



THAILAND SLUSE FIELD REPORT- 2008

Factors affecting the household economic in Ban Khlong Tu Rian: Case study on maize, cattle and tomato productions

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<u>Abstract</u>

Ban Khlong Tu Rian is one of the six villages of Nakhon Ratchasima Province located in Northern Thailand that SLUSE Course has taken as a target area for field work and is comprised of at least 73 household who their main commodities are maize, tomato and cattle as coping strategy for sustaining their livelihood through income generating. The main cash commodity is maize, therefore tomato and cattle constitute supplementary activities for the villagers. The present report aims at exploring various factors that influence villagers to choose theses commodities as their source of income. To accomplish our objective various methods such as questionnaire survey, semi-structure interview, PRA, soil analysis, GPS and informal talk were used for gathering all necessary information.

Our study revealed that maize and tomato suitable commodities for our village due to convenient to the agro-ecological condition but this production challenging with the constraints. For those who have enough resources to recover from the crisis tend to continue with these productions and those who less resource and small land tend to sell the land and shift to off-farm activity. In the next 20 years, there will be many people shifting from maize and tomato to off-farm activities.

Acknowledgement

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List of Abbreviation

BAAC	Bank of Agriculture and Agricultural Cooperative
GPS	Global Positioning System
SLUSE	Sustainable Land Use and Natural Resource Management
SPSS	Statistical Package for the Social Science

I. Background

SLUSE basic concept is that "the sustainable land use can be best understood by studying the Agro-ecological, socio-economic, institutional and policy consideration in combination" (Hill and Torben, n.d). We are very interested on this concept especially the acknowledgement of understanding natural resource management which cannot be adequately studied and understood from a mono-disciplinary point of view. Therefore, our major interest is for both theory and practical application for inter-disciplinary approach to understand the way of how people in Ban Khlong Tu Rian village respond to the current development and change in Nakhorn Rachaseema province, Thailand.

Nakhon Ratchasima Province, situated in low northeastern of Thailand where is often said to be a region with poor soil and not favored agriculture (Ekasingh *et.*al, 2004). Since 1980s, Northeast region has been a major spread of cash cropping in which the driving forces were proved to come from the impact of infrastructural improvement, desire of farmer and their ability to engage in cash cropping and role of private sectors (Rigg, 1987). Rigg (1987) emphasized that it was also accompanied by availability of credit and communication. Government and farmer play role in spreading cash crop in Thailand. An interesting issue is that the change in cropping pattern in commercial agriculture is related to variations in price. The past study showed that farmers were regarded as sensitive to economic stimulation and they were responding to price incentive (Rigg, 1987).

There are five major crops in Thailand-rice, cassava, sugarcane, rubber and maize in which maize occupies a major portion of Thai upland farmland around 33 percent. Maize firstly was introduced in Thailand in 1950 and become the most dominant strategic crop in northeastern and particularly in Nakhorn Rachaseema (Ekasingh *et.al*, 2004), our study province. However, the past patterns of land use of maize, farmers often cultivate on sloping land where is vulnerable to erosion. Low soil fertility are said to be resulted in low maize yield which is the third ranking reason contributing to low income (Pouliot *et.* al, 2006). In seeking other alternative crops, it is considered as being "either more risky or physically or socioeconomically unsuitable to these marginal farmers" (Ekasingh *et.*al, 2004).

Pouliot *et.* al (2006) argued that the rapid change occurred in the last five years where people start seeking for new alternatives. New trend appears in correlation to the increase of input price while output price more or less stagnant or even more declined (Ekasingh *et.*al, 2004). Most maize farmers show their unhappiness with high price of species and fertilizers. The survey on maize farmer by Ekasingh *et.*al (2004) in northeastern Thailand, including Nakhorn Rachaseema, proved "higher maize yield would not be possible without chemical fertilizers, but concurrently recognized the declined of soil fertility with continuous maize cropping". Comparing to other provinces, maize production in Nakhorn Ratchaseema contributes the smallest proportion (35.7%) of total household income. Profit from maize is very small; therefore, many farmers have quitted maize farming and switched to non-farm employment. Some farmers change from maize to other fruit trees such as lychee, longan, tamarind etc because these crops are important cash crop playing no least role than maize (Ekasingh *et.*al, 2004).

However, force factors driving farmer to grow maize apparently from Thai policy that aim to increase maize production to accommodate both the export and domestic markets (Gerbert, 2007). Pouliot *et.* al (2006) share concrete finding that it is farmer preference to grow maize themselves rather than incentive from outsiders. Furthermore, maize is easy to grow and has a low production risks compared to other crops (Gerbert *et.* al, 2007; Ekasing *et.* al 2004). It is

a drought and insect tolerant crop and allows farmer to cultivate double cropping. It is the best crop for rainfed uplands with good rainfall (Ekasing et. al 2004).

In such complex context, there is trend where small farmers can not tolerate with the process of development and change in Tambon¹ Wang Nam Khiao, and, therefore, transfer their land to rich farmers, some seeking alternative opportunity such as off-farm job and other alternative crops (Gausset and Jongkroy, 2007). Therefore, our main objective is to understand why people choose maize, tomato and cattle as main strategy for sustaining their livelihood. We will try to explore the answers of these questions by looking into particularly on coping strategy of villagers in the Ban Khlong Tu Rian is a village, Tambon Wang Namkiao, Nakhorn Rachaseema province.

II. Methodology

This study is designed to meet the objective of interdisciplinary where team members from different discipline agree on interdisciplinary methods to investigate the interrelated phenomena of ways in which villagers are coping with changes in the study village. Livelihood is a complex system which requires holistic approach so that livelihood strategy in coping with context is well explained. According to Yin (2003) and Denscombe (2007) case study approach is appropriate for this study. Our case study is a combination of participatory approach, semi-structure interview, small scale questionnaire survey, and soil sampling.

1. Pair wise ranking

Pair wise ranking was used to find out from villagers composed by the three main groups stratified into maize plus tomato, maize plus cattle, and off-farm activities in order to make the comparison between each main production such as maize, tomato, and cattle with input, out-put, labor, and risk. Cropping calendar was also drawn to understand the activities of main productions all along the year.

2. Key informants interview

12 key informants were selected using purposive sampling. They were asked to provide information for the overview of the study area, different coping strategies, problem and constraint in productions. Interview guideline was used to collect the information. They are local authorities such village chief, TAO member, elder to the village, off-farm people and households who work on maize, tomato, and cattle. Informal talk was also done with villagers and with staff of KU-SLUSE who are knowledgeable about the studied village. Information was recorded. Field notes were written up and categorize in the table around the main theme for analysis.

3. Questionnaire survey

36 respondents were selected stratified random based on three main strata (table 1). This number of respondent is within the range 30 to 250 suggested to be suitable for small scale questionnaire survey (Denscombe, 2007). Data was coded in SPSS 12. Frequency, Cross tabulation, Compare mean, Chi-square test, Visual Banded, compute and correlation and other tools were used in the analysis.

Group	Maize + tomato	Maize + cattle	Off-farm	Other*	Total
Number of household	20	20	21	12	73
Selected sample	11	11	12	0	36

Table 1 Selected stratified random sampling

*This household were excluded from our strata because they do other activities that out of our focus

¹ Sub-district

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3. Soil sampling

Two plots of maize land for collecting soil sampling were identified from questionnaire survey based on the level of fertilizer used and yield that farmers gained (Table 2). We chose one plot where farmer applied much fertilizer and get high yield and another plot where applied less fertilizer and get less yield (See table below). Our aim is to relate soil fertility with soil erosion with different slope linking to the productivity.

	Selected p	iot for som sa	mpning						
Plot	Land side (rai)	Maize yield (ton)	Fertilizer (kg)	Type of fertilizer	Maize(ton) /rai	Fertilizer(kg) /rai	Soil type	Slope	Land use history
Farmer A (#227)	60	60	9000	16.20.00	1	150.00	Li-C	4.6 %	grow only maize more than 30 years
Farmer B (#236)	45	28	4000	16.20.00	0.62	88.89	ML	22.1%	grow only maize more than 30 years

Tahla	2	Selected	nlat for	coil	sampling
rable	4	Selecteu	piot 101	5011	sampning

From identification of the slopes, we divided the slope in three equal intervals (see scheme bellow)



Sample was selected along the perpendicular line across the slope and in both levels (lower and upper slope) 7 samples were taken in plot A, making random composing for analysis in each level. And we did the same with plot B but in this plot three samples were taken in each level because the plot wasn't wide enough, therefore we thought that three samples in each level were enough to represent the field. In this case, no random composing. Short interview was done with land's owner to get the history of land use such as fertilizer use, and yield. GPS was used to demarcate the point of sample and maize plot and also to measure the slope. This data was used to combine with Arial photograph and soil map to see the location of sampled plot and to know the soil type. Test kit was use to measure pH, N, P, and K content.

Arial photograph of the sampled field







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1. Setting of the village

1.1 Main economic activities

Village was establishing in 1967. At that time the sub-district was called Sakeorat and later on was changed to Wang Nam Khieaw. Since that time people start growing only maize as main production in the village. Now many people grow maize, tomato and raise cattle as their source of income but also about 34% of people involve in off-farm activities. Recently the price of maize increased remarkably that makes the maize grower fell pleased. This is apparently because high demand of maize for producing bio-fuel ethanol.

Table	Table 3 Timeline of Ban Khlong Tu Rian village							
Year	Duration years	Order of event						
1967	41	 This village's name came from the fact that there were many durian trees along the canal when the first group of villagers arrived This village was founded by 16 households who migrated from Lopburi province. The place initially was a forest and they had to move and clear the area for maize production The 16 households owned 400-500 rais each 						
1978	30	- Begin to use fertilizer in the village.						
1988	20	 SPK organization redistributes land for the villagers (50 rai/household) Maize production started having problems, changing from traditional to new hybrid which they had to purchase. Started using the tractor 						
1993	15	 Changed from Sakaerat sub-district, Pakthongchai district to Wangnamkhiao sub-district, Wangnakhiao district 						
1998	10	 People got server lose from maize and sold land pay for debt Started growing tomato Village savings fund group for production established 						
2000	5	 SPK04-01 was allowed by Taksin Sinavatra government' policy put in the bank for getting loan. Land price remarkably increased People got server lose from maize and sold land pay for debt Remarkably land selling 						
2006	2	 SPK04-01 was not allow to use for bank loan any more Influx coming of resort 						

From the table, we can see that livelihood strategy of villagers has been change since 1988 when the land was reformed. Main production, maize, has been change from traditional species to hybrid for commercialization. Tomato has become the new strategic crop since 1998 when the first serious loses of maize production occurred and some maize lands had been sold.

1.2. Land use and land tenure

Maize is dominant cash crop in the village approximately account for 88% of land. Only 3.57% grow tomato and 7% is for other agricultural production (figure 1). Cassava shares very small proportion of land because it is not suitable to soil condition. In general manner, maize is not only dominant crop in our village but also in other villages in Wang Nam Khieaw (figure 2).



Figure 1 Proportion of land use in studied village

Figure 2 Proportion of land use in 6 villages

There are two main land tenure SPK04-01 and PBT in the village. SPK04-01 refers to land title issued by the Agricultural Land Reform Office. PBT is not a kind of title but a kind of invoice to pay tax for land use issued by Department of land (Duangpatra, 2008). Both of them are not allowed to sell, to guarantee for loan or transfer, but transfer can be done only by inheritant. However, people still sold their land. The contradiction between the law and practice create the complication of land tenure and it remains unsolved. However, the problems of land selling and shifting to off-farm are strongly bound to maize production and the increase of land price.



The dominant land tenure is SPK4-01 which is mainly village land (70.49%, figure 3). Nearly 13% is land title that has tax paid receipt. 16.61 % of land was rent by villagers last year. None of villager acquire land in the last 5 year but 9% out of 36 respondents reported that their land have been transferred in last 5 year. Comparing to other villages, Khlong Tu Tian people had least rent the land (figure 4).

Because Wang Nam Khieaw situated near the Khao Yai National park covering by natural forest and Khao Phaeng Ma reservation zone with some reforestation, this area became the focus spot of tourism investment since the last five years. The influx arrival of resort began in last two years. Many resorts were built. Therefore drastically increase of land price is attracting villager to sell their land and seek new alter natives.

2. Maize

In accordance with the information obtained from various source such as semi-structured interview, PRA, questionnaire survey and informal talk with villagers and outsider it was verified that the main reasons that make villagers to chose maize as their coping strategy are constituted by the following points: maize is considered to be suitable to their agro-ecological condition, short rain season crop and short life cycle.

Maize also constitutes an historical practice since the village has been settled. For them, learning how to grow other commodities would be a waste of time because they always get benefit every year from growing it. Therefore, they understand they have access to use equipment (tractor to plough the land and at the same time they can apply fertilizers). Growing maize is low cost of production and easy to look after. After first planting, they let it grow and then harvest. Hence, no need of taking care as it is done with tomato. It is almost a safe crop for them, less problem with plagues, good price and market accessible. When the price of maize increases they gain more, they can keep some part of the harvest to feed their animals such as chicken and pigs. In addition, during the discussion held with the villagers, they referred to us that Wang Nan Kiaw in term of the weather is the suitable area for maize and tomato production in Northern Thailand.

