though, it is not fulfilled completely yet.

### ***1.3.5. Past current land-use conflicts***

The conflict in land-use has been arisen for many years until now, but so different circumstance. During the period of opium growing, the Karen had a conflict with the Hmong and the lowland people who had invaded and marked out in their opium cultivation and cash crops land, so that made them have fewer rotational shifting cultivation than ever. At the same time, the quantity of water had been shortened consistently for their opium fields in Mae Lu watershed area so villagers negotiated with opium growers. Additionally, the government had changed its policy, opium growing became illegal and prohibited by law. The conflict in land-use was fallen. Later, the government had sanctioned over primitive economic system. They supported the Karen to plant some cash crops for selling in the market, limited rotational shifting cultivation by the policy of forest conservation and watershed quality classification, controlled in land-use. The villagers were bared in forest management surrounding the village. While as there was a development project such as the Mae Chaem Watershed Project, the villagers who did high-land systematic cultivation (especially those were townmen) would be promoted to get the bill of right in land using. So there were many lowland people coming to mark out lands on mountain for crops planting. It even has been worse situation. They have very small pieces of land so they adapted due to such conditions. They do cultivation on their lands condensely and grow rice on the same land repeatedly without leaving (fallow period). It causes the lacking of foods and depending on more marketing system.

As the result, they have to change their way of life from primitive economic system into producing crops for market demand. On the contrary, The Karen are not capable to reach the marketing competition, asset, information, so they are in disadvantage status and lose benefits in dealing with outside merchandise.

According to the water management, there are some conflicts between the Mae Lu community and the Gong Kaek community which is located downstream in the same watershed. Because of their need in planting cash crops strongly, so they fight for water resource inevitably.

However, the villagers have never surrendered to such those pressure, they try hard to seek out the suitable adaptation for their own survival. In the household level, they try to earn their income much more from working as employee both in industrial sector and any other sectors to gain some money. They are trying to find out a method in improving their rotational shifting cultivation which has a shorter period of its fallow. As the adaptation in the community level, the villagers have done both inside and outside the community; they have adapted their own culture or custom in working style, improved the value of moral standard and the belief inside their society. Apart from those mentioned, they have adjusted “the community forestry principles” to energize the stronger local organization and expand its cooperation among villagers (network). They use Tambol Council as a stage to negotiate benefits between villages and further with the government or its authority gradually.

## **1.4. Major Village Land Use Systems**

The village land use systems within Mae Lu could be categorized into 2 main systems. Those are:

Firstly, Simple Land Use System, which is the only significant system that villagers use their own land for producing the single crop. It has been shown in 3 patterns as following:

- (1.1) Rainfed Upland Rice and Land Rotation (LR).
- (1.2) Rainfed Upland Rice (UR).
- (1.3) Paddy Rice (PR).

Secondly, Composite Land Use System, which is the system that each household uses their lands more complicatedly and mixed. It has been shown in 8 patterns as following:

- (2.1) Rainfed Upland Rice and Land Rotation and Rainfed Upland Rice (LR, UR).
- (2.2) Rainfed Upland Rice and Land Rotation and Paddy Rice (LR, PR).
- (2.3) Rainfed Upland Rice and Paddy Rice (UR, PR).
- (2.4) Paddy Rice, Orchard and Cash Crop (fruit trees, soybeans and corns) (PR, OCC).
- (2.5) Rainfed Upland Rice and Land Rotation, Rainfed Upland Rice and Paddy Rice(LR,UR,PR).
- (2.6) Rainfed Upland Rice and Land Rotation, Rainfed Upland Rice and Orchard and Cash Crop (fruit trees, soybeans and corns)(LR, UR, OCC).
- (2.7) Rainfed Upland Rice and Land Rotation, Paddy Rice and Orchard and Cash Crop (fruit trees, soybeans and corns)(LR, PR, OCC).
- (2.8) Rainfed Upland Rice, Paddy Rice and Orchard and Cash Crop (fruit trees, soybeans and corns)(UR, PR, OCC).

From our survey, we found that villagers have produced in those various kinds of systems (patterns) related to different sizes of the land owning with those producing patterns. They are shown in the table. The table displays the land owning of each producing patterns.

Systems	Patterns	No. of HH	<i>No. of Rai</i>	Average (Rai/HH)	No. of Plots	Average (Rai/Plot)
Simple Land Use Systems	LR	40	339.75	8.49	61	5.57
	UR	13	120.5	9.27	20	6.025
	PR	1	11.25	11.25	2	5.625
Composite Land Use Systems	LR	13	82	6.31	16	5.125
	UR		81.5	6.27	16	5.09
	Total		163.5	12.58	32	10.215
	LR	21	216.5	10.31	42	5.15
	PR		128.5	6.12	26	4.94
	Total		345	16.43	68	10.09
	UR	4	31	7.75	6	6.17
	PR		30.75	7.69	6	5.125
	Total		61.75	15.44	12	11.295
	PR	1	6.75	6.75	1	6.75
	OCC		12	12	3	4
	Total		18.75	18.75	4	10.75
	LR	6	24.5	4.08	6	4.08
	UR		34	5.67	6	5.67
	PR		32	5.33	8	4
	Total		90.5	11	14	9.67
LR	4	54	13.5	10	5.4	
UR		21	5.25	4	5.25	
OCC		7.5	1.88	4	1.88	
Total		82.5	7.13	8	7.13	
LR	3	23	7.67	6	3.83	
PR		21.75	7.25	6	3.63	
OCC		13	4.33	3	4.33	
Total		57.75	11.58	9	7.96	
UR	1	2	1	1	2	
PR		8.75	8.75	3	2.92	
OCC		7	7	1	7	
Total		17.75	15.75	4	9.92	
Total		107	1309	12.23	404	3.78

Total LR = 739.75 Rai

Total UR = 290 Rai

Total PR = 239.75 Rai

Total OCC = 39.5 Rai

From the table, it implied that most villagers still practical produce for their daily lives and use very simple producing pattern. It is all about growing rice for their own

consuming in their families but they are different ways to the pattern either shifting cultivation or paddy rice. There are only 9 families that improved their shifting cultivation area into orchards and cash crop farms. The changing of shifting cultivation into orchards and cash crops farms are the major trends of villagers adjustment which is easily being seen in general villages. They stay in the forestry areas where are under pressured from the conservation policy of the Thai government and market shares system.

Therefore, the shifting cultivation has been changed all the times. It depends on in what circumstances they are facing at that time, they are so pressured so that it causes either much more deforestation or it (that condition) may support the development of shifting cultivation into conservation ways, for example, it has been adapted into green botanical farming etc.

## 2. PAM Analysis of Representative Farming Systems

In this studying we use the model analysis PAM of Monke and Pearson (1989) to analyze the government policy and marketing system. We focused on the economical point of views. It is assumed that Private profitability of Land Use systems of the villagers and Social Profitability of Land Use System which are linked to the government policy, whether how it could implement Substantial tax or Subsidy in the inputs-outputs of the Land Use Systems or deal with market failures.

The main columns of PAM table are composed of input-output, private prices, private budget, social prices, social budget of each planted crop; Rainfed Upland Rice and Land Rotation, Rainfed Upland Rice, Paddy Rice, Rainfed corn, and Rainfed Upland soybeans.