This finding is supported by Ekasing *et* al (2004) who argue that, maize is easy to grow and has a low production risks compared to other crops. Hence, it is a drought tolerant crop, insect tolerant, allows double cropping and is the best crop for rainfed uplands with good rainfall. In Nakhon Rachasima province, most of the maize production is first season maize, from April to June (Periods of early rain). Therefore, Ekasing *et* al (2004) refers that currently maize is utilized for animal feed, with the range of 80-100% production being sold to commercial poultry and livestock feed mills. There are three groups of maize farmer's producers, and these are poor, medium and rich farmers. Therefore about 5-20% of all maize growth is consumed as food in form of white corn or sweet corn.

2.1 Who benefit from maize²

Analyzing questionnaire survey showed there is no difference in term of net-income per rai between the grouped land sizes (p = 0.566). This means that for 1 rai of land, people who have small land get almost the same net-profit to those who have big land (see table 4).

Maiza land	No of	Maize net income(Bath)
classification (Rai)	househod	Subset for $alpha = .05$
		1
1 to 10	4	3535.83
11 to 20	6	2909.36
21 to 30	2	2020.30
31 to 40	3	3799.34
41 to 60	4	2377.63
Sig.		0.177
Significant among gr	ouped lands is	s p = 0.566

Table 4 Maize net-income per rai

 $^{^2}$ The result obtained for this section was analyzed by using one way ANOVA (post hoc, ducan) tool *By Group 1: Kimlong, Enoque and Ataulfo*

The difference shows very clear when total maize net-profit per household was calculated according to the different grouped land. We found that those who have land less than 30 rai got significantly less net-benefit than those whose land is bigger than 30 rai ($p = 0.005^*$) because big land give large amount of out-put influence the total income. Table 5, column number 2 distinguish between these two group.

	Maize land	No of	Percentage of	Maize net-income			
		household		of Subset for alpha = .05			
		househ		1	2	3	
	1 to 10 Rai	4	21.1	16840.00			
	11 to 20	6	31.6	51183.33			
	21 to 30	2	10.5	57877.40	57877.40		
	41 to 60	4	21.1		<mark>122912.50</mark>	<mark>122912.50</mark>	
	31 to 40	3	15.8			143081.33	
	Sig.			0.236**	0.058	0.532	

Tabla	5 Maiza	not_income	nor house	hold hy	difforant	arounad	lond
Lanc	JWIAILE	net-meome	per nous	choiu by	unititut	groupeu	lanu

Note: * The significant of among the groups is p = 0.005 ** The significant among the subset

The same analysis for maize expenditure showed that there is no difference in term of expenditure per rai (p = 0.715) but in term of expenditure per household, we found that those who have land less than 30 rai significantly less expend compare to those who have land bigger than 30 rai (p = 0.000). But looking back to net-income per household (table 5) tell us that those who have land bigger than 30 rai still got much more net-income than those who have land less than 30 rai. This clearly give the picture that those who get more benefit from maize are those who have big land size (particularly more than 30 rai).

This finding strongly support to the finding from semi-structure interview and participatory group discussion that adequate land size for growing maize is very important generate adequate income for sustaining villager's livelihood.

"Currently 10 to 20 rais is not enough for growing maize for making sufficient income" said a Chhalee, 40 year old man. "40 Rai is good enough for growing maize but the income from maize is not enough for me to feed my children" said a 40 years old lady who sold her maize land.

"We grow tomato because, maize is not enough to sustain our life" said one lady during the group discussion.

The quotation above implied that 40 rai is the optimal land size that can maximize maize income but the land size between less than 30 rai as categorized seem not to be enough to sustain their livelihood. Therefore, we notice that most people who grow maize always grow tomato to get additional benefit. The picture below is an example of a villager who has big land and has high maize production and has enough capital to pre-process maize and sells to big factories.



Maize commercialization of big land owner

2.2 Applying more fertilizer not a good strategy for more income

Fertilizer is the most dominant expenditure for maize production. From semi-structure interview, we found that in our studied village the soil fertility declining. Therefore, if people do not apply fertilizer, they would not get good yield. This implies that the more people apply fertilizer, the more yield people are expecting to get.

However, analyzing the questionnaire survey we found that there is a trend of applying more fertilizer per rai which seems that villager gain high output of maize per rai but this gain seems that it does not correspond to the amount of fertilizer applied. Therefore, the contribution of fertilizer to yield may not imply the good income especially when the price of fertilizer increases.

Table (Table 6 Maize yield per rai and fertilizer used per rai									
Maina land	No of	Maize	Yield	Contiline (log/noi)	Fertilizer					
Maize land	nousenoid	yield(ton/ral)	Sta.dev.	Fertilizer(kg/rai)	Sta.dev.					
1 to 10 Rai	4	1.08	0.119	127.78	52.558					
11 to 20	6	1.05	0.055	107.22	18.156					
21 to 30	2	0.90	0.141	142.59	34.046					
31 to 40	3	0.96	0.072	108.33	38.188					
41 to 60	4	0.86	0.163	102.22	34.175					
Total	19	0.98	0.131	114.40	34.020					

In fact, there are many factors that contribute to high yield such as soil fertility, plain or slope land. However, we tried to build the model of maize production base on the assumption that fertilizer is most dominant factor to generate good yield. The result from regression was used to construct the maize yield model as follow below:

Y = 15065 + 2.95 X, ($R^2 = 0.995$, Significant p = 0.00)

This model implied that if we increase 1 kg of fertilizer we can increase yield about 2.95 kg. If the maize price is 7-8 Bath per kg, the increase of maize income is equal to (2.95*7) 23.5-(2.95*8) 23.6 Bath while the price of fertilizer 1 kg is equal to 24 Bath. Therefore, increasing fertilizer in maize field may not imply to increase good income. So the factor contributing to maize income may fall to the previous discussion that size of land is the most dominant factor that contributes to high income and net income. However, this model is just to practice way of learning. The many high rate of uncertainty. Actually, to get

2.3 Constraints in maize production

appropriate result, we need more number of respondents.

The main constraints for maize production in Ban Khlong Tu Rian are: drought, high input prices, land size, high interest rate from the middlemen and declining of soil fertility.

2.3.1 Drought

Semi-structure interview with villagers who work in off-farm activities showed losses in maize production caused by drought and that led farmers to sell their land in order to get money to clean their debts with middlemen and the BAAC. In both cases they have to put the land as a guarantee

According to villagers it appears that drought happens every year, therefore it depends on the intensity to affect maize production. This situation was also reported by Ekasingh *et*.al (2004) who argues that drought and dry spells are the first rank of constraint in maize production of the Northeast Thailand.

Maize, tomato and cattle, even with drought, are high income generators making the farmer take this risk.

2.3.2 High prices of inputs

The high price of inputs is due mainly to the increase of the price of seeds and fertilizers. From semi-structure interview we found that farmers complain about the high price of fertilizers. As discussed before, increasing the use of fertilizers may no imply good income.

This high price of the seeds limits the accessibility for good varieties to poor farmers and also increases the expenditure for the crop, both, for the seed and for the fertilizers, being a major constraint for those farmers that have less land and therefore less total outcome compare to the one from bigger lands.

This is accord to the literature review. Ekasingh *et*.al (2004) conclude that the price of the inputs are increasing through the years, while the output prices still the same or are going down, as they consider labor and material inputs supply constraints. This produce lower farm profits, especially for poor and marginal farmers that are the first ones to quit maize production when the profits decrease or disappear.

2.3.3 Declining of soil fertility

From semi structure interviews with the headman and other key informants we found that villagers are worried about the intense use of fertilizer that produce high yields in short term but in long term decrease soil fertility due to the burning of soil.

Mr. Sida, a former headman of the village said that he uses fertilizer because if he doesn't use it the production would be lower. Farmers plant the same crop every time and that's affect the fertility. People don't change their soil management because they don't want to take any chance in lowering their productions. So they prefer applying high amount of fertilizers to ensure a good yield.

The land topography in our study village is sloppy and undulate which face the soil erosion while growing the same crop, the soil fertility tend to decline.

From our soil analysis, we found a lot of variation along the results. Many reasons could affect the variation of the values. For example one could be the differents methods for applying the fertilizers (by hand or by tractor). Another could be the moment in which we made the sampling. As we made the sampling out of the growing calendar of maize, if we make the sampling during the cultivation, we should get others results.

Taking few samples, probably are not enough to represent the fields, making more difficult to identify the variations and also to get a clear conclusion from them. Therefore there are difficult to relate to the farmers yield, fertilizer application and productivity, and therefore income. The results don't help much to our objective so we are going to comment only this (see appendix).

These constraints constitute major factors affecting maize production. We presume that some villagers that are growing maize actually as principal cash commodity, due to these constraints and other factors, will shift to off-farm and non-farm activities.

3 Tomato

3.1 Tomato economic

Normally tomato is labor and capital intensive and also requires a lot of water; therefore people grow tomato on only 1 to 2 rai of land per household even if they have much more land for growing tomato. Base on pair wise ranking in term of output per rai, tomato have the very high output compare to maize. Group discussion reveals that normal yield of tomato is 10 tones per rai.

Majority of expenditure is labor renting following by fertilizer expend and species expenditure (Figure 12). Therefore, if the price of input supply increase (especially labor rent) this production is harm to get lost.



Figure 5 Source of tomato expenditure

Tomato are said to bring high profit but also high risk.

"Tomato can bring the cultivators rich immediately but also poor immediately as well" said village headman.

Table 7 shows the profit and lost of tomato production.

Table 7 Profit and lost of tomato									
Tomato profit classification (Bath)	Ν	Percent	Mean of tomato profit (Bath/hh)	Std. Deviation	Minimum	Maximum			
<= .00	4	30.77	-12725	6750.37	-18000	-2850			
1.00 - 50000.00	5	38.46	12956	7740.44	4250	24500			
50001.00 - 100000.00	1	7.69	97050		97050	97050			
100001.00 - 150000.00	2	15.38	111000	9545.94	104250	117750			
150001.00+	1	7.69	204900		204900	204900			
Total	13	100.00	41371.53	68159.33	-18000	204900			

 Table 8 Tomato price that bring profit

Tomato price classification	Ν	Mean price	Price min	Price max	Tomato profit	Profit min	Profit max
<= 3.00 Bath/kg	4	2.63	1.5	3	-1450	-15650	8450
3.01 - 6.00	4	5.50	5	6	49250	-18000	204900
6.01 - 9.00	3	8.17	7.5	8.5	106350	97050	117750
9.01+	2	10.00	10	10	13790	11680	15900
Total	13	5.92	1.5	10	41371.54	-18000	204900

By Group 1: Kimlong, Enoque and Ataulfo

It seems that the price of tomato determine both profit and losses. From semi-structure interview, questionnaire survey, and group discussion prove that price of tomato is much fluctuated and it possibly rank from 1.5 to 20 Bath/kg. Comparing table 6 and 7 we see clearly that those who sell the tomato at price 3 Bath/kg got lose. People argue that they can get the break even point if tomato price rank from 3 to 4 Bath/kg.



Figure 6 Compare tomato profit according to classified price

However, by transforming table 8 into box plot (figure 6), we found that there big variation in term of profit and losses related to the price ranging from 3 to 6 Bath. By crosstabulation between tomato profit and price, we found that there are villagers who profit at price 3 bath and vice versa and there are those who profit at the price of 5 Bath. But there are also villagers who got big losses at this price as well. This implies that not only price that determine profit but also other expenditures such hiring labor and input supply, or diseases that lower the yield. Therefore, the price of 3 Bath seems to be true as break even-point of tomato production. But there are some people who got big losses and big profit from this price implying that tomato production is highly uncertain to get profit. However beside price, and other technical risk, tomato production apparently challenges to the increase price of labor and input supplies that make this production is risky to lose.

"The most problem in agriculture in the village now is lack of labor and the increase rent of labor", said Mr.Chhook Di, knowledgeable elder in the village.

"We grow tomato because, maize is not enough to sustain our life" said one lady during the group discussion. How their livelihood will be sustained if tomato so risky like this. In such condition will people still going to grow tomato?

3.2 Factors influencing villagers to choose tomato

As we went interviewing people we have realized that they choose growing tomato as their supplementary commodity as a source of income because tomato has opportunity to bring very high profit. They have plain access for tomato market. Therefore, tomato is one of the vegetable crops that is mainly grow in northern region of Thailand. By cross-checking

information obtained from the field with literature, Changchan (1993) emphasize that tomato is one of the most common and popular vegetable crop in the world. Therefore, the production of tomato and other vegetables has been introduced in northern Thailand in early 1970 and intensified in 1980 (Hau and Oppen, 2004). Tomato market is considered to be strong comparing with other kind of vegetables due to the fact that tomato can be consumed freshly as salad and processed as tomato source or integrate another kind of meals. Therefore tomato can be sold in informal contracts between the farms and tomato traders at farm level or using formal contracts by placing directly at the market (Hau and Oppen, 2004). Furthermore, it reported that tomato market and production has different set of assumptions than any other vegetables (Hau and Oppen, 2004). Price variation or fluctuation was also reported as one of the situation that occurs with tomato market comparing with other commodities (Hau and Oppen, 2004). Hence, our field work had the similar results as those reported above.

Comparing tomato and maize in terms of net-income maize appears to be constant and tomato presents oscillations. We tried to design some graphic using data from SPSS but it was not possible to explain clearly due to the variation of numbers.

The same situation happens when using price as a factor of comparison. Maize has constant price while tomato present many fluctuations. Our result from semi-structure interview, questionnaire survey, PRA and informal talk, seem to be supported by the researchers cited above. Anyhow, Villagers opt to choose tomato as a supplementary coping strategy for sustaining their livelihood. This is to the market access. Therefore, we found that tomato as a commodity constitute a good fight-back.

3.3 Constraints in tomato production

The constraints for the farmer that we found are the fluctuation price in the market, diseases, high price of inputs, labor intensive, high interest rate from the middleman, disconnection from the market due to the relationship middlemen-villager and water limitation.

Even knowing about these constraints, farmers grow tomato because they expect to gain a lot of money from this production. It's a good complement with maize and provides an extra income. Pair wise ranking show that tomato production is the most risky compare to maize, cattle and off-farm activities.

3.3.1 Fluctuation price in the market

We found that the fluctuation of price is the main factor that affects the tomato production income. This finding was supported by Hau and Oppen (2004) stated tomato price in the market is fluctuated comparing to others commodities and make farmers sometimes win and sometimes lose.

As shown discuss earlier, with prices lower than 3 or 4 Baht/kg the farmer will get suffer lose in his/her production.

The price of the tomato in the market depends on the quantity and the quality of the tomato, but both of them mainly are uncertain for the farmers, as they sell everything to the middlemen and it's this one who decides the price and the quality of the production considering the market aspects.

As a seasonal crop, the amount of tomato in the market varies day by day as tomato cannot be store like the maize, so it has to be sold at the price of that day.

3.3.2 Diseases

Tomato production in our village is affected by a disease. Farmers think it is fungus. This plague it's out of control, finding the disease every year. Farmers spread a fungicide provided by sell mans from Bangkok and Korat province. These sell mans act as researchers. They test the products and tell the farmers which product could work. But still no product was efficient against this plague.

Farmers seem not to have a solution. They don't really know which disease it is and which kind of chemical are using with a possible consequence in the consumer health. From semi-structure interview we found that villagers find learning this kind of management a waste of time.

As a protection strategy, they change the tomato field every year but even making rotation, the closeness of the fields allows the fungus spread easily, knowing that sometimes the spores can travel a long way with the wind.

"Tomato disease is difficult to solve, unless farmer change the variety. Otherwise tomato will disappear from the village" said Mr.Chhok Di, elder in the village.

Nath et al (1999) says that tomato is very sensible to disease. Very few varieties are locally available that are tolerant or resistant to biotic stresses. During the summer season, production is seriously affected by the diseases. When farmers have to depend on seed imported from temperate zones their crops become highly susceptible to tropical pests and diseases

3.3.3 High price of inputs

From questionnaire and semi structure interview we found that they complained about the high price of inputs. Pair wise ranking show that tomato need high amount of input compare to maize. Tomato production requires big use of fertilizers. Farmers will expend much money in fertilizers for a very risky crop. But they expect to obtain a bigger yield and get high prices for the output.

Also the accessibility to seeds of productive varieties and those tolerant to diseases is limited with these high prices, mainly for small farmers or poor farmers, limiting their productions.

To off-set the increase of the price of chemical fertilizers, some tomato farmers combine chemical fertilizers with organic manure to reduce costs, maintaining the productivity and therefore increasing their economic return.

Nath *et.* al (1999) states that the most vital input is a quality seed. The cost of imported or locally developed hybrid seeds, and even some OP varieties, is too high and are beyond the reach of the resource poor farmers forced to grow traditional varieties.

3.3.4 Labor intensive

Tomato needs a lot of care during the production, so that means high cost of labor for taking care of the tomato plants and for harvesting and management of the crop.

From semi structure interview we found that farmers plant no more than 2 rais of tomato. More rais means more care of the plantation involving higher costs. From PRA we found that for use of labour, tomato is ranked in the first place.

3.3.5 High interest rate from middlemen

As discussed for the maize production, the middlemen provide inputs or money to the farmers at high interest rate but for tomato maybe is a bigger problem because the production is more risky and they can suffer bigger loses, also needs more inputs.

3.3.6 Disconnection from the market due to the relationship middlemen-villager

From semi structure interview and informal talk with villagers, we found that tomato farmers sell all their production to the middlemen that it's the one who sells the product in the market.

As the middlemen is a merchant, he has to take his percentage from the operation, so he could offer to the farmer low prices and take his income from the sells.

There is much uncertainty in this merchandising and how the middlemen deal with the farmers. The Thai group refuses to make any interview with the middlemen because it's a sensible theme.

This relationship middlemen-farmer disconnects the farmer from the market.

Based on the information gained from semi structure interview and informal talking, it seems that the diagram of the tomato merchandising is this one:



By informal talking, we found that may be 2 grades of middlemen, one the middlemen from 79 market and over him another related to the government that provides the first one with money. About the second middlemen we weren't able to confirm this information, as we couldn't make an interview with the middlemen at 79 market.

Nath *et.* al (1999) states that crops are produced without any knowledge of the market demand and farmers are then at the mercy of middlemen who offers low prices. Low prices may also be due to the poor planning of the crop calendar. Growers do not have planned programs targeting market demand. Advancing a tomato crop by two weeks earlier than the main season by raising seedlings well in advance or by choosing earlier varieties will help farmers to get

the first harvest earlier than others and obtain premium prices. In most instances the middlemen's exploit farmers (Nath et al, 1999).

3.3.7 Water limitation

Tomato production need high requirement of irrigation. The tomato production in our village is localized along the river margins. They use the water from the river to irrigate the tomato fields. As the area near the river is limited, also the land for growing tomato. That's another reason for growing on only 1 to 2 rai of land.

4 Cattle

From semi structure interview and from group discussion, the result shows that cattle raising is just a supplementary income. People sell cattle at any year but not every year. 1 head of cattle can sell about 12000 Bath. If they can sell one head a year then cattle contributes to household income about 12000 Bath a year. People mainly raise cattle for commercialization only. Figure 7 By excluding the big cattle raiser who own 130 heads of cattle in Hhong Tong Pattana village in analysis, give the picture that in our studied village, people raise more a mount of cattle compare to other village (exclude Sufficient economic village where villager were provided the cattle by the project).



Figure 7 Number of cattle compare across studied villages

However, from pair-wise ranking, villagers revealed that even cattle have good market access comparing to maize, but in tern of labor input, cattle require a lot of household labor input to take care and look after.

"Huh! raising cattle waste a lot of my time and I got income from it but I don't sell it every year" said on cattle raiser during pair wise ranking.

4.2 Factors influencing villagers to raise cattle

4.2.1 Benefit of cattle

Semi-structure interview showed that cattle production is an activity of long term and it appear to secure livelihood of many villagers in case of agricultural failure, have good market access, good price, and generate good profit, is a big financial resource reserve and constitutes a fight-back or rearguard activity for household economy. These are the factors that drive villagers to choose cattle as a supplementary commodity for coping strategy for sustaining their livelihoods. The information above is supported by Mandalay (2001), who argues, livestock has a considerable role in Agriculture, hence, cattle and buffalo apart from providing nutritious food for populations, they are also considered as a financial reserve, source of income and draft power for cropping and, as a means for transport for the rural community. Furthermore, a head of cattle bought at a price of about 5,000-6,000 baht can be sold for 8,000-10,000 baht at a livestock market or slaughterhouse meaning a higher income generation for rural communities (Mandalay, 1998).

Table below shows the number of villagers who grow cattle, the number of cattle per villager, purchase price, sale price in baths and economic return. Also it is possible to see that the purchase price and sale price of a head vary from household to a household.

Name Of villagers	Number of cattle	Purchase price (Baht/head)	Sell price (Baht/head)	Economic of return
Amorhrat	7	6,000	15,000- 20,000	9,000
Mrsee	4	6,000- 10,000	22,000	16,000
Ting	7	6,000- 10,000	20,000-	14,000
Prayur	7	5,000- 6,000	11,000- 12,000	6,000 - 6,000
Sanit	30	6,000- 10,000	15,000- 20,000	9,000 - 10,000
Headman	31	6,000- 8,000	10,000- 20,000	4,000 - 12,000
Toe	15	6,000- 7,000	12,000- 20,000	6,000 - 13,000

Table	9	Benefit	of	cattle
ant	,	Denem	UI.	cattle

4.2.1 Education level of villagers

In general it does not mean that those raise cattle need to have high education. Statistical analysis gives an impression that there relation between raising cattle and education level. We found this when we make crossable between education and raising cattle variable (Village 1,2,3,5 and 6, village 4 is excluded because people was provided the cattle from the royal project) by grouping education level into 0 (illiterate and primary school) and 1 (secondary school and above), this crossbabulation is significant different (p < 0.05) implying that education level have significant relation with choice of raising cattle and those who do not raise cattle. This study could not find reasons to explain this relation. We just want to give an impression.

4.3 Constraints in cattle production

From semi structure interview and questionnaires and pair wise ranking along with informal talk with villager, we found that the main constraints for cattle are the lack of grace land and when drought occurs, lack of drinking water and less pasture. No diseases constraints were reported.

4.3.1 Lack of graze land

Most of the land is occupied by agriculture activities, so there is a lack of grace land. When the crops are harvested, they graze the cattle in the corn fields, for example. For this reason they import fodder to feed the cattle, offsetting the lack of graze land. Maybe all of them import fodder or maybe one import and the others buy the fodder from the first one. Not only Khlong Turian village but other villages reported to have insufficient grazing land (figure 8).



Figure 8 Availability of grace land by each village



Feed for cattle

Cattle raisining

4.3.1 Lack of drinking water and pasture

Drought is also a constraint for cattle raising. During drought period, lacking of drinking water for the cattle can cause the cattle death. Even it was not reported to be important issue; drought also reduces the availability of pasture for the cattle. Therefore, importing fodder to offset shortage of pasture is the strategy of cattle raisers.

5 Off-farm people

5.1 Off-farm activities

Based on semi-structure interview we found that those who involve in off-farm activities are those who don't have agricultural land. They used to grow maize production but their land was sold in the last ten year and the last five year.

> "Now a day, among 8 households, there are 3 household decided to sell their land and involve off-farm and non-farm activities" said Mr Chhok Di, a knowledgeable elder in the village.

Figure below illustrate main sources of income of off-farm people.



Figure 9 Proportion of income of off-farm people

The pie above shows different sources of household income. Selling labor refer to non-farm activities such as construction work, factory work or other source of employment. Other non-farm refers to activity that people involve their own non-farm activity such as grocery at home, driving taxi, building house working in the resort etc. It is not surprisingly that the off-farm people have major income from non-farm activities. However, off-farm job on maize and tomato farms still plays very important role in supplementing income to some households. Even the statistical data shows the small proportion of income from farming (12.5%) but from the semi-structure interview with off-farm people and participatory group discussion show that working in maize and tomato farm is major income for those who do not have non-farm activity completely. Base on cropping calendar show that maize and tomato farm provide off-farm job all a long the year.

Off-farm people usually less borrow the money from credit sources compare to those who involve in maize and tomato farming. They tend to borrow from relative and village fund rather than from BAAC (figure 10). This implied off-farm people have less risk to have dept compare to on-farm people. In general comparison amount of borrowing with other village, our study village have the less amount of borrow than most other villages.



Figure 10 Amount of borrowing from different sources in village



Compare to surrounding villages, the number of people involved in off-farm activities in our village is less than the other five villages. There is significant difference of number of off-farm people between the villages (p = 0.009). This implies that there is trend of transfer from farm to off-farm activities in Wang Namkhieaw region (see figure below).



Figure 12 Comparing different work forces in different villages

Turning to our studied village, comparing between the group, there is significant difference between number of persons working in their own farm, working in off-farm and working elsewhere among the groups (p = 0.000, 0.001, 0.000 respectively, figure 13). But there is no significance different among the groups in term of total use of labor to sustain livelihood (p = 0.713) meaning that to sustain livelihood in each strategy (off-farm and farming) people invest almost the same labor.



Figure 13 Compare number of labor force between groups

5.2 Income off-farm people

Table below illustrates the classification of net-income of off-farm people.