Then we made Whole-farm PAM which is composed of 9 patterns as follows:

1. Rainfed Upland Rice and Land Rotation (1 sample)
2. Rainfed Upland Rice (5 samples)
3. Paddy Rice (3 samples)
4. Rainfed Upland Rice and Land Rotation and Paddy Rice (2 samples)
5. Rainfed Upland Rice and Paddy Rice (2 samples)
6. Paddy Rice and Rainfed Upland Corn (1 sample)
7. Paddy Rice and Rainfed Upland Soybeans (1 sample)
8. Rainfed Upland Rice , Rainfed Upland Corn and Rainfed Upland Soybeans (1 sample)
9. Paddy Rice, Rainfed Upland Corn and Rainfed Upland Soybeans (1 sample)

The result of each work has been calculated from the average land sizes of each crop per one family, we get a Whole-farm private profitability of land use in each pattern and bring it to analyze the divergences between Private Prices and Social Prices and so on.

### 2.1. Results of PAM Analysis

#### 2.1.1. Private Profitability

After the researchers have collected some information from villagers interviewing and collected 17 sampling questionnaires, those are 9 representing samples from Mae Lu, 5 samples from Ban Pa Lau, 2 samples from Ban Huay Sai and 1 sample from Ban Huay Puu Ake. Then the researchers bring that information and put in the Table.

These tables display each crop per area of one rai (6.25 rai=1 hectare) of each household. These are **table 1 Input-Output**, **table 2 Private Prices** and **table 3 Private Budget**, which came out from the result in table 1 multiplies by result in table 2. This table will show the Private Profitability.

Table 3 Profit Household calculated from the average of land use in each crop variously such as Rainfed Upland Rice and Land Rotation 4.67 rai, Rainfed Upland Rice 5.13 rai, Paddy Rice 5.33 rai, Rainfed Corn 3.00 rai, and Rainfed Upland Soybeans 4.00 rai. It has been found that Paddy Rice and Rainfed Upland Soybeans bring the good benefits, that it gains profit (Return to Management) 25.84 baht and 1,245.49 baht accordingly.

In contrast, the results of Rainfed Upland Rice and Land Rotation, Rainfed Upland Rice, and Rainfed Upland Corn of each household do not gain well, It lost profit -1,322.12 baht, -1,897.68 baht and -827.16 baht accordingly. The average yield per rai of Rainfed Upland Rice and Land Rotation is 409.29 kilograms, Rainfed Upland Rice is 547.68 kilograms and Rainfed Upland Corn is 211.11 kilograms, the price of rice costs 4.00 baht per kilogram and corn costs 2.50 baht per kilogram, variable costs of Rainfed Upland Rice and Land Rotation costs 27% of Rainfed Upland Rice (Rainfed Upland Rice and Land Rotation has variable costs 148.88 baht and Rainfed Upland Rice has 525.75 baht), variable cost of corn is 234.85 baht, labor cost of LR is 2,788.05 baht (55.76 man -day per rai ); UR is 3,483.79 baht (68.68 man-day per rai), Rainfed Upland Corn is 1,084.86 baht (12.05 man-day per rai). Whenever we calculate all costs together including labor cost, the villagers do not gain any profits from their traditional rice growing. That is because the research method takes too much labor cost in both LR and UR. In reality, the villagers manage the labor quite well. They exchange their own labors mainly, the labor hiring does not normally occur.

Moreover, in calculating labor time, villagers principle is so different from man-day calculating of economists in general, traditional labor exchange would count working in one time even very short time or not the whole day (from morning till evening) but they would count it as one day of working labor. But contrary to economics, it focuses on the amount of working hours, for example, working hours in a day is 8 hours. So the cost of labor will be too much higher (It deals the labor wages of the traditional crops at about 50 baht a day but when we calculate the real labor cost or Implicit Wage Rate , it is only half of the labor cost , that LR is 26.29 baht a day , and UR is 22.76 baht a day). While the LR of the villagers, they would plant some vegetables for their own consuming, there are many kinds including wild natural growth vegetables. Those are not included in calculating in this method, it needs to cover and restudy in the next research in the future. We can not ignore even the less important factors in our study.

There are 2 reasons why Rainfed Upland Corn lacks of benefit in Private Profitability. The first reason is on its low output. From interviewing with Mae Lu villagers, we found that in the last two years there were too many rats spread all over the agricultural plantation. They damaged rice and corn that causes its low output, in addition to the lacking of soil fertilizing and climate variance. The second factor is about high labor cost (labor cost of each crop is deal at 90 baht a day; when we calculate its labor cost with that point of view or Implicit Wage Rate, it takes only half of its labor cost at 21.38 baht a day).

### **2.1.2. Social Profitability**

**Table 4 Social Prices** of this studying resulted from the improvement of table 8 and table 9 of Benchaphun et al. (1999) PAM 's report. We transfer and drop out some unrelated crops from table 8 and table 9.

The Social Budget calculating is the same as Private Budget one. We multiply the Social Prices with Input-Output in Input-Output table, hence we actually get the Social Profitability.

From **table 5 Social Budget**, we found that Rainfed Upland Soybeans is the only one crop that brings profit. The profit (Return to Management) is 2,568.75 baht, while as the another 4 crops lose their expecting profit; Rainfed Upland Rice, Rainfed Upland Rice and

Land Rotation, Rainfed Corn, and Paddy Rice are -1,883.55 baht, -1,386.32 baht, -210.61 baht, and -46.80 baht accordingly. The Variable Cost of Rainfed Upland Rice and Land Rotation is 163.91 baht, Rainfed Upland Rice is 478.49 baht, Paddy Rice is 311.00 baht and Rainfed Corn is 165.00 baht. The Labor Cost of Rainfed Upland Rice and Land Rotation is 2,788.05 baht, Rainfed Upland Rice is 3,483.79 baht, Paddy Rice is 1,794.46 baht and Rainfed Corn is 1,084.86 baht.

The Social Price of Rice is lower than the Private Price (Social Price is 3.84 baht per kilogram, the Private Price is 4.00 baht per kilogram). We also found that Rainfed Corn has the Variable Costs of Social, Depreciation and Interest lower than the Private Price of villagers (the Variable Costs of Social is 165.00 baht, Variable Costs of Private is 234.85, Depreciation and Interest of Social is 11.74 baht and Depreciation and Interest of Private is 35.23 baht). Eventhough the result of social Output of Corn is higher than the Private Output of Corn (Social Output is 4.98 baht per kilogram and Private Output of Corn is 2.50 baht per kilogram), but it is not enough to gain profit.

### **2.1.3. Measurement of Government Intervention/Market Imperfection**

We can consider the government Intervention and Market Imperfection from **PAM table** (table 6) and **PAM ratios** (table 7). The most considerate principles are the **Output Transfer** or the **Nominal Protection Coefficient for tradable Output** (NPCO), if the revenue column of Social Prices has more than the Private Prices, so the Output divergence is a minus result; it implies that it is the result of the tax effect for producers. The Tax effect would come from the sanction of the government or from the market imperfection.