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Classified net-income	Number of household	Percent	Cumulative Percent					
<= .00	3	25.0	25.0					
1.00 - 10000.00	2	16.7	41.7					
20001.00 - 30000.00	1	8.3	50.0					
30001.00+	6	50.0	100.0					
Total	12	100.0						

Table 10 Classification of net-income

We can see that that most of off-farm people have positive economic profit except some households who statistically show the negative economic. The negative sign may be because of fix standard of calculation based on interview and other strategic source of income may not have revealed during interview. But it is apparently because they have a lot of children in the household. From correlation table (see appendix), we found that there is strong significant correlation between expenditure and number of children in a household.

The pre-conclusion give us a picture that there are three main sources or factor contribute to their income fist is non-farm job, number of people working elsewhere, and off-farm activities and number of people working in off-farm.

In off-farm people's perspective, they don't really want to go back to agriculture or cultivate maize because off-farm and non-farm work can sustain their livelihood. In their point of view doing agriculture is high risk.

5.3 Reason for choosing off-farm work

Usually off-farm people are former experienced maize producers who choose to sell their land because they had serious losses in maize production. This session discuss deeply why people sell their lands.

There are various reasons that led people to practice off-farm activities as their supplementary source of income. In our study village we encountered with two types of people who are involved in off farm activities as mentioned. First, people who sold the land because they could not pay the debts from loans contraired in Banks or with middleman and second, young people who by their educational level felt to search for another type of activities.

5.3.1 Selling for paying debt

Former maize producers who had lost their land because could not have sufficient production to pay back the loans they had contraired from agricultural bank or from the middleman. So they sold their land in order to get some money to cover the debt and then because of not having other things to do they started working on off farm activities.

5.3.2 Young generation seeking new alternatives

Another reason is related to young people who have acceptable education and preferred to be contracted by big farmers whose intention was to have a Clark during the harvest season or during the plantation to write and supervisor the work of other employees.

All the information stated above is in accordance of what we found during the semi-structured interview, questionnaire survey, informal talk and PRA. Therefore we may refer that is also supported by information obtained from literature review as it appears in continuation of this session.

Rief and Cochrane (1990) discuss that decision for villager's members of a household to work outside the family farm and to work in other occupations than farming could be related to the value of time within the household and in alternatives outside the household or the household farm. Therefore the value of time in the household could depend on the individual's own conditions and on the resource endowment of the household as well as the standard of farm technology, hence the value of time in the village would therefore depend on availability of good wage employment if considered in general and the demand for particular individual abilities. Off Farm activities can increase with the family size of the household (Rief and Cochrane, 1990). To this, it should be considered that tendency of villagers on shifting their labour within the agricultural sector could be explained as resulting from change in relative prices, of land development, or of technological changes whereas a transfer of labour to nonagricultural sectors may probably arise from change in the composition of the aggregate exigencies. Another condition should be that off Farm activities can greatly increase with the family size (Rief and Cochrane, 1990). The level of education can contribute significantly on the effect off -farm activities and productivity. The off-farm workers can therefore be distributed among the following activities. Construction, transport, sales, self-employed and other industrial occupations. Nevertheless, the quality of school between sexes can be connected to the fact that men tend to have higher wages than women's. Therefore, the decision of a family to send males to off-farm more than the female is likely to be influenced by the higher wages that are paid to men and also by the relative efficiency of women at home (Rief and Cochrane, 1990). The possibility of on-Farm may have a significant influence on wages off-farm. To this, those workers who own more land may also earn higher wages (Rief and Cochrane, 1990). Rief and Cochrane (1990) discuss that the interesting aspect was related to younger and more educated who at their time were more likely to have of a primary job of off-farm.

6. Other alternatives

We found in the semi-structure interview that it seems very difficult to find other alternative crops to replace maize and tomato. Even the there are very few household start growing cassava in the village but people perceive that this is just a trail cultivation.

"It is impossible to replace maize by growing cassava because cassava is not fit to soil condition in the village, require a lot of labor for both growing and harvesting" said village headman.

"It is difficult to say that people will seek other alternative crops for sustaining their livelihood because they are not patient enough to wait the result, but it is easy to say that people will sell the land and involve in off-farm activity" said Mr.Chhok Di, knowledgeable elder in the village.

As chicken raising is mainly for home consumption, it seem that only cattle are animals fit to socio-economic condition of villager.

People in our village use to raise pig but this activity fail to generate profit to people. "Previously, there was a project from village development fund encourage people to raise pig but the feed is expensive and when I sell I got very low price which can not compensate to my expenditure. Therefore, I stopped raising pig. Not only me but every one met the same problem like me"

IV. Discussion

Turning to our objective which focus on "why people choose maize, tomato and cattle, as the main strategies for sustaining their livelihood", or their option on off-farm activity, our discussion aims at triangulating information to address our objective. The results obtained from questionnaire survey, semi-structure interview, PRA and informal talking demonstrated that these commodities are suitable for agro-ecological conditions, are short term productions, have good market access (high price, facility for transportation, contract market with cooperative and traders etc). Tomato price in the markets has fluctuation; even though tomato production is risky, villagers continue growing tomato because they expect high profit from it. Cattle are supporting financial reserve. This is was supported by Ekasing et al (2004) that maize is easy to grow and has a low production risks compared to other crops. Because of tomato is one of important source of food, the market of tomato is quite open (Hau and Oppen, 2004). Therefore tomato can be sold in informal contracts between the farms and tomato traders at farm level or using formal contracts by placing directly at the market (Hau and Oppen, 2004). Chantalakhana and Skunmun (2002) confirm large animals such as cattle can ensure food security for farm family in case of crop failure, because these animals can be sold for large sum of cash.

Maize and tomato are considered to be the main source of income in the village. To get more profit from maize for sure that people need to get high price of maize, suitable price of fertilizer, rich soil fertility but it does not imply that this factors could generate enough income to sustain the people's livelihood. Our study found the concrete evidence to prove that beside those mentioned factors; land size is the most important factor that could generate more income from maize production. Big land size for growing maize will generate big income as both statistically reveal in maize section and from key informant interview. It is apparently to be true that maize production is could bring large income when people grow it on big land size particularly more than 30 rai. As major of maize expenditure is devoted to fertilizer, increasing price of fertilizer will drive people reduce amount of fertilizer or increase fertilizer expenditure that would affect maize profit. Our study found that increasing amount of fertilizer will not be a good strategy contributing to better economic benefit from maize. Looking back to questionnaire survey, excluding the big land lord whose land is 700 rai, the majority of people (about 65% of maize growers) grow maize on land less than 30 Rai this include the rented land, by correlating this to what we observed during semi-structure interview and group discussion reveal that people growing tomato because the maize income is not enough. That is why we observe that normally those who grow maize mostly grow tomato. At the present time, tomato price is most prominent factor that contributes to tomato income. However, other factors could happen and affect to income as well especially the disease that makes low yield and the increase of labor rent. Cattle is just a supplementary income and reason why they choose to raise it may be related to the habit of each household or the education level of the household head who understand the demand of market and household security.

Looking to the constraint of maize and tomato, the major constraint of maize is drought. Ekasing et al (2004) also gives the first consideration to drought as the main constrain for maize production in this study in northeastern Thailand. In fact maize price is also important but the current trend proves that maize price is higher than the past one, and therefore more stagnant that would not be the constraint. Tomato has two main constraints fluctuation of price and disease. Even so people still prefer growing tomato rather than grow maize twice a year because it will cause shortage land preparation for catching up with cropping calendar.

But they prefer to grow tomato because they get more profit and high out-put (pair wise ranking). As discussed in tomato section, tomato price range from 1.5 Bath up to 20 Bath and break-event point price is just about 3-4 Bath. While the normal yield of tomato is 10 ton per rai, this mean that the opportunity of getting high profit is very high. However, tomato is also challenging with high risk comparing to maize and cattle. Tomato attacked by many diseases that are hardly to get rid off. This would generate a double loss if diseases drive people get low yield and at the same time, falling into low price. The price is also determined by the quality of tomato; the input used such as content of pesticide for diseases elimination and improves the quality in tomato harvest.

"Growing tomato is risky with everything!" an interjection of tomato grower during group discussion. "10 to 20 rais are not enough for growing maize" said one off-farm people. Why people still want to practice this kind of activity? There is no alternative for village apart from these two productions that fit to their socio-economic condition. People need a cash crop which is short term and that generates higher profit for sustaining livelihood. Other alternatives such as cassava, fruit trees and so on are not suitable for this village. As maize was grown the in the same plot more than 30 year plus land forming slop, soil fertility is declining, and turns into unsuitable for other alternative crops, alternative seem to be crops that improve soil fertility such as tree plantation which take long time to get benefit and this kind of thing will not be acceptable for villagers who need the punctual income from maize and tomato.

From the list of our sample frame provided by the village chief, off-farm people account for nearly 35 percent. All of them when interviewed they expressed that they sold the land about 15 years ago. This implies that just only 5 to 10 years, there are about 35% of maize farmers converting their life to off-farm work. The main reason for selling the land is because of losses in maize production caused by drought. This has led them to sell land in order to pay their debts that they originated from borrowing money from the middleman or the BAAC. Rather than bad management of the loans, drought is another major cause. High interest rate from money lenders is also a critical and major cause for debt. Those who have enough capital resources to recover from this crisis can still produce maize. Off-farm people do not want to go back to agriculture sector because they say, they can sustain their livelihood.

"[Tham Kraset, Khat Thoun Yeurk], Doing agriculture, has lost a lot of capital. At that time, I rented 36 rai to grow maize using money borrowed from BAAC but droughts provoked big losses and until now still have to pay the debt to BAAC about 36000 Bath. Even now the price of maize increases, I have no intention of turning and do that again because working as construction worker and my wife work at shrimp farm we find it to be enough for us" said a Chhalee, 40 year old man.

People who have small land may not tolerate in case of crisis occur again, even there are borrow sources of the village but this source of borrow apparently not sufficient for people while land title SPK04-1 and PBT are not allowed to guarantee for loaning from any bank, people turn to borrow from meddle man because it is easy to get access to even they know that the interest rate is a bit high. Therefore, if the drought occurs, as high land price, these people have no choice besides selling land and seek other off-farm or non-farm activities. It seams that drought happen in every 5 to ten years. This problem was occurred 2 time already in the last five and ten years. For sure that new generation will not involve in farming activity because from the redistribution of land 50 rai per household, most household (65 %) remain less than 30 rai which income from this land hardly to sustain livelihood while 40 rai is consider to enough, so there is no reason that young generation would take land divided by their parents to grow maize for not enough income. For them none-farm activity is visible. Therefore, in next 20 year in the future, there will be a lot of people convert from farming to off-farm activities.

When off-farm people increase, it is apparently that will be shortage of labor of people working in agriculture and this would bring the labor rent increase. While in-put price increase such as fertilizer plus risky of in maize and tomato production, farming will be gradually challenging with less profit and not able to sustain livelihood. Together with price of land increase, this trend will lead to cycle of sell the land to big land owner or outsiders and end up in off-farm activity. Therefore, any intervention for improving people's livelihood in the village in the future, this study would suggest considering on skill of people related to off-farm work or non-farm work.

V. Reflection on methodology used

On the ground, we realized that a large portion of villagers are involved in off-farm activities. Thus, off-farm group did not fit into the main part of our questionnaire. Therefore, we developed questions about all source of income and all source of expenditure for the off-farm group. But due to our limited knowledge and experience in using stratification, we were not able to imagine that it could be possible for us to use stratification to compare other sources of household economic of the three strata (Maize-tomato, Maize-cattle and off-farm) to see clearly which of the strategy was better. During the field supervision in the middle term review we realized that it was late to ask the questions about other sources of income and expenditure in those two strata (beside off-farm group) with the same household, because they were not available at home. If we had possibility to do it we could have seen clearly, which group would be better than other and which livelihood strategy would be the best. One more important element in this is that if we could use random sampling, then we could have added more questions by increasing number of respondent and at least we could have been able to compare household economic among the group. After understanding the nature of the problem, we have tried to focus on semi-structure interview and it has permitted us to understand more clearly why people grow maize tomato, cattle and get involved in off-farm work. Furthermore, statistical analysis based on small amount of samples made us feel that there will be a higher no précised result found. However, we feel that our conclusion appear to be appropriate when we triangulate with semi-structure interview.

As mentioned in methodology, we tried to relate soil fertility with soil erosion in different slope linking them with productivity and household economic. But we have found many fluctuations in the results of soil analysis. We spent a lot of time doing soil sampling but these fluctuations seem to cause difficulties for interpretation of the values. Hence, the fluctuations do not permit to draw conclusion about the relationship between soil fertility, soil erosion and farmer economic. The methodology used for soil analysis and sample collection was good. The only problem was the lack of time for more samples collection in different periods of the cultivation, in order to understand and interpret the fluctuations. However, for us the benefit of soil sampling and analysis was the lesson on how to integrate the methods.

VI. Conclusion

From the above discussion, we can see that maize and tomato are the suitable commodities for our village; it is because these commodities fit to agro-ecological conditions of the village. Hence they meet villagers' objectives providing regular income by sustaining villager's livelihood. The commodities are considered to be short life cycle cash crops. Even though in some period of years the severe drought had caused crisis to maize growers, some of them still grow maize because they have enough sources of capital to recover. But those who do not have enough capital tend to sell their land. This apparently happen to those whose land is less than 30 rai. The increase of land price would contribute as catalyst to many losses in maize and cause land sell. The problems tend to take the same direction with tomato production. Although the constraints in tomato production are somehow different from maize, the fluctuations of price attached to diseases tend to be the major constraints that mostly affect growers. This makes people stop growing tomato in long term, especially when the losses are higher.

Land sizes for maize production constitute another important factor that can help people to generate enough income for sustaining their livelihood. More than 30 rai of land are expected to generate enough income for sustaining livelihood. Applying more fertilizer seems not to be a good strategy for maize because it doesn't always respond to output gained especially when the price increases. Off farm activities appear to be the consequence of land sell when villagers are in shortage of enough capital to pay back the loans taken from banks and from the middleman

Even the study was conducted with short period of time; the finding gave us the glue to see the future path of maize and tomato in the village. In the next 20 years, there will be many people shifting from maize and tomato to off-farm activities. These are apparently those whose land is less than 30 rai. Therefore, the activities will continue to be developed by few people whose land size is big together with sufficient capital to cop with the crisis.

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VIII. List of appendix

Appendix A: Result from pair wise ranking

PRA allow villagers to choose by preference the most important aspects in the entire factor affecting production. We used The Analytical Hierarchy Process to calculate the values. **Pair wise comparison for each criteria:**

Rank	2	1	3	4	
Decision			Criterion 1: INP	UT	
Variables	Maize	Tomato	Cattle	Off-farm	
Maize	1	4	1/3	1/5	
Tomato	1/4	1	1/4	1/5	
Cattle	3	4	1	1/2	
Off-farm	5	5	2	1	
	9 1/4	14	3 4/7	1 8/9	

Normalized values					Average	Consistency
Maize	Tomato	Cattle	Off-farm		Avelage	Ratio
0,11	0,29	0,09	0,11		0,15	4,17
0,03	0,07	0,07	0,11		0,07	4,04
0,32	0,29	0,28	0,26		0,29	4,35
0,54	0,36	0,56	0,53		0,50	4,35
1	1	1	1		1	0,13

Comparing the variables using <u>inputs</u> we found that tomato occupies the first place followed by maize, then cattle and finally off-farm employment. This means that for tomato production require more inputs compare to maize and cattle.

Output

Rank	2	1	4	3	
Decision		С	riterion 2: OUT	PUT	
Variables	Maize	Tomato	Cattle	Off-farm	
Maize	1	1/2	3	2	
Tomato	2	1	5	3	
Cattle	1/3	1/5	1	1/2	
Off-farm	1/2	1/3	2	1	
	3 5/6	2	11	6 1/2	

Normalized values					Average	Consistency
Maize	Tomato	Cattle	Off-farm		Avelage	Ratio
0,26	0,25	0,27	0,31		0,27	4,02
0,52	0,49	0,45	0,46		0,48	4,02
0,09	0,10	0,09	0,08		0,09	4,01
0,13	0,16	0,18	0,15		0,16	4,00
1	1	1	1		1	0,01

Comparing the variables using <u>outputs</u> we found that tomato occupies the first place followed by maize, off-farm and cattle. This means that villagers feel that from tomato production can get high outcome, compare to maize, off-farm and cattle. **Labour**

Rank	2	1	3	4	
Decision		C	riterion 3: LABO	UR	
Variables	Maize	Tomato	Cattle	Off-farm	
Maize	1	2	2	1	
Tomato	1/2	1	1/2	1	
Cattle	1/2	2	1	1	
Off-farm	1	1	1	1	
	3	6	4 1/2	4	

Normalized values					Average	Consistency
Maize	Tomato	Cattle	Off-farm		Avelage	Ratio
0,33	0,33	0,44	0,25		0,34	4,16
0,17	0,17	0,11	0,25		0,17	4,08
0,17	0,33	0,22	0,25		0,24	4,13
0,33	0,17	0,22	0,25		0,24	4,11
1	1	1	1		1	0,07

Comparing the variables using <u>labour expenditure</u> we found that tomato occupies the first place followed by maize, cattle and off-farm. This means that tomato require higher amount of labour compare to the other commodities.

Easy to sell in the market

Rank	1	4	2	3						
Decision	Criterion 4: MARKET									
Variables	Maize	Tomato	Cattle	Off-farm						
Maize	1	4	2	3						
Tomato	1/4	1	1/3	1/2						
Cattle	1/2	3	1	2						
Off-farm	1/3	2	1/2	1						
	2	10	3 5/6	6 1/2						

	Norm	Average	Consistency		
Maize	Tomato	Cattle	Off-farm		Ratio
0,48	0,40	0,52	0,46	0,47	4,05
0,12	0,10	0,09	0,08	0,10	4,02
0,24	0,30	0,26	0,31	0,28	4,04
0,16	0,20	0,13	0,15	0,16	4,02
1	1	1	1	1	0,02

Comparing the variables using <u>market</u> we found that maize occupies the first place followed by cattle, off-farm and tomato. This means that maize it's easy to sell in the market, more than cattle. For tomato, as they ranked in the last place, compare to others, it's more difficult to sell in the market.

Risk

Rank	2	1	3	4							
Decision	Criterion 5: ความเสี่ยง(RISK)										
Variables	Maize	Maize Tomato Cattle Off-farm									
Maize	1	1/5	2	3							
Tomato	5	1	4	5							
Cattle	1/2	1/4	1	2							
Off-farm	1/3	1/5	1/2	1							
	6 5/6	1 2/3	7 1/2	11							

	Norm	Average	Consistency		
Maize	Tomato	Cattle	Off-farm	Melage	Ratio
0,15	0,12	0,27	0,27	0,20	4,13
0,73	0,61	0,53	0,45	0,58	4,37
0,07	0,15	0,13	0,18	0,13	4,04
0,05	0,12	0,07	0,09	0,08	4,07
1	1	1	1	1	0,09

Comparing the variables using <u>risk</u> we found that villagers ranked tomato as the more risky crop followed by maize, cattle and off-farm that villagers perceive as the most safety activity.

Appendix B: Result from analysis questionnaire survey

Year people settle in the village

		Year th	nat move in t	he village		Total
village	<= 5	6 - 15	16 - 25	26 - 35	36+	
Khong Tu Dian	1	2	8	15	10	36
Knong Tu Klan	2.8%	5.6%	22.2%	41.7%	27.8%	100.0%
Klong Bong Pattana	0	2	4	2	9	17
Kiong Dong I attaila	.0%	11.8%	23.5%	11.8%	52.9%	100.0%
Uhong Tong Dattana	0	6	3	14	19	42
Fillong Tong Fattalia	.0%	14.3%	7.1%	33.3%	45.2%	100.0%
Sufficient economic	40	0	0	0	0	40
Project	100.0%	.0%	.0%	.0%	.0%	100.0%
Khong I Deary	3	3	2	11	4	23
Knong I Paew	13.0%	13.0%	8.7%	47.8%	17.4%	100.0%
Klana Sai	1	2	8	13	8	32
Klong Sal	3.1%	6.3%	25.0%	40.6%	25.0%	100.0%
Total	45	15	25	55	50	190
	23.7%	7.9%	13.2%	28.9%	26.3%	100.0%

Comparing off-farm work

Village name		Number of persons work on own farm	Number of persons work off-farm	Number of persons work elsewhere
Khong Tu Rian	Mean	1.44	.69	.53
	N	36	36	36
	Std. Deviation	1.206	1.009	.845
Klong Bong	Mean	1.88	.76	.82
Pattana	Ν	17	17	17
	Std. Deviation	1.495	1.200	1.510
Hhong Tong	Mean	1.44	1.24	.71
Pattana	N	41	41	41
	Std. Deviation	1.379	1.019	1.055
Sufficient	Mean	1.50	.78	.23
economic Project	N	40	40	40
	Std. Deviation	.751	.698	.423
Khong I Paew	Mean	2.48	1.64	.76
	Ν	25	25	25

By Group 1: Kimlong, Enoque and Ataulfo

	Std. Deviation	5.889	1.777	1.535
Klong Sai	Mean	1.41	1.31	1.06
	Ν	32	32	32
	Std. Deviation	1.316	1.306	1.294
Total	Mean	1.62	1.06	.65
	Ν	191	191	191
	Std. Deviation	2.401	1.190	1.113

Significant in less off farm work in village I than village 2,5,6. Significant in less hire labor in village one than 6.

Raising cattl	e and education				
			educ	2cat	
			.00	1.00	Total
cattle yes-no	no	Count	72	61	133
		% within cattle yes-no	54.1%	45.9%	100.0%
	yes	Count	5	14	19
		% within cattle yes-no	26.3%	73.7%	100.0%
Total		Count	77	75	152
		% within cattle yes-no	50.7%	49.3%	100.0%

Village 1,2,3,5 and 6 (village 4 is excluded because people was provided the cattle from the royal project), and then group education level into 0 (itliterate and primary school) and 1 (secondary school and above). This crossbabulation is significant diffent (p < 0.05).

Correlations of land tenure

		Amount of BAAC loan (bahts)	Amount of borrow from middle man (bahts)	Amount of land held with a PBT	Amount of land rented last year	Amount of land held with SPK4-01
Amount of BAAC loan	Pearson Correlation	1	.180(*)	.285(**)	.267(**)	043
(bahts)	Sig. (2-tailed)		.016	.000	.001	.600
	N	186	177	149	152	151
Amount of borrow from	Pearson Correlation	.180(*)	1	.060	.440(**)	.211(**)
middle man (bahts)	Sig. (2-tailed)	.016		.470	.000	.010
	N	177	177	146	149	148
Amount of land held	Pearson Correlation	.285(**)	.060	1	.013	150
with a PBT	Sig. (2-tailed)	.000	.470		.880	.068
	N	149	146	149	149	149
Amount of land rented	Pearson Correlation	.267(**)	.440(**)	.013	1	023
last year	Sig. (2-tailed)	.001	.000	.880		.784
	N	152	149	149	152	151
Amount of land held	Pearson Correlation	043	.211(**)	150	023	1
with SPK4-01	Sig. (2-tailed)	.600	.010	.068	.784	
	Ν	151	148	149	151	151

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

Relevant correlation to income

		Age of head of house hold	Gende r of head of house hold	Number of adults in househol d (>16 yo)	Number of chrildren in househol d (<16 vo)	Year that move in the village	Number of persons work on own farm	Number of persons work elsewhe re	Total_in	Expendit ure total	Net_i ncom e	High est level of educ ation
Age of head of household	Pearson Correlati on	1	.218	.195	233	.156	071	.054	405	169	405	298
	Sig. (2- tailed)		.202	.254	.171	.364	.679	.752	.192	.600	.192	.078
	N	36	36	36	36	36	36	36	12	12	12	36
Gender of head of household	Pearson Correlati on	.218	1	.034	020	.135	488(**)	.421(*)	162	263	067	089
	Sig. (2- tailed)	.202		.846	.908	.433	.003	.011	.615	.408	.837	.605
	N	36	36	36	36	36	36	36	12	12	12	36
Number of adults in household (>16 yo)	Pearson Correlati on	.195	.034	1	052	.304	.137	.046	.129	.113	.100	.003
	Sig. (2- tailed)	.254	.846		.764	.071	.427	.791	.690	.727	.757	.984
	N	36	36	36	36	36	36	36	12	12	12	36
Number of chrildren in household (<16 yo)	Pearson Correlati on	233	020	052	1	.105	133	.021	.574	.686(*)	.357	.170
	Sig. (2- tailed)	.171	.908	.764		.544	.438	.905	.051	.014	.255	.321
	N	36	36	36	36	36	36	36	12	12	12	36
Year that move in the village	Pearson Correlati on	.156	.135	.304	.105	1	248	.130	.075	.246	029	.063
	Sig. (2- tailed)	.364	.433	.071	.544		.144	.451	.816	.441	.928	.715
	N	36	36	36	36	36	36	36	12	12	12	36
Number of persons work on own farm	Pearson Correlati on	071	- .488(**)	.137	133	248	1	545(**)	276	313	179	.104
	Sig. (2- tailed)	.679	.003	.427	.438	.144		.001	.386	.323	.577	.547
	N	36	36	36	36	36	36	36	12	12	12	36
Number of persons work elsewhere	Pearson Correlati on	.054	.421(*)	.046	.021	.130	545(**)	1	513	412	416	232
	Sig. (2- tailed)	.752	.011	.791	.905	.451	.001		.088	.184	.178	.174
	N	36	36	36	36	36	36	36	12	12	12	36
Total_inco me	Pearson Correlati on	405	162	.129	.574	.075	276	513	1	.585(*)	.918(* *)	007
	Sig. (2- tailed)	.192	.615	.690	.051	.816	.386	.088		.046	.000	.984
	N	12	12	12	12	12	12	12	12	12	12	12
Expenditur e_total	Pearson Correlati on	169	263	.113	.686(*)	.246	313	412	.585(*)	1	.216	.367
	Sig. (2- tailed)	.600	.408	.727	.014	.441	.323	.184	.046		.500	.241
	N	12	12	12	12	12	12	12	12	12	12	12
Net_incom e	Pearson Correlati on	405	067	.100	.357	029	179	416	.918(**)	.216	1	187
	Sig. (2- tailed)	.192	.837	.757	.255	.928	.577	.178	.000	.500	-	.561