From table 6, we found that 3 traditional crops (LR,UR,PR) are not effected by Tax, but 2 cash crops (Rainfed Corn and Rainfed Upland Soybeans) have Social Output Prices higher than the villagers receiving from field at farm gate. It is assumed that agricultural sector could be produced effectively and better when it is related to international market and better market place. That is because of those villagers who grows both kinds of cash crops are being Tax effected from the government or even from the Market failure. On the contrary, the **Input Transfer** or the **Nominal Protection Coefficient for Tradable Inputs** (NPCI) has the tradable input column in Private Prices more than Social Prices, the divergence is positive, it implies there is a Tax in inputs, when private prices are less than social prices, the divergence is negative and procedures are subsidized.

It is found that LR, PR from table 6 have negative NPCI , it is subsidized from the government which is beneficial for villagers. While as UR, Rainfed Corn and Rainfed Upland Soybeans have a positive NPCI because they are in the stage of “Tax” in producing those three crops.

The Prices of Tradable Inputs (fertilizers, chemical, fuel and seeds) concerning villagers producing, for instance, UR, Rainfed Corn and Rainfed Upland Soybeans are being under the conditions of “Tax”, especially chemical (Social Prices of chemical may differ because it is only the estimated figures), moreover UR is under “Tax” from Prices of fuel at farm gate (Private Prices of fuel is 11.13 baht per liter, Social Prices of fuel is 7.63 baht per liter).

The Divergences between Private and Social Prices of factors (Labor, Capital and Land Charge), generally Labor Cost depends on the social opportunity costs without government intervention. The villagers told that wage labor to cash crops; female labor is 80 baht a day, male labor is 90 baht a day, and in this study we found that it is 50 baht a day for traditional crops and 90 baht a day for cash crops. When we calculated the implicit wage rate it is found that paddy rice costs closest to the real price (It is 50.72 baht a day; Table 3) The financial asset is also a factor in divergence in domestic factor. In the capital market, private

interest rate is around 15% while the social interest rate for the Central Bank of Thailand is around 5%. We use these rates to calculate the Costs of Capital for the Private and Social Prices of Inputs.

About the **net profits** from table 6 we found that LR and PR have positive divergences in closely figures, LR is 64 baht per rai and PR is 73 baht per rai. It implies that villagers are so happy and prefer producing in those sorts of crops because they are higher private output prices than social output prices by the government subsidy and lower private input prices than the social prices from its government subsidy.

By contrast, the net profit of UR, Rainfed Corn and Rainfed Upland Soybeans have negative divergences from most to less as follows: UR is -14 baht per rai, Rainfed Corn is -616 baht per rai and Rainfed Upland Soybeans is -1,323 baht per rai accordingly. These negative transfer were the sum of all transfers. First, NPCO or output transfer (e.g. lower private output prices than social output prices due to imperfection of the market). Second, NPCI or input transfer (e.g. higher private input prices than the social prices due to taxes and imperfection of the market).

Therefore, the upper land development such as the case of the Karen community of Ban Mae Lu and all the results above indicate that it should have been improved its market and reduced indirect taxation of the government. It will help the villagers to produce their crops much more effectively.

#### **2.1.4. Whole-farm PAMs**

Whole-farm PAMs were derived from taking into account villagers' average farm size. Nine patterns of farming systems which are in the case study of Private and Social Profitability as in table 11, we found that farming systems which bring better benefit (the profit is positive); there are 4 systems as follows:

1. The LR system itself; (It has a higher Private Output Price than a Social Output Price, and lower Private Tradable Input Price than Social Tradable Input Price). This system is under subsidized from the government both Output Price and Tradable Input.
2. The PR system itself; (It has a higher Private output Price than a Social Output Price, and lower Private Tradable Input Price than Social Tradable Input Price). This system is under subsidized from the government both Output Price and Tradable Input.
3. The LR and PR system; (They have higher Private Output Price than Social Output Price, and lower Private Tradable Input Price than Social Tradable Input Price). This system is under subsidized from the government both Output Price and Tradable Inputs.
4. The UR and PR system; (They have higher Private Output Price than Social Output Price but higher Private Tradable Input than Social Tradable Inputs.) This system is under subsidized from the government only the Output Price but all producing of the villagers inputs at farm gate are under the condition to "Tax" from the government.

On the other hands, there are 5 systems of the farming systems which are unsuccessful (Its profit is negative). Those are:

1. The single UR system; the villagers are under the condition of "Tax" from the government about the Inputs though the government subsidizes its Private Output Prices.
2. The PR and Rainfed Corn system; the market system does not facilitate its gaining and the villagers are under the condition of "Tax" in Inputs. (They have lower Private Output Prices than Social Output Prices and higher Private Tradable Input Prices than Social Tradable Input Prices.)



3. The PR and Rainfed Upland Soybeans; the market system also does not facilitate its gaining and the villagers are under the condition of “Tax” in Inputs. (They have lower Private Output Prices than Social Output Prices and higher Private Tradable Input Prices than Social Tradable Input Prices.)
4. The UR, Rainfed Corn and Rainfed Upland Soybeans; the market system also does not facilitate its gaining and the villagers are under the condition of “Tax” in Inputs. (They have lower Private Output Prices than Social Output Prices and higher Private Tradable Input Prices than Social Tradable Input Prices.)
5. The PR, Rainfed Corn and Rainfed Upland Soybeans; the market system also does not facilitate its gaining and the villagers are under the condition of “Tax” in Inputs. (They have lower Private Output Prices than Social Output Prices and higher Private Tradable Input Prices than Social Tradable Input Prices.)

### 2.1.5. Relevant PAM Ratios

The analyze of the land use system in the study has created some ratios from the PAM table which are calculated from the general information as in the following table.

	Tradable		Domestic Resources			Profit
	Outputs	Inputs	Labor	Capital	Land	
<b>Private</b>	A	B	C	D	E	F
<b>Social</b>	G	H	I	J	K	L
<b>Divergences</b>	M	N	O	P	Q	R

The ratios modules compose of:

$$1. \text{ Private Cost Ratio (PCR)} = \frac{\text{Private Domestic Resources}}{\text{Private Revenue} - \text{Private Tradable Input Costs}} = (C+D+E)/(A-B)$$

$$2. \text{ Domestic Resource Cost Ratios (DRC)} = \frac{\text{Social Domestic Resources}}{\text{Social Revenue} - \text{Social Tradable Input Costs}} = (I+J+K)/(G-H)$$

$$3. \text{ Effective Protection Coefficient (EPC)} = \frac{\text{Private Revenue} - \text{Private Tradable Inputs}}{\text{Social Revenue} - \text{Social Tradable Inputs}} = (A-B)/(G-H)$$

$$4. \text{ Ratio of Private and Social Profit (RP\&SP)} = \frac{\text{Private Profit}}{\text{Social Profit}} = F/L$$

$$5. \text{ Subsidy Ratio to producers (SRP)} = \frac{\text{Net Transfer}}{\text{Social Revenue}} = R/G$$

So they came to those ratios of each crops in table 7. In producing crops of the villagers should have PRC and DRC from their calculation less than 1 so it would be good and gain benefit, because it implies that the price of producing resources of the villagers are lower than the social price. It means the crops producing of the villagers is subsidized. From the table it shows the producing in Rainfed Upland Soybeans of the villagers having profit

both Privately and Socially Profitability. The producing of Paddy Rice of the villagers however, has only Privately Profitability. While as the LR, UR, and Rainfed Corn producing of the villagers do not gain any profit neither Privately nor Socially Profitability.