By Group 1: Kimlong, Enoque and Ataulfo

	Ν	12	12	12	12	12	12	12	12	12	12	12
Highest level of education	Pearson Correlati on	298	089	.003	.170	.063	.104	232	007	.367	187	1
	Sig. (2- tailed)	.078	.605	.984	.321	.715	.547	.174	.984	.241	.561	
	N	36	36	36	36	36	36	36	12	12	12	36

Compare mean of land tenure across village

Village name		Amount of land held with a PBT	Amount of land held with SPK4-01	Amount of land rented last year	Amount of land transfered last 5 years	Amount of land acquired last 5 years
Khong Tu Rian	Mean	2.6528	14.4958	3.4167	3.8889	.0000
	Ν	36	36	36	36	36
	Std. Deviation	9.05840	17.98857	10.50816	14.83775	.00000
	Minimum	.00	.00	.00	.00	.00
	Maximum	40.00	60.00	50.00	80.00	.00
Klong Bong	Mean	4.8235	15.3235	59.5882	1.7059	1.4706
Pattana	Ν	17	17	17	17	17
	Std. Deviation	8.70514	33.96457	118.89494	5.02201	3.84249
	Minimum	.00	.00	.00	.00	.00
	Maximum	30.00	140.00	400.00	20.00	13.00
Hhong Tong	Mean	3.1590	15.3049	44.1667	3.1190	.2083
Pattana	Ν	39	41	42	42	42
	Std. Deviation	6.24522	28.35112	111.79313	8.81850	1.35015
	Minimum	.00	.00	.00	.00	.00
	Maximum	30.50	150.00	600.00	34.00	8.75
Khong I Paew	Mean	2.3900	21.2913	12.9600	2.1200	.0000
	Ν	25	25	25	25	25
	Std. Deviation	8.54098	38.40499	32.54289	9.61041	.00000
	Minimum	.00	.00	.00	.00	.00
	Maximum	40.00	180.00	150.00	48.00	.00
Klong Sai	Mean	8.0625	2.5938	9.1719	1.6250	3.1250
	Ν	32	32	32	32	32
	Std. Deviation	14.22897	5.89072	17.86807	7.31657	7.83602
	Minimum	.00	.00	.00	.00	.00
	Maximum	60.00	23.00	60.00	40.00	40.00
Total	Mean	4.1507	13.4115	23.7401	2.6645	.8799
	Ν	149	151	152	152	152
	Std. Deviation	9.82537	26.32582	74.66029	10.06400	4.02630
	Minimum	.00	.00	.00	.00	.00
	Maximum	60.00	180.00	600.00	80.00	40.00

Compare mean of land tenure across village (ANOVA Table)

			Sum of				
			Square		Mean		
			S	df	Square	F	Sig.
Amount of land held with a	Between	(Combine	694.00	1	172 500	1 0 2 0	125
PBT * Village name	Groups	d)	0	4	173.500	1.000	.125
	Within Groups		13593.	111	04 400		
			620	144	94.400		
	Total		14287.	110			
			620	140			
Amount of land held with	Between	(Combine	5548.4	4	1207 120	2.050	000
SPK4-01 * Village name	Groups	d)	78	4	1307.120	2.056	.069
	Within Groups		98408.	146	674 022		
	-		856	140	674.033		

By Group 1: Kimlong, Enoque and Ataulfo

	Total		10395 7.334	150			
Amount of land rented last	Between	(Combine	63937.	4	15984.25	2.004	000
year * Village name	Groups	d)	020	4	5	3.021	.020
	Within Groups		77776	1/7	5200 801		
			0.966	147	5290.091		
	Total		84169	454			
			7.985	151			
Amount of land transfered	Between	(Combine	120.25	4	20.005	201	002
last 5 years * Village name	Groups	d)	8	4	30.065	.291	.003
	Within Groups		15173.	147	102 222		
			630	147	103.222		
	Total		15293.	151			
			888	151			
Amount of land acquired	Between	(Combine	233.39	1	58 340	3 873	005
last 5 years * Village name	Groups	d)	6	4	50.549	5.075	.005
	Within Groups		2214.4	1/7	15 064		
			75	147	13.004		
	Total		2447.8	151			
			71	151			

Factor contribute to maize income

ANOVA: Maize_Netincome_per_rai (no different between the group)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6572843.253	4	1643210.813	.763	.566
Within Groups	30142071.417	14	2153005.101		
Total	36714914.670	18			

Duncan : Maize_Netincome_per_rai

Maize_land_group	N	Subset for alpha = .05 1
21 to 30	2	2020.3022
41 to 60	4	2377.6389
11 to 20	6	2909.3651
1 to 10 Rai	4	3535.8333
31 to 40	3	3799.3446
Sig.		.177

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 3.333.

b The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

ANOVA: Maize_Netincome

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	40597589322.865	4	10149397330.716	6.135	.005
Within Groups	23161457561.020	14	1654389825.787		
Total	63759046883.885	18			

Duncan: Maize_Netincome

Maize_land_group	Ν	Subset for alpha = .05				
		1	2	3		
1 to 10 Rai	4	16840.0000				
11 to 20	6	51183.3333				
21 to 30	2	57877.4000	57877.4000			
41 to 60	4		122912.5000	122912.5000		
31 to 40	3			143081.3333		
Sig.		.236	.058	.532		

Means for groups in homogeneous subsets are displayed. a Uses Harmonic Mean Sample Size = 3.333. b The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

		Sum of Squares	df	Mean Square	F	Sig.
Maize_Expenditure	Between Groups	720/355580/ 181	1	18235888973.	13 1/17	000
		72943555694.161		545	10.147	.000
	Within Groups	10/10316036 020	1/	1387094066.8		
		19419310930.020	14	59		
	Total	92362872830.201	18			
Maize_Expenditure_per_rai	Between Groups	2515701.900	4	628925.475	.531	.715
	Within Groups	16582247.276	14	1184446.234		
	Total	19097949.176	18			

ANOVA: Maize expenditure and maize expenditure per ria

Duncan: Maize_Expenditure

Maize_land_group	N	Subset for alpha = .05				
		1	2	3		
1 to 10 Rai	4	31097.5000				
11 to 20	6	68283.3333	68283.3333			
31 to 40	3		121418.6667			
21 to 30	2		126622.6000			
41 to 60	4			206587.5000		
Sig.		.218	.074	1.000		

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 3.333.

b The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Duncan: Maize_Expenditure_per_rai

Maize_land_group	N	Subset for alpha = .05
		1
31 to 40	3	3367.3220
41 to 60	4	3971.2500
11 to 20	6	4223.9683
21 to 30	2	4429.6978
1 to 10 Rai	4	4464.1667
Sig.		.257

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 3.333.

b The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Maize_yield_per_rai

Maize_land_group	Mean	Ν	Std. Deviation
1 to 10 Rai	1.0750	4	.11902
11 to 20	1.0500	6	.05477
21 to 30	.9000	2	.14142
31 to 40	.9583	3	.07217
41 to 60	.8556	4	.16254
Total	.9841	19	.13092

Maize_Fertilizer_use_per_rai

Maize_land_group	Mean	Ν	Std. Deviation
1 to 10 Rai	127.7778	4	52.55802
11 to 20	107.2222	6	18.15571
21 to 30	142.5926	2	34.04588
31 to 40	108.3333	3	38.18813

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41 to 60	102.2222	4	34.17457
Total	114.3957	19	34.02035

Building maize model

Model Summary

			Adjusted R	Std. Error of
Model	R	R Square	Square	the Estimate
1	.998(a)	.995	.995	10347.07591
a Dradiat	ana (Canatan	h) Maina fami	una lia	

a Predictors: (Constant), Maize_ferti_use_kg

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regressio n	408425671 907.228	1	40842567190 7.228	3814.853	.000(a)
	Residual	203417761 6.581	19	107061979.82 0		
	Total	410459849 523.810	20			

a Predictors: (Constant), Maize_ferti_use_kg

b Dependent Variable: Maize_Yield_kg

Coefficients(a)

		Unstandardized Coefficients		Standardized Coefficients		
Model		B Std. Error		Beta	t	Sig.
1	(Constant)	15065.634	2346.030		6.422	.000
	Maize_ferti_u se_kg	2.957	.048	.998	61.764	.000

a Dependent Variable: Maize_Yield_kg

Tomato economic Tomato price

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.50	1	2.8	7.7	7.7
	3.00	3	8.3	23.1	30.8
	5.00	2	5.6	15.4	46.2
	6.00	2	5.6	15.4	61.5
	7.50	1	2.8	7.7	69.2
	8.50	2	5.6	15.4	84.6
	10.00	2	5.6	15.4	100.0
	Total	13	36.1	100.0	
Missing	System	23	63.9		
Total		36	100.0		

Cattle and other source of income

Compare mean of number of cattle between three village

Village name	Mean	Ν	Std. Deviation	Minimum	Maximum
Khong Tu Rian	3.53	36	7.919	0	33
Hhong Tong Pattana	4.45	42	20.511	0	130
Sufficient economic Project	4.13	38	4.388	0	20
Total	4.06	116	13.244	0	130

ANOVA Table Number of Cattle

			Sum of Squares	df	Mean Square	F	Sig.
Number of cattle * Village name	Between Groups	(Combined)	16.858	2	8.429	.047	.954
	Within Groups		20155.719	113	178.369		
	Total		20172.578	115			

Number of chicken

Village name	Mean	Ν	Std. Deviation	Minimum	Maximum
Khong Tu Rian	6.86	36	12.840	0	50
Klong Bong Pattana	20.88	17	30.012	0	100
Hhong Tong Pattana	13.76	42	28.575	0	150
Sufficient economic Project	4.75	40	11.935	0	55
Khong I Paew	8.92	25	17.618	0	55
Klong Sai	9.75	32	12.415	0	50
Total	9.92	192	19.887	0	150

Compare Means of chicken between village 1 4 5 6

Number of chicken

Village name	Mean	Ν	Std. Deviation	Minimum	Maximum
Khong Tu Rian	6.86	36	12.840	0	50
Sufficient economic Project	4.75	40	11.935	0	55
Khong I Paew	8.92	25	17.618	0	55
Klong Sai	9.75	32	12.415	0	50
Total	7.31	133	13.506	0	55

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Number of chicken * Village name	Between Groups	(Combined)	524.715	3	174.905	.958	.415
	Within Groups		23553.646	129	182.586		
	Total		24078.361	132			

Compare Means of Own fish pond Own fish pond

Village name	Mean	Ν	Std. Deviation
Khong Tu Rian	.25	36	.500
Klong Bong Pattana	.29	17	.470
Hhong Tong Pattana	.21	42	.415
Sufficient economic Project	.45	40	.504
Khong I Paew	.16	25	.374
Klong Sai	.37	32	.492
Total	.30	192	.469

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Own fish pond * Village name	Between Groups	(Combined)	1.967	5	.393	1.825	.110
	Within Groups		40.111	186	.216		
	Total		42.078	191			

Compare fruit tree across village



Use of fruit tree in Khlong Tu Rian village: Coconut use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	25	69.4	69.4	69.4
	home consumption	9	25.0	25.0	94.4
	cash + home consumption	2	5.6	5.6	100.0
	Total	36	100.0	100.0	

Banana use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	26	72.2	74.3	74.3
	home consumption	9	25.0	25.7	100.0
	Total	35	97.2	100.0	
Missing	System	1	2.8		
Total	, i	36	100.0		

Papaya use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	26	72.2	72.2	72.2
	home consumption	9	25.0	25.0	97.2
	cash + home consumption	1	2.8	2.8	100.0
	Total	36	100.0	100.0	

Agar use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	36	100.0	100.0	100.0

Thai apple use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	35	97.2	97.2	97.2
	home consumption	1	2.8	2.8	100.0
	Total	36	100.0	100.0	

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		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<40.00	15	75.0	75.0	75.0
	40.00+	5	25.0	25.0	100.0
	Total	20	100.0	100.0	

Percentage of Classification of those who have land less than 40 Rai Maize_land_total (Banded)

Appendix C: Result from soil analysis

Soil types were determined by soil map.

We use Soil Series Description of 17 Provinces in the Northeast Thailand (1999) published by The Division of Soil Survey and Classification of Thailand to describe the soil types.

The Soil type of the first sample was serie LI-C: Shallow soil. Has good water drainage. The Texture is Clay-loam. The presence of clay in the soil was confirmed by ribbon finger test made in the field.

Has low soil fertility and is suitable for grass land but not recommended for cultivation because quality vary much along the places. It has much slopes.

The soil type of the second sample was serie ML: Shallow soil. Has good drainage and a loamy texture. Moderate fertility but in theory higher than LI-C. Also, the land is suitable for livestock.

Ekasingh et.al (2004) states that clay-loam soils have good water holding capacity but the disadvantage of some laterite in soil. About loam they said that is suitable for maize, but has the problem of poor water holding capacity in the dry season.

Laterite is a surface formation in hot and wet tropical areas which is enriched in iron and aluminium, that gives rise to a residual concentration of more insoluble elements as iron and aluminium. The percolating rain water causes dissolution of primary rock minerals and decrease of easily soluble elements as sodium, potassium, calcium, magnesium and silicon (Wikipedia).

The results from the analysis were

L: Lower slope U: Upper slope

First field (farmer A): 4,666% of slope

	рН	Ammonium	Nitrate	Phosphorus	Potassium		
L1	6.5	Low (L)	Very low (VL)	High (H)	Low (L)		
L2	6.5	Low (L)	Very low (VL)	Very High (VH)	Low (L)		
L3	6.5	Low (L)	Very low (VL)	High (H)	Low (L)		
U1	6	Low (L)	Very low (VL)	Medium (M)	High (H)		
U2	6.5	Low (L)	Very low (VL)	Medium (M)	High (H)		
U3	6.5	Low (L)	Very low (VL)	Medium (M)	High (H)		

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Second field (Farmer B): 22, 1% of slope

	рН	Ammonium	Nitrate	Phosphorus	Potassium
L1	6	Very low (VL)	Very low (VL)	Low (L)	Medium (M)
L2	5.5	Very low (VL)	Very low (VL)	High (H)	Medium (M)
L3	6.5	Very low (VL)	Very low (VL)	Low (L)	Medium (M)
U1	5.5	Very low (VL)	0	High (H)	Medium (M)
U2	5.5	Very low (VL)	0	Medium (M)	Medium (M)
U3	6.5	Very low (VL)	Very low (VL)	Low (L)	Medium (M)

VL = Very low L = Low M = Moderate/MediumH = High

The values were obtained from the handbook for soil quick testing of the Department of Soils, Kasitsart University.

From this source is possible to obtain the soil test values and the sufficiency or deficiency levels of N, P and K contents in soils for average crops, especially the annual crops (Maize, cassava and others).

<u>NH4[±]-N (ppm)</u>

Soil	
test	
levels	Value
VL	0
L	0 to 10
М	11 to 20
н	21 to 30
VH	31 to 50

Available P (ppm)

Soil test levels	Value
VL	1 to 3
L	4 to 6
М	7 to 9
Н	10 to 12

<u>NO⁼₃ – N (ppm)</u>

Soil test levels	Value
VL	1 to 10
L	11 to 20
М	21 to 30
Н	31 to 50

<u>Available K</u>

Soil test levels	Value
L	0 to 40
М	40 to 80
	80 to
H	120

Maize can grow from pH 5.5 to 8.0, but its very sensible to acidity, mostly if aluminium is present. So the optimum goes from 6.0 to 8.0. (Agroecological Requirements of Maize, source: <u>http://www.queretaro.gob.mx/sedea/Estadisticas/agricola/MAIZ.pdf</u>).

Also the pH influence directly in the mobility and availability of the nutrients.



As we see, at pH of 5.5, the availability of phosphorus should be lower than nitrogen and potassium, due to its lower solubility and immobilization at this pH (wikipedia). The maximum solubility of phosphorus is achieved at pH little less than 6.5.

But as illustrated in the table, in the second field, the higher values of phosphorus are at pH 5.5. This doesn't make sense with the availability of phosphorus at this pH shown in the figure above. This values of phosphorus at pH 5.5 that we got are difficult to explain and therefore to conclude clearly something about the high presence of phosphorus in this field.

Williams (1998) state that nitrogen is one of the three major's nutrients to be depleted from the soil as it will leach out easily.

So should be a limitation.

As it shown in the table, the values of nitrate and ammonium in the first field are very low and low respectively in both upper and lower slope. In the second field we see that the values are very low in the lower slope. In upper slope 2 values are 0. This could be a possible effect of the soil erosion due to the high slope of the second field. Also nitrogen is very variable over the season and we cannot conclude much of the soil fertility on this.

But as we are sampling in the dry season we can expect that N levels will reflect soil fertility since there is a stable mineralization of mineral from the organic pools. Periods of water saturation lead to poor aeration decreasing the mineralization rate from the microorganisms (Bot and Benites, 2005).

So if it's like this, the second field will reflect less fertility than the first one as the values of nitrogen are lower.

Though the classification of soils describes ML series as more fertile than the ones in the Li-C, the higher slope of the second probably cause the depletion of the nitrogen levels.

About phosphorus we see that in the first field there is more phosphorus in the lower slope than in the upper. Phosphorus attaches to the organic matter and to the clay minerals in the top soil and therefore if the topsoil moves downhill due to the soil erosion, phosphorus could accumulate at the foot of the slope, getting higher values.

This is reflected in the first field. However, in the second field we found the opposite, which weakens the argument. Here we see another variation in the data of phosphorus.

Another variation comes with potassium. Also we could expect to see in this field the effects of soil erosion, as the slope is high compare to the first field. In the second field we don't see any effect of the soil erosion as all the values were medium. But from the results for the first field we see that not only don't support the effects of soil erosion but reflects more potassium at the upper slope than in the lower part.

In the first sample the soil has clay and we also saw breakage head of the slope as the soil was dry, so we though of expansible clays minerals as vermiculites. Vermiculite expands with the application of heat (wikipedia). This could explain the breakage.

The immobile potassium is due the presence of 2:1 clays minerals as vermiculite that attaches potassium interlaminate (Albocol, 2004). That could explain the high content of potassium.

So we see a lot of variation in the results. This variation could be due to some reasons

One could be the application of fertilizer by hand not applying homogenously along the field. In the first field, could apply with tractor, but in the second we found too much slope, so maybe is not possible for the tractor to work.

Even observing gradients in the nutrients down the slopes, could be more likely attributed to ash dispersal after burning, rather than soil erosion (Neergaard et al, n.d.).

Also some samples could be taken in spots where not fertilizer was applied, so the results vary from samples to samples, even in the same slope level. The fertilizer can be applied in rows, so if we take the sample between rows the results could be lower that the ones taken in the row.

Another could be the moment in which we made the sampling. If we do sampling during the cultivation of maize we should get others results. Also will be a variation along the life cycle of maize. There are not the same necessities in the first states than in the pre-harvest period.

About the testing kit some scales of the color tester for some nutrients were uncertain. For example, potassium has three color scales so sometimes the color is between two values and is difficult to asset. The value depends on the light and on the experience of the eye that is testing meaning some uncertainty in the values.

By mixing samples of the same slope we hide variations or information that could be important. In the second sampling we didn't mix for the analysis.

Farmers in both fields apply NP fertilizer (16-20-00). Probably they know that the content of potassium (K) is high. As erosion can occur, they will need to apply more fertilizers, increasing the content of phosphorus and reducing maize yields. This could explain the high content of phosphorus available, even at pH 5.5, in the fields and therefore the low yield for the farmers.

Maybe is more useful to use nitrate fertilizer like urea to complement the nitrogen levels.

All these reasons could affect the variation of the values. Taking 6 samples in both fields probably are not enough to represent these fields, making more difficult to identify the variations and also to get a clear conclusion from them.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maize												
First Plough												
Second Plough												
Seedling and First Fertilizer 25 kg./rai												
Use of Herbicides												
Second Fertilizer 50 kg./rai												
Harvest												
Tomato												
Plough												
Plantation												
First Fertilizer												
Use of Herbicides												
Harvest												
Cucumber												
First Plough												
Second Plough												
Plantation												
Fertilizer												
Harvest												
Cassava												
Plough												
Plantation												
Fertilizer												
Harvest												
Garlic and scallion												
Source: village headman and Joda Haho												

Appendix D: Cropping calendar Cropping calendar in Ban Khlong Tu Rian village

Appendix E: Synopsis





Synopsis

On

Assessing the household coping strategy based on main commodities: Case study on maize and cattle production in Ban Khlong Tu Rian, Tambon Wang Nam Khiao, Nakhon Rachasima Province, Northeastern Thailand

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Proposed for field study in SLUSE course

By Group 1: Kimlong, Enoque and Ataulfo

<u>Abstract</u>

The current development and changes in Northeastern Thailand draw much attention from both government and academic institutions to consider how the people in the area respond to these changes in term of their livelihood strategy especially where the area is facing soil erosion, low soil fertility, land expansion, commercialization and development interventions. Our study aim at assessing whether maize and cattle are the main agricultural productions that are the suitable strategies for sustaining livelihood of villagers in Ban Khlong Tu Rian village of Nakhon Rachasima province, in low northeast Thailand or not. The study will look at three main themes (1) agro-ecological situation (2) the benefit of the current productions and (3) institutional arrangement in the village.

Our case study will be a combination of PRA (village mapping and transect), semi-structure interview, small scale questionnaire survey and soil testing (analysis). At least 6 key informants will be purposively selected and 30 respondents will be chosen based on stratified random sampling. Village mapping and transect together with semi-structure interview and physical observation will be used to understand agro-ecological situation of the village. Benefit of production will be analyzed based on questionnaire survey. Finally soil sampling/testing will be done based on the criteria from both questionnaire survey and semi-structure interview to find out how the current strategies affect soil fertility using comparable plots.

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List of Abbreviation

DFID	Department for International Development
GPS	Global Positioning System
SPSS	Statistical Package for the Social Science

1. Background

SLUSE basic concept is that "the sustainable land use can be best understood by studying the biophysical, socio-economic, institutional and policy consideration in combination" (Hill and Torben, n.d). We are very interested on this concept especially the acknowledgement of understanding natural resource management which cannot be adequately studied and understood from a monodisciplinary point of view. Therefore, we would like to apply inter-disciplinary approach to understand the way of people in Ban Khlong Tu Rian village respond to the current development and change in Nakhorn Rachaseema province, Thailand.

2. Problem Analysis

Nakhon Ratchasima Province, situated in low northeastern of Thailand where is often said to be a region with poor soil and not favored agriculture (Ekasingh *et.*al, 2004). Since 1980s, Northeast region has been a major spread of cash cropping in which the driving forces were proved to come from the impact of infrastructural improvement, desire of farmer and their ability to engage in cash cropping and role of private sectors (Rigg, 1987). Rigg (1987) also emphasized that it was also accompanied by availability of credit and communication. Government and farmer play role in spreading cash crop in Thailand. An interesting issue is that the change in cropping pattern in commercial agriculture is related to variations in price. The past study showed that farmers were regarded as sensitive to economic stimulation and they were responding to price incentive (Rigg, 1987).

There are five major crops in Thailand-rice, cassava, sugarcane, rubber and maize in which maize occupies a major portion of Thai upland farmland around 33 percent. Maize firstly was introduced in Thailand in 1950 and become the most dominant strategic crop in northeastern and particularly in Nakhorn Rachaseema (Ekasingh *et.*al, 2004), our study province. However, the past patterns of land use of maize, farmers often cultivate on sloping land where is vulnerable to erosion. Low soil fertility are said to be resulted in low maize yield which is the third ranking reason contributing to low income (Pouliot *et.* al, 2006). In seeking other alternative crops, it is said to be "either more risky or physically or socioeconomically unsuitable to these marginal farmers" (Ekasingh *et.*al, 2004).

Recently it is noticed that there is major change in Nakhorn Rachaseema. Pouliot *et.* al (2006) argued that the rapid change occurred in the last five years where people start seeking for new alternatives. New trend appears in correlation to the increase of input price while out put price more or less stagnant or even more declined (Ekasingh *et.*al, 2004). Most maize farmers show their unhappiness with high price of species and fertilizers. The survey on maize farmer by Ekasingh *et.*al (2004) in northeastern Thailand, including Nakhorn Rachaseema, proved "higher maize yield would not be possible without chemical fertilizers, but concurrently recognized the declined of soil fertility with continuous maize cropping". Comparing to other provinces, maize production in Nakhorn Ratchaseema contributes the smallest proportion (35.7%) of total household income. Profit from maize is very small; therefore, many farmers have quited maize farming and switched to nonfarm employment. Some farmers change from maize to other fruit trees such as lychee, longan, tamarind etc because these crops are important cash crop playing no least role than maize (Ekasingh *et.*al, 2004).

However, force factors driving farmer to grow maize apparently from Thai policy that aim to increase maize production to accommodate both the export and domestic markets (Gerbert, 2007). Pouliot *et.* al (2006) share concrete finding that it is farmer preference to grow maize themselves rather than incentive from outsiders. Furthermore, maize is easy to grow and has a low production risks compared to other crops (Gerbert *et.* al, 2007; Ekasing *et.* al 2004). It is a drought and insect

tolerant crop and allows farmer to cultivate double cropping. It is the best crop for rainfed uplands with good rainfall (Ekasing *et.* al 2004).