How about the EPC, if the rate has less than 1, it indicates that there is a “Taxation” to the villagers but, if the EPC has more than 1, there is a subsidy (protection) for the crop.

From the table, it implies that the producing of Rainfed Corn and Rainfed Upland Soybeans of the villagers were not subject to protection by the government/society (EPC is less than 1) while as the producing of LR, UR, and PR of the villagers are under the condition of subsidy from the government or it has a protection by the government or society (EPC is more than 1).

The ratios between Private and Social Profit can indicate the efficiency of the villagers producing in up to the society level. That is if this ratio’s result has more than 1, it means that the villagers are subsidized and at the same time if the result has less than 1, it means that they are “Taxed”. From the table we could get only the ratio of Private and Social Profits of Rainfed Upland Soybeans, it is 0.48 so that it means being “Taxed”. But Subsidy Ratio to producers indicates how much net transfer is a ratio of social revenue. If the ratio is a positive figure; it is subsidized and, if it is a negative one; it is taxed. The ratios can also be compared across crops. For instance, it is (0.04) of Paddy Rice and (-0.59) of Rainfed Corn comparing to (-0.01) of Rainfed Upland Rice, (-0.59) of Rainfed Corn and (-0.23) of Rainfed Upland Soybeans. It implied that the mixed producing system between Paddy Rice and Rainfed Corn are taxed in taxation from the government less than the three crops integrated producing (UR, Rainfed Corn and Rainfed Upland Soybeans) because it has less SRP.

#### **2.1.6. Sensitivity Analysis**

From the PAM analysis as already mentioned, it was only the situation that did not activate for a while in the past. In fact, the situation has been changed all the times so it would be effectively implemented to real policy propaganda from its analysis much more. It needs to imitate the situation in analyzing the sensitivity to earn the possibilities and changes to initiate the benefit to the villagers. The changes in this study consist of two sides.

##### **1. Price Changes**

- a) The price of export rice increases 10%.
- b) The price of corn increases to 5 baht /kilogram.
- c) The price of soybeans increases to 10 baht /kilogram.

##### **2. Productivity Changes**

- a) LR output increases 30%.
- b) UR output increases 30%.
- c) PR output increases 20%.
- d) Corn output increases 20%.
- e) PR output decreases 10%.
- f) Soybeans output decreases 40%.

The results of all cases are as follows: (see table 13 together)

<b>Crops</b>	<b>Situations</b>	<b>Results</b>
a) Rice		
1) LR	Export price increases 10%	Negative private profit is the same, negative social profit decreases but still negative.
2) UR	Export price increases 10%	Negative private profit is the same, negative social profit decreases but still negative.
3) PR	Export price increases 10%	Private profit is the same, social profit becomes positive.
b) Corn	Price increases 5 baht/kilogram	Negative private profit decreased but still negative.
c) Soybeans	Price increases 10 baht/kilogram	Private profit increases 1.5 times.
d) LR	Output increases 30%	Negative private and social profit decreases but still negative.
e) UR	Output increases 30%	Negative private and social profits decreases but still negative.
f) PR	Output increases 20%	Private profit much increases (18 times), negative social profits became positive.
g) Corn	Output increases 20%	Negative private profit decreases but still negative and negative social profit became positive.
h) Paddy Rice	Output decreases 10%	Private profit became negative, negative social profit increases.
i) Soybeans	Output decreases 40%	Private profit became negative, social profit decreases but still positive.

From the analysis of Sensitivity, it shows that LR and UR are still negative Private and Social Profits even though the export price increases to 10% or the producing of Output increases 30%. So both 2 kinds of producing have some difficulties in improving. About the case of PR when export price increases to 10%, the Social profit became positive or the production has Output increasing to 20%, the Private Profit dramatically increases: the Social Profit became positive. Therefore, the improvement of Paddy Rice can be easier than LR and UR at least it should produce much more about 20%. On the contrary, the decreasing in output for Paddy Rice in one year was 10%, the PR did not make any profit neither privately nor socially profitable.

Even though, in the case of Rainfed Corn, the price of the productivity increased from 2.50 baht per kilogram to 5.00 baht per kilogram, in another word it has been increased double prices. The Private and Social Profits are still negative. If it had been developed in producing process, the productivity would increase much more 20%, then the Social Profit situation would be better. The Rainfed Upland Soybeans more producing increase is much better situation, that it could gain both Private and Social Profits. If its productivity decreased onto 40%, it would lose the Private Profit but still gain the Social Profit.

Then, the comparison of the Sensitive among these 5 crops, it has been found that PR is the most Sensitive, the second one is Rainfed Upland Soybeans, the third one is Rainfed Corn and the least Sensitive are LR and UR.

### **3. Implication**

When we consider the PAM ratios, we can say that the government has a leading role in 2 manners of intervention. The first one is that it will indirectly “Tax” the Output Price if it is lower than the Social Output Price and “Tax” the factor prices if it is higher than the Social factor prices. The Rainfed Corn and Rainfed Upland Soybeans have been “Tax” greatly in this manner. The second one is that the producers are subsidized the Output Prices for crop if the NPCO was positive and subsidized through the Input Prices, so it would be benefit for producing the PR.

The capital market mechanism does not run effectively and influence dramatically towards two cash crops (corns, soybeans). It does not support or provide any profit to the villagers though they grow those 2 crops for special earning in their families. Unfortunately, those crops producing are failed. So the government must solve the market failure unevitably to help the villagers to gain some profit in producing any cash crops.

However, the villagers have adjusted themselves to those circumstances that they are being under “Tax” from the government or even the worst market failures. They grow many variety of crops, develop their own rotation land into cash crops plantation, orchard farms and even develop it into the Agro-forestry (we do not study this issue in this research). Nowadays, the rotational lands are the main topics to discuss about in the sustainable development and that one alternative is the developing rotational lands into Agro-forestry. The villagers must have some stables to earn their own lives and have enough lands to rotate or fallow many years, (Jesada, 1999).

From the Whole-farm PAMs Analysis at Ban Mae Lu, we found that the villagers reduce their risks in producing and market failure by planting many kind of crops. For instance, they plant PR and Rainfed Upland Soybeans, they plant PR and Rainfed Corn, some plant UR, Rainfed Corn and Rainfed Upland Soybeans while the others plant PR, Rainfed Corn, and Rainfed Upland Soybeans etc. From those 4 kind of farming systems we found that the PR and Rainfed Corn lost at the lowest rate, the second place is the PR, Rainfed Corn and Rainfed Upland Soybeans.

In addition to the role of the government to economical sanctions, the forestry conservation policy of the government is also the main factor to suppress and effect greatly towards the villagers earning and sizes of lands to maintain the rotational cultivation, under the chaos and confuse of property rights on the land. They treated the natural resources according to their traditional custom in communal rights but the government treated those resources with state property and private property instead. It ignores their cooperative will which has been spread all over this area among those villages and upland communities. The reformation of rotational lands of the villagers into forestry areas to reserve it of the government, hence effected those developing the rotational lands onto more risks and unsustainable.

Therefore, the improvement-only reduced the “Tax” towards the villagers and promote the subsidy for crops is not enough. It needs to solve the bad effects of the conservation policy of the government as well, then it would be useful for the producers of cash crops on the highland or in the forestry area actually.

### **4. Recommendations for Further PAM Studies**

The analysis of farming systems or land uses of the villagers who live in the highland community in the forestry area by using PAM model as its strategy to study, needs to employ another aspects to reflect the social relation among villagers themselves and outside society

as well, for example, the relation with another communities, government agencies and marketing system. Because PAM model has only focused on the analysis of the economic aspects. It employs the numbered figures from related mathematics calculation. We found from this study that the most important thing about PAM model is that it has some limitations in searching and finding the figurative information of the Social Costs, especially, the traditional way of life which they might gain from the forest such as wood, plants, tropical foods and other resources that could not find any approach to value the obtained data in recording it systematically and reliable. Including the community forest which is relevant the shifting cultivation directly. There are also some growing plants, natural grown plants in rotational lands, vegetables and orchards of the villagers have not been analyzed the profit at all.

Consequently, we should carefully use the PAM model because the out-come solution from the study usually promote the reformation from the traditional system into a very commercial producing to maintain the most profitability. It may leave the suitable subsistence (traditional way of life) which is very important for their own daily lives behind. It also does not value the ability of the villagers that they can develop the shifting cultivation into the most sustainable system themselves.

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**Table 1. Inputs and outputs per rai for five crop component grown in Mae Lu.**

<b>I-O</b>	<b>Quantities</b>	<b>Rainfed Upland Rice and Land Rotation</b>	<b>Rainfed Upland Rice</b>	<b>Paddy rice</b>	<b>Rainfed Corn</b>	<b>Rainfed Upland Soybeans</b>
<b>Tradables</b>	<b>Fertilizer (Kg/Rai)</b>					
	16-20-0	10.71	35.37	25.35	19.44	16.67
	<b>Chemical</b>					
	Sait (Kg./Rai)	21.43	124.15	13.15	0.00	0.00
	Gold 2E (c.c./Rai)	0.00	39.02	7.51	0.00	166.67
	Gramoxon (c.c./Rai)	42.86	136.59	15.02	200.00	250.00
	<b>Seed (Kg/Rai)</b>	13.93	12.44	13.05	0.00	11.25
<b>Fuel (Liters/Rai)</b>	0.00	1.57	5.18	0.00	0.00	
<b>Factors</b>	<b>Labor (Days/Rai)</b>					
	Slash and Burn	5.75	5.82	0.00	0.00	0.00
	Seedbed Prep.	0.00	0.00	0.97	0.00	0.00
	Prepared Land	0.00	2.43	5.54	2.89	4.67
	Planting	7.50	4.25	7.63	3.17	5.17
	Weeding	19.44	39.34	6.70	0.11	12.92
	Fertilizing	0.17	1.59	0.62	1.00	0.81
	Chemical Spraying	0.00	0.65	0.00	0.56	0.36
	Watering	0.00	0.00	0.34	0.00	0.00
	Harvesting	8.96	6.95	5.54	3.22	7.58
	Threshing/Winnowing	11.39	5.72	6.84	0.00	0.00
	Storage	2.55	2.93	1.71	1.11	0.00
	Total Labour Use per Rai	55.76	69.68	35.89	12.05	31.50
	<b>Capital</b>					
	Working Capital (Baht/Rai)	148.88	525.75	293.43	234.85	393.16
	Tractor Services (Day/Rai)	0.00	0.00	0.00	0.00	0.00
	Thresher (Kg/Rai)	0.00	0.00	0.00	0.00	525.00
Transportation (day)	0.00	0.00	0.00	0.00	0.00	
<b>Land (Rai)</b>	1.00	1.00	1.00	1.00	1.00	
<b>Output</b>	<b>(Kg./Rai)</b>	409.29	547.68	539.44	211.11	525.00

**Table 2 Private prices paid locally for inputs and outputs five crop components in Mae Lu**

<b>P-Prices</b>	<b>Private Prices</b>	<b>Rainfed Upland Rice and Land Rotation</b>	<b>Rainfed Upland Rice</b>	<b>Paddy rice</b>	<b>Rainfed Corn</b>	<b>Rainfed Upland Soybeans</b>	
<b>Tradables</b>	<b>Fertilizer (Baht/kg)</b>						
	16-20-0	5.47	6.60	6.60	6.27	5.40	
	<b>Chemical</b>						
	Salt (Baht/Kg)	1.00	1.00	1.00	1.00	1.00	
	Gold 2E (Baht/c.c.)	0.00	0.88	0.91	0.00	0.38	
	Gramoxon (Baht/c.c.)	0.53	0.55	0.55	0.57	0.53	
	<b>Seed (Baht/Kg)</b>	3.33	3.33	3.33	16.67	8.00	
	<b>Fuel (Baht/Liter)</b>	0.00	11.13	10.50	0.00	0.00	
	<b>Factors</b>	<b>Labor (Bath/Day)</b>					
		Slash and Burn	50	50	50	90	90
Seedbed Prep.		50	50	50	90	90	
Prepared Land		50	50	50	90	90	
Planting		50	50	50	90	90	
Weeding		50	50	50	90	90	
Fertilizing		50	50	50	90	90	
Chemical Spraying		50	50	50	90	90	
Watering		50	50	50	90	90	
Harvesting		50	50	50	90	90	
Threshing/Winnowing		50	50	50	90	90	
Storage		50	50	50	90	90	
<b>Capital</b>							
Working Capital (%)		15%	15%	15%	15%	15%	
Tractor Services (Baht/Day)							
Thresher (Baht/Kg.)	0	0.00	0.00	0.00	0.03		
Transportation (Baht/Kg)							
<b>Land (Baht/Rai)</b>							
<b>Output</b>	<b>(Baht/Kg)</b>	4.00	4.00	4.00	2.50	8.63	



**Table 3 Private budget of costs and returns per rai for five crop components grown in Mae Lu**

<b>P-Budget</b>	<b>Costs and Returns (Baht/Rai)</b>	<b>Rainfed Upland Rice and Land Rotation</b>	<b>Rainfed Upland Rice</b>	<b>Paddy rice</b>	<b>Rainfed Corn</b>	<b>Rainfed Upland Soybeans</b>	
<b>Tradables</b>	<b>Fertilizer</b>						
		16-20-0	58.57	233.41	167.32	121.85	90.00
	<b>Chemical</b>						
		Salt	21.43	124.15	13.15	0.00	0.00
		Gold 2E	0.00	34.15	6.82	0.00	63.33
		Gramoxon	22.50	75.12	8.26	113.00	132.50
	<b>Seed</b>		46.38	41.42	43.46	0.00	90.00
	<b>Fuel</b>		0.00	17.50	54.42	0.00	0.00
	<b>Factors</b>	<b>Labor</b>					
			Slash and Burn	287.55	290.96	0.00	0.00
		Seedbed Prep.	0.00	0.00	48.28	0.00	0.00
		Prepared Land	0.00	121.36	277.21	259.98	419.97
		Planting	375.00	212.31	381.72	284.97	464.97
		Weeding	972.17	1,966.90	334.83	9.99	1,162.50
		Fertilizing	8.33	79.41	30.86	89.97	72.48
		Chemical Sprayingf	0.00	32.57	0.00	49.98	32.49
		Watering	0.00	0.00	17.14	0.00	0.00
		Harvesting	448.00	347.51	276.91	289.98	682.47
		Threshing/Winnowing	569.33	286.10	342.13	0.00	0.00
		Storage	127.67	146.68	85.39	99.99	0.00
		<b>Capital</b>					
		Working Capital (Baht/Rai)	22.33	78.86	44.02	35.23	58.97
		Tractor Services (Baht/Rai)	0.00	0.00	0.00	0.00	0.00
		Thresher (Baht/Rai)	0.00	0.00	0.00	0.00	17.33
		Transportation (Baht/Rai)	0.00	0.00	0.00	0.00	0.00
		<b>Land Charge (baht/rai)</b>	0.00	0.00	0.00	0.00	0.00
<b>Output</b>		Total Revenue	1,637.14	2,190.73	2,157.75	527.78	4,532.50
<b>(Baht/Rai)</b>		Total Variable Costs	148.88	525.75	293.43	234.85	375.83

<b>P-Budget</b>	<b>Costs and Returns (Baht/Rai)</b>	<b>Rainfed Upland Rice and Land Rotation</b>	<b>Rainfed Upland Rice</b>	<b>Paddy rice</b>	<b>Rainfed Corn</b>	<b>Rainfed Upland Soybeans</b>
	<b>Gross Margin</b>	<b>1,488.26</b>	<b>1,664.98</b>	<b>1,864.31</b>	<b>292.93</b>	<b>4,156.67</b>
	Depreciation and Interest	22.33	78.86	44.02	35.23	76.30
	<b>Return over Land and Labor</b>	<b>1,465.93</b>	<b>1,586.12</b>	<b>1,820.30</b>	<b>257.70</b>	<b>4,080.37</b>
	Labor Costs	2,788.05	3,483.79	1,794.46	1,084.86	2,834.88
	Total Costs	2,959.26	4,088.41	2,131.91	1,354.94	3,287.01
	<b>Profit (Return to Management)</b>	<b>-1,322.12</b>	<b>-1,897.68</b>	<b>25.84</b>	<b>-827.16</b>	<b>1,245.49</b>
<b>Calculation of "Implicit Wage Rate" (Baht/Day)</b>		<b>26.29</b>	<b>22.76</b>	<b>50.72</b>	<b>21.38</b>	<b>129.54</b>
Average Area (Rai/HH)		4.67	5.13	5.33	3.00	4.00
<b>Profit per Household</b>		<b>-6169.90</b>	<b>-9725.60</b>	<b>137.59</b>	<b>-2481.49</b>	<b>4981.95</b>

**Table 4 Social prices paid for inputs and outputs of five crop components**

<b>S-Prices</b>	<b>Social Prices</b>	<b>Rainfed Upland Rice and Land Rotation</b>	<b>Rainfed Upland Rice</b>	<b>Paddy rice</b>	<b>Rainfed Corn</b>	<b>Rainfed Upland Soybeans</b>
<b>Tradables</b>	<b>Fertilizer (Baht/kg)</b>					
	16-20-0	8.19	8.19	8.19	8.19	8.19
	<b>Chemical</b>					
	Salt (Baht/Kg)	1.00	1.00	1.00	1.00	1.00
	Gold 2E (Baht/c.c.)	0.03	0.03	0.03	0.03	0.03
	Gramoxon (Baht/c.c.)	0.03	0.03	0.03	0.03	0.03
	<b>Seed (Baht/Kg)</b>	3.84	3.84	30.47	30.47	10.88
<b>Fuel (Baht/Liter)</b>	7.63	7.63	7.63	7.63	7.63	
<b>Factors</b>	<b>Labor (Bath/Day)</b>					
	Slash and Burn	50	50	50	90	90
	Seedbed Prep.	50	50	50	90	90
	Prepared Land	50	50	50	90	90
	Planting	50	50	50	90	90
	Weeding	50	50	50	90	90
	Fertilizing	50	50	50	90	90
	Chemical Spraying	50	50	50	90	90
	Watering	50	50	50	90	90
	Harvesting	50	50	50	90	90
	Threshing/Winnowing	50	50	50	90	90
	Storage	50	50	50	90	90
	<b>Capital</b>					
	Working Capital (%)	5%	5%	5%	5%	5%
	Tractor Services (Baht/Day)					
	Thresher (Baht/Kg.)					0.03
Transportation						
<b>Land (Baht/Rai)</b>	0.00	0.00	0.00	0.00	0.00	
<b>Output</b>	(Baht/Kg)	3.84	3.84	3.84	4.98	10.88

**Table 5 Social budget of costs and returns per rai for five crop components grown**

<b>S-Budget</b>	<b>Costs and Returns (Baht/Rai)</b>	<b>Rainfed Upland Rice and Land Rotation</b>	<b>Rainfed Upland Rice</b>	<b>Paddy rice</b>	<b>Rainfed Corn</b>	<b>Rainfed Upland Soybeans</b>
<b>Tradables</b>	<b>Fertilizer (Baht/Rai)</b>					
	16-20-0	87.70	289.47	207.51	159.16	136.42
	<b>Chemical (Baht/Rai)</b>					
	Salt	21.43	124.15	13.15	0.00	0.00
	Gold 2E	0.00	1.07	0.21	0.00	4.56
	Gramoxon	1.25	3.99	0.44	5.84	7.31
	<b>Seed (Baht/Rai)</b>	53.49	47.77	397.68	0.00	122.38
	<b>Fuel (Baht/Rai)</b>	0.00	12.00	39.53	0.00	0.00
<b>Factors</b>	<b>Labor (Baht/Rai)</b>					
	Slash and Burn	287.55	290.96	0.00	0.00	0.00
	Seedbed Prep.	0.00	0.00	48.28	0.00	0.00
	Prepared Land	0.00	121.36	277.21	259.98	419.97
	Planting	375.00	212.31	381.72	284.97	464.97
	Weeding	972.17	1,966.90	334.83	9.99	1,162.50
	Fertilizing	8.33	79.41	30.86	89.97	72.48
	Chemical Spraying	0.00	32.57	0.00	49.98	32.49
	Watering	0.00	0.00	17.14	0.00	0.00
	Harvesting	448.00	347.51	276.91	289.98	682.47
	Threshing/Winnowing	569.33	286.10	342.13	0.00	0.00
	Storage	127.67	146.68	85.39	99.99	0.00
	<b>Capital</b>					
	Working Capital (Baht/Rai)	7.44	26.29	14.67	11.74	19.66
	Tractor Services (Baht/Rai)	0.00	0.00	0.00	0.00	0.00
	Thresher (Baht/Rai)	0.00	0.00	0.00	0.00	17.33
	Transportation	0.00	0.00	0.00	0.00	0.00
<b>Land Charge (Baht/Rai)</b>	0.00	0.00	0.00	0.00	0.00	
<b>Output (Baht/Rai)</b>	Total Revenue (Baht/Rai)	1,571.66	2,103.10	2,071.44	1,050.99	5,711.28
	Total Variable Costs	163.86	478.44	658.52	165.00	270.67

<b>S-Budget</b>	<b>Costs and Returns (Baht/Rai)</b>	<b>Rainfed Upland Rice and Land Rotation</b>	<b>Rainfed Upland Rice</b>	<b>Paddy rice</b>	<b>Rainfed Corn</b>	<b>Rainfed Upland Soybeans</b>
	<b>Gross Margin</b>	<b>1,407.79</b>	<b>1,624.66</b>	<b>1,412.92</b>	<b>885.99</b>	<b>5,440.61</b>
	Depreciation and Interest	7.44	26.29	14.67	11.74	36.98
	<b>Return over Land and Labor</b>	<b>1,400.35</b>	<b>1,598.37</b>	<b>1,398.25</b>	<b>874.25</b>	<b>5,403.63</b>
	Labor Costs	2,788.05	3,483.79	1,794.46	1,084.86	2,834.88
	Total Costs	2,959.36	3,988.53	2,467.65	1,261.60	3,142.53
	<b>Profit (Return to Management)</b>	<b>-1,387.70</b>	<b>-1,885.42</b>	<b>-396.21</b>	<b>-210.61</b>	<b>2,568.75</b>
<b>Calculation of "Implicit Wage Rate" (Baht/Day)</b>		25.11	22.94	38.96	72.53	171.55
Average Area		4.67	5.13	5.33	3.00	4.00

Table 6. Private Prices of Inputs and Outputs of four major crops

PRICE		<u>Paddy Rice</u>	<u>Upland Rice</u>	<u>Upland Soybeans</u>	<u>Rain-fed Corn</u>	
<b>Tradables</b>	<b>Fertilizer (B/Kg)</b>					
		16-20-0	8.6	8.6	8.6	8.6
		13-13-21	10.2	10.2	10.2	10.2
	<b>Herbicide (B/cc)</b>					
		Gramoxon (B/Rai)	0.12	0.12	0.12	0.12
		2E (B/Rai)	0.72	0.72	0.72	0.72
		LD6G (B/Rai)	20.00	20.00	20.00	20.00
	<b>Insecticide (B/cc)</b>					
		Floridon (B/Rai)	0.60	0.60	0.60	0.60
	<b>Hormone (B/cc)</b>					
		Nothai (B/Rai)	-	-	-	-
	<b>Seed (B/Kg)</b>		3.84	3.84	10.88	30.47
	<b>Fuel (B/litre)</b>		7.63	7.63	7.63	7.63
	<b>Factors</b>	<b>Labor (B/Day)</b>				
Slash and burn		50.00	50.00	50.00	50.00	
<i>Canal Maintenance</i>		50.00	50.00	90.00	90.00	
<i>Nursery</i>		50.00	50.00	90.00	90.00	
<i>Seedbed Prep.</i>		50.00	50.00	90.00	90.00	
<i>Planting</i>		50.00	50.00	90.00	90.00	
<i>Crop Care</i>						
1. Weeding		50.00	50.00	90.00	90.00	
2. Fertilizing		50.00	50.00	90.00	90.00	
3. Watering		50.00	50.00	90.00	90.00	
4. Insecticide Spraying		50.00	50.00	90.00	90.00	
<i>Harvesting</i>		50.00	50.00	90.00	90.00	
<i>Threshing/Winnowing</i>		50.00	50.00	90.00	90.00	
<i>Transportation&amp;Storage</i>						
<i>Shelling</i>		50.00	50.00	50.00	50.00	
<i>Drying</i>		50.00	50.00	50.00	50.00	
<b>Capital</b>						
Working Capital (Baht/Rai)		0.05	0.05	0.05	0.05	
Tractor Services (Days/Rai)		150.00	150.00	-	-	
Thresher (Day/Rai)		-	-	-	-	
<b>Hand Tools (Pcs./rai)</b>						
Knive (Pcs./rai)	3.84	3.84	10.88	4.98		
Hoe (Pcs./rai)						
Pick (Pcs./rai)						
Sparyer (Pcs./rai)						
<b>Land (Rai)</b>						
	(Baht/Kg)					

**Table 7 PAM Ratios**

	<b>Rainfed Upland Rice and Land Rotation</b>	<b>Rainfed Upland Rice</b>	<b>Paddy rice</b>	<b>Rainfed Corn</b>	<b>Rainfed Upland Soybeans</b>
Privately Profitable	No	No	Yes	No	Yes
Socially Profitable	No	No	No	No	Yes
Output Transfer (NPCO)	Subsidy	Subsidy	Subsidy	Tax	Tax
Input Transfer (NPCI)	Subsidy	Tax	Subsidy	Tax	Tax
Factor Transfer	Tax	Tax	Tax	Tax	Tax
Net Transfer	Subsidy	Tax	Subsidy	Tax	Tax
Private Cost Ratio	1.89	2.14	0.99	3.82	0.70
Domestic Resource Cost Coefficient (DRC)	1.99	2.16	1.28	1.24	0.53
Effective Protection Coefficient (EPC)	1.06	1.02	1.32	-0.33	0.76
Ratio of Private and Social Profits (RP&SP)					0.48
Subsidy Ratio to Producers (SRP)	0.04	-0.01	0.20	-0.59	-0.23

Table 8: Social Prices of Inputs and Outputs for Major Crops in the case-study villages

<b>PRICE</b>		<b>Paddy Rice</b>	<b>Upland Rice</b>	<b>Upland Soybeans</b>	<b>Rain-fed Corn</b>
<b>Tradables</b>	<b>Fertilizer (B/Kg)</b>				
	16-20-0	8.19	8.19	8.19	8.19
	13-13-21	-	-	-	-
	<b>Herbicide (B/cc)</b>				
	Gramoxon (B/Rai)	0.03	0.03	0.03	0.03
	2E (B/Rai)	0.03	0.03	0.03	0.03
	LD6G (B/Rai)	0.03	0.03	0.03	0.03
	<b>Insecticide (B/cc)</b>				
	Floridon (B/Rai)	0.00	0.00	0.03	0.00
	<b>Hormone (B/cc)</b>				
	Nothai (B/Rai)	-	-	-	-
	<b>Seed (B/Kg)</b>	3.84	3.84	10.88	30.47
	<b>Fuel (B/litre)</b>	7.63	7.63	7.63	7.63
<b>Factors</b>	<b>Labor (B/Day)</b>				
	Slash and burn	50.00	50.00	50.00	50.00
	<i>Canal Maintenance</i>	50.00	50.00	90.00	90.00
	<i>Nursery</i>	50.00	50.00	90.00	90.00
	<i>Seedbed Prep.</i>	50.00	50.00	90.00	90.00
	<i>Planting</i>	50.00	50.00	90.00	90.00
	<i>Crop Care</i>				
	1. Weeding	50.00	50.00	90.00	90.00
	2. Fertilizing	50.00	50.00	90.00	90.00
	3. Watering	50.00	50.00	90.00	90.00
	4. Insecticide Spraying	50.00	50.00	90.00	90.00
	<i>Harvesting</i>	50.00	50.00	90.00	90.00
	<i>Threshing/Winnowing</i>	50.00	50.00	90.00	90.00
	<i>Transportation&amp;Storage</i>				
	<i>Shelling</i>	50.00	50.00	50.00	50.00
	<i>Drying</i>	50.00	50.00	50.00	50.00
	<b>Capital (Baht)</b>				
	Working Capital (%)	0.05	0.05	0.05	0.05
	Tractor Services (Baht/Day)	150.00	150.00	-	-
	Thresher (B/Kg)	-	-	-	-
	Land (Baht/Rai)	-	-	-	-
	Output (Baht/Kg)	3.84	3.84	10.88	4.98



**Table 9 Social export parity prices**

	Output			Fuel	Fertilizers 16-20-0	Seed			Chemical		
	Paddy	Corn	Soybean			Paddy	Corn	Soybean	Salt	Gold 2E	Gramoxon
<b>Social export parity values</b>											
c.i.f. (\$/ton)											
Freight and Insurance (\$/ton)											
f.o.b. (\$/ton)	224										
Exchange rate (baht/\$)	26.13	26.13	26.13								
Exchange rate premium	0.3395	0.3395	0.3395								
Equilibrium exchange rate	35	35	35								
f.o.b in domestic currency	7840										
Weight conversion factor (kg/ton)	1000										
f.o.b in domestic currency	7.84										
transportation costs (from factory)(baht/kg)	0.35										
Marketing costs (baht/kg)	0.5										
Value after processing (baht/kg)	6.99										
Processing conversion factor (%)	0.65										
Import parity value at wholesale (baht/kg)	4.54										
Processing cost (baht/kg)	0.2										
Distribution costs to farm (baht/kg)	0.5										
Import parity at farm gate (baht/kg)	3.84										

**Table10 Wholefarm Private Budget for farmers in Mae Lu**

<b>No.of Patterns</b>	<b>Component</b>	<b>Rainfed Upland Rice and Land Rotation</b>	<b>Rainfed Upland Rice</b>	<b>Paddy Rice</b>	<b>Rainfed Corn</b>	<b>Rainfed Upland Soybeans</b>	<b>Total Profit</b>
Pattern 1	LR	8.00					-10576.97
Pattern 2	UR		5.60				-10627.00
Pattern 3	PR			6.17			159.33
Pattern 4	LR, PR	3.00		1.88			-3917.92
Pattern 5	UR, PR		4.50	6.50			-8371.61
Pattern 6	PR, Corn			3.50	3.00		-2391.05
Pattern 7	PR, Soybeans			8.50		6.00	7692.55
Pattern 8	UR, Corn, Soybeans		4.00		4.00	4.00	-5917.41
Pattern 9	PR, Corn, Soybeans			6.00	2.00	2.00	991.68
	Private Profits	-1,322.12	-1,897.68	25.84	-827.16	1,245.49	

Rainfed Upland Rice and Land Rotation, fallow 5-7 years

**Table 11 Wholefarm PAMs****Farming System 1****Rainfed Upland Rice and Land Rotation (LR)**

8.00 Rai

	Tradables		Domestic Resources			Profits
	Output	Inputs	Labor	Capital	Land	
Private	13,097	1,191	22,304	179	-	(10,577)
Social	12,585	1,311	22,304	60	-	(11,090)
Divergences	512	(120)	-	119	-	513

**Farming System 2****Rainfed Upland Rice (UR)**

5.60 Rai

	Tradables		Domestic Resources			Profits
	Output	Inputs	Labor	Capital	Land	
Private	12,268	2,944	19,509	442	-	(10,627)
Social	11,788	2,680	19,509	147	-	(10,548)
Divergences	480	264	-	294	-	(79)

**Farming System 3****Paddy Rice (PR)**

6.17 Rai

	Tradables		Domestic Resources			Profits
	Output	Inputs	Labor	Capital	Land	
Private	13,306	1,810	11,066	271	-	159
Social	12,786	1,918	11,066	90	-	(288)
Divergences	520	(108)	-	181	-	448

**Farming System 4****LR PR**

3.00 1.88 Rai

	Tradables		Domestic Resources			Profits
	Output	Inputs	Labor	Capital	Land	
Private	8,957	997	11,729	150	-	(3,918)
Social	8,607	1,075	11,729	50	-	(4,247)
Divergences	350	(78)	-	100	-	329

**Farming System 5****UR PR**

4.50 6.50 Rai

	Tradables		Domestic Resources			Profits
	Output	Inputs	Labor	Capital	Land	
Private	23,884	4,273	27,341	641	-	(8,372)
Social	22,949	4,175	27,341	214	-	(8,781)
Divergences	935	98	-	427	-	409

**Farming System 6****PR Corn**

3.50 3 Rai

	Tradables		Domestic Resources			Profits
	Output	Inputs	Labor	Capital	Land	
Private	9,135	1,732	9,535	260	-	(2,391)
Social	10,410	1,583	9,535	87	-	(795)
Divergences	(1,275)	149	-	173	-	(1,596)

**Farming System 7****PR Soybeans**

8.50

6.00

Rai

	Tradables		Domestic Resources			Profits
	Output	Inputs	Labor	Capital	Land	
Private	45,536	4,749	32,262	832	-	7,693
Social	51,891	4,267	32,262	347	-	15,015
Divergences	(6,355)	482	-	485	-	(7,323)

**Farming System 8****UR****Corn****Soybeans**

4.00

4.00

4.00

Rai

	Tradables		Domestic Resources			Profits
	Output	Inputs	Labor	Capital	Land	
Private	29,004	4,546	29,614	762	-	(5,917)
Social	35,469	3,657	29,614	300	-	1,898
Divergences	(6,465)	889	-	462	-	(7,815)

**Farming System 9****PR****Corn****Soybeans**

6.00

2.00

2.00

Rai

	Tradables		Domestic Resources			Profits
	Output	Inputs	Labor	Capital	Land	
Private	23,067	2,982	18,606	487	-	992
Social	25,964	2,737	18,606	185	-	4,435
Divergences	(2,897)	245	-	302	-	(3,444)

**Table 12 Assumptions Table**

<b>Macro-Economic Assumptions</b>	
Nominal interest rate (%)	15%
Social interest rate (%)	5%
Official exchange rate	26.13
Exchange premium (%)	34%
Long-term exchange rate	35

**Table 13 Sensitivity Analysis**

	<b>Crops</b>	<b>Situations</b>		<b>Private profitability</b>		<b>Social profitability</b>	
				<b>Base</b>	<b>Results</b>	<b>Base</b>	<b>Results</b>
a1)	LR	Export Price increase:	10%	-1,322	-1,322	-1,386	-1,232
a2)	Upland rice	Export Price increase:	10%	-1,898	-1,898	-1,884	-1,677
a3)	Paddy rice	Export Price increase:	10%	26	26	-47	156
b)	Corn	Price increase to :baht/kg	5.00	-827	-299	-211	-211
c)	Soybeans	Price increase to :baht/kg	10.00	1,245	1,963	2,569	2,569
d)	LR	Output increase:	30%	-1,322	-831	-1,386	-914
e)	Upland rice	Output increase:	30%	-1,898	-1,240	-1,884	-1,253
f)	Paddy rice	Output increase:	20%	26	457	-47	368
g)	Corn	Output increase:	20%	-827	-722	-211	0.42
h)	Paddy rice	Output decrease:	10%	26	-190	-47	-254
i)	Soybeans	Output decrease:	40%	1,245	-568	2,569	284

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