In such complex context, there is trend where small farmers can not tolerate with the process of development and change in Tambon³ Wang Nam Khiao, and, therefore, transfer their land to rich farmers, some seeking alternative opportunity such as off-farm job and other alternative crops (Gausset and Jongkroy, 2007). How do people cop with such context? What are the suitable strategies for sustaining their livelihood? We will try to explore the answers of these questions by looking into particularly on coping strategy of villagers in the Ban Khlong Tu Rian is a village, Tambon Wang Namkiao, Nakhorn Rachaseema province.

Ban Khlong Turain village consists approximately of 80 households, and is comprised of 1565.16 ha for both habitation and agriculture. The major agricultural commodities of the village consist of maize, cattle and tomato (Gausset and Jongkroy, 2007; Mandalay 1998; Krasachat, 2007).

3. Overall objective

Are agricultural productions particularly maize, tomato, and cattle production the right strategy for sustaining livelihood in the village?

4. Specific Objectives

• To explore how the soil fertility is affected by current agricultural practice from different field

- To analyze how the benefit from the current productions contribute to household economic
- To explain the pattern of choice coping strategy of villagers for responding to the current context

5. Research questions

- What is the agro-ecological situation in the village?
- Why maize is the dominant cash crop in the village?
- What are the benefits of these strategies?
- What are factor driving people to choose such strategy and are these strategies suitable to the current condition of the village or are there other alternatives?

6. Conceptual framework

As it is explained in the problem analysis, the discussion provide the background for assuming that to understand the coping strategy of villager under the context of regional development and constant change requires a good understanding of (1) agro-ecological aspect in term of landscape of village, history of land use in general and in particular for household and soil fertility, (2) Household economic availability of capital of investment on production and economic return of production and (3) Institutional arrangement both inside the village and external intervention. These three main factors are interrelated and determine the household coping strategy. Land use method such as commodities, fertility application will contribute to change the soil quality and this change will influence to production methods and inputs (land use method) and economic of return. Economic of return will also affect back the choice of production and production input. Finally, institutional arrangement will coordinate and interrelate these two such as market price and demand, improvement of infrastructure, access to capital, social organization etc.

The appropriate strategy will be assessed by the way of coping and its outcomes with appropriate to sustain agro-ecological environment, household economic and respond to the current regional development.

³ Sub-district

By Group 1 Ban Khlong Tu Rain village

7. Analytical framework

This study will use model of factors that influences household coping developed by Adams *et.*al (1998) as framework in our analysis (see figure below). DFID (1999), it gives sustainable livelihood framework which determine the way of understanding the livelihood strategy. We found that these two frameworks are interrelated, because both are consistent with a way of managing assets, factor influence assets and strategy to cop with change. The study prefers to use the framework suggested by Adams *et.*al because it seems more specifically focusing on coping theory but we still keep in mind on way of understanding livelihood suggested by DFID.



Figure 14 Model of factors influences household coping

For catalyst(s), exogenous and endogenous factors framework see appendix A. This framework explains that "coping is *successful* if the household is able to summon sufficient resources to overcome adversity without endangering long-term objectives such as livelihood security". "*Failing to cope* occurs when efforts to avert crisis are unsuccessful and both short and long-term objectives are sacrificed in the struggle for survival".

8. Methodology

This study is designed to meet the objective of interdisciplinary where team members from different discipline agree on interdisciplinary methods to investigate the interrelated phenomena of ways in which villagers are coping with changes in the study village. Livelihood is a complex system which requires holistic approach so that livelihood strategy in coping with context is well explained. According to Yin (2003) and Denscombe (2007) case study approach is appropriate for this study. Our case study will be a combination of participatory approach, semi-structure interview, and small scale questionnaire survey, and soil testing (analysis). PRA include village mapping and transect together with semi-structure interview and physical observation will be used to understand agroecological situation of the village. GPS will be also used to assist in this work. Existing of farming system will be identified in this stage. Then questionnaire survey will be done through stratify random sampling to understand the benefit of the current productions on household economic. Strata can be possibly base on the identified farming system, or farm side, or social status or base on different group of farmers or input intensity. The choice will be made in the actual field. Sample will be selected representatively/proportionally from each stratum.

Semi-structure interview will be used to gather information for the overview of the study area, different coping strategies, problem and constraint in productions and internal and external intervention. Interview guideline will be designed in detail to get specific information in the case study (See appendix B). Data obtained from these sources will be categorized based on the main themes or issues based on field note and combined for analysis. Finally, the study will conduct soil testing base on the identified characteristic from questionnaire survey, semi-structure interview and PRA. Once we have a correct pattern for classifying the farmers, we will make the selection for

sampling choosing those who have similar conditions in their fields to make easier the comparison. Non-cultivated land (virgin area) also test so that we can compare how nutrient change between original land and cultivation land with different management and input intensity. We will find out pH, conductivity, N, P, and K content (see data collection sheet in appendix C).

Secondary data will be collected a long the way in field to get relevant information such as history and setting of study area, demography, and Agro-ecological situation in target area. Information obtained will be cross checked with the empirical data collected from the field. For specific data requirement see the table 1.

Literature review will be used to understand the overall context, theories related to the study area such as production system, agro-ecological environment, constraint, development intervention. This review of literature will use as the theoretical background for discussion to achieve all objectives.

Data collection

Sampling method

At least 6 key informants will be chosen through purposive sampling for semi-structure interview. They are local authorities such village chief, farmers, extension agent, chief of department of agriculture and possibly staff of KU-SLUSE who is knowledgeable about the study village. Information will be recorded. Field notes will be written up for the basis of analysis. However, key informant will be identified more in the field according to information needed. According to Denscombe (2007) suggested that in small scale survey, the sample can be ranged from 30 to 250 samples. In this study, to fit the timeframe and resource, at least 30 samples will be selected for questionnaire survey.

Data analysis

Qualitative data will be organized and "categorized" in the table around the main theme. Impressive or surprised data will be highlighted by quoting link to the context. For quantitative data from survey will be coded in MS excel and exported to SPSS 12. Frequency, Cross tabulation, Compare mean, Chi-square test, Visual Banded, Weighted mean, compute and correlation tool will be used in the analysis.

Main	Research questions	Data Requirement	Methods	Who
themes				
То	1. What is the agro-	1.1 Overview of the village	1.1.1Village	-Group of
explore	ecological situation in		mapping	informants
how the soil	the village?	1.2 Farming system in the village	1.2.1Transect	-Key farmers
fertility is affected		1.3 Soil information	1.3.1 Soil sampling and	-Farmers' plot
by current			testing (test kid:	
agricultur			N,P,K, CD, ph	
al practice			water)	
from		1.4 Geographical	1.4.1 Secondary	-Literature, data
different		information(topography,	data collection	from department
field		temperature, rainfall etc)		of agriculture
То	2. Why maize is the	2.1 History of village and	All are obtained	
analyze	dominant cash crop in	agricultural production	by both semi-	-Key informants
how the	the village?	2.2.Importance of maize,	structure	(SSI)
benefit		cattle, tomato	interview (SSI)	
from the		2.3 Land ownership	and structure	-Farmers(SI)
current		2.4 Land use	interview (SI)	
productio		2.5 Perception of the villagers		-Extension
ns		on the importance of maize		agents(SSI)
contribute		and cattle raising		

Table 11 Logical data requirement

By Group 1 Ban Khlong Tu Rain village

to household economic	3. What are the benefits of these strategies?	 3.1Commercialization/Income 3.2 Support agent (government subsides, credits, extension) 3.3 Market, price 3.4 Labors and employment 3.5 Input and productivity 	Secondary data	
To explain	4. What are factor	4.1 Opportunity and	All are obtained	-Key informants
the pattern	driving people to	constraints(productions,	by both semi-	(SSI)
of choice	choose such strategy	market, etc)	structure	
coping	and are these strategies		interview (SSI)	-Farmers(SI)
strategy of	is suitable to the current	4.2 Off-farm employment	and structure	
villagers	condition of the village	4.3.Use of cattle manure	interview (SI)	-Extension
for	or there are other	4.4 Use of maize for livestock		agents(SSI)
respondin	alternatives?	feeding		
g to the			Secondary data	
current				
context				

9. Risk and ethical consideration

This design of synopsis is mainly based on the literature and little information from the study area; therefore, on the ground the actual context may differ from what is expected and lead to the overall change in our research design. Furthermore, this study will cooperate with Thai partner and this may affect the overall design.

This is the first experience for us to conduct cross cultural and cross discipline within the team and our collaborative partner, plus the field survey conducted through interpreter, thus, our data may lose its utility. Therefore any kind of bias will be minimized. We will try to make a well inform-consent to respondents to understand our objectives. Respondents will be highly respected in both communication and trust building.

10. Implementation plan

The table below describes only main activities during the field work.

ubic 14	- incurrency	51011		
No.	March	Activities	Duration	Prerequisite
			(day)	
1	6	Plausibility testing	1	
2	7-8	Agro-ecological understanding(village mapping	2	1
		and Transect), identify key informants		
3	9-10	Questionnaire survey	5	1, 2
4	11-15	Semi-structure interview	2	2, 3
5	16	Soil sampling and verify information(what lack,	1	2, 3, 4
		what need more)		
6	17	verify information(what lack, what need more)	1	
7	18	Prepare presentation, analyze some finding	2	
8	19	Present finding to community, get community	1	
		feedback		
		Total	15	

Table	12	Activity	plan
			P

Note: All material need for this field work is concerned.

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12. Appendix

Appendix A Detail analytical framework

Catalyst affecting coping strategy

Generalised catalysts	Household-specific catalysts
Drought, flood or other climatic crises	Illness/death of a key productive worker
Crop infestation	Divorce/family quarrels
Human or animal epidemic	Indebtedness/bankruptcy
Civil unrest	
Structural adjustment/inflation/price shoc	ks

Framework for a	ussessing the e	exogenous a	and endogenous	context of	coping

Factor	Description
Exogenous Broader economic and political forces	Structural adjustment, growth, taxation, inflation, and exchange rates Political climate International aid
Local climate and ecology	Climatic and rainfall patterns Seasonality Soil fertility and carrying capacity
Local economy	Diversity of production systems Seasonality of production systems Relationships between production systems
Local culture, institutions and networks	Notions of community (religious, ethnic, and kinship) Norms and values Existence of credit groups, communal work associations, etc.
Local infrastructure	Proximity to: roads; rivers; transhumant paths; markets; other villages; schools; health services; water supply Quality of infrastructure
Endogenous Demographic structure	Household size Household life-cycle stage Household composition (age, gender) Education of household members
Socio-economic status	Household assets: land; agricultural equipment; livestock; radio/cassette player Productive activities Household income and expenditure Indebtedness Household food security
Social networks	Access to social claims and transfers by means of kinship, membership in village organisations, etc.
Intrahousehold dynamics and decision-making	Gender and/or generational dynamics and control over household resources Decision-making
Recent crises, coping strategies and consequences	Crises provoked by illness; ceremonial expenses; food shortage; natural disaster; loss of employment; litigation; asset loss; inflation; social crises Strategies undertaken, their sequence and consequences for livelihood, consumption, health and status

Source: Adams et. al 1998

Draft	Interview	Guide	for	Key	Informants

Person interviewed (including role): Province: District: Commune: Village: Date & time of the interview: Interviewer/s: Note taker Write up by:

I. Village setting

-Background of informant (name, age, role in village, household size, year of settle in village)

-History of village:

-when village was established, at then how many people? What did they do? How many total lands in village? How land had been expanded? Who come to control land expansion (role of Royal Forest Department at that time)?

-Once village was created, what kind of agriculture product people produce? What crop and why?

-How the situations in village change? What are main factor for change? And when you noticed to be major change?

II. Economic activities

-what are the main sources of income?

-when people start growing maize?

-why people growing maize? (Because of market, price, soil, family preference, availability of labor, or incentive from government or credit institution...)

-Are there any alternative of production or job beside the current production? How many people involve in those alternative jobs and why they do so?

III. Land use and land tenure

-What is the current practice of production on land management (cropping pattern, irrigate, fertilize, manure, fallow etc)? How do you think about the soil fertility now? How should be improve?

-What type of land holding in the village? Do every one have land tittle?

IV. Opportunity and constraint

-What kind of constraint villagers face to develop their activities? How people deal with this challenge?

-What is role of agricultural extension play to help villagers to overcome possible constraints?

-What kind of barriers the villagers face to develop their quotidian activities?

-Do villagers finding technologies in their quotidian live to cop their livelihood strategies?

-What is the role of government and local NGOs in helping villagers to develop their activities?

-Is there any employment of livestock manure as fertilizer in agriculture for the villagers?

Appendix C Draft questionnaire survey

Draft Questionnaire Survey

Village: Number of questionnaire: Name of informant (optional):

We are a group of student from University of Copenhagen, Faculty of Life Science, Denmark, studying Agricultural development. We have cooperation with a group of Thai student from Kasetsat University. We kindly ask you to participate in my questionnaire survey. Your answers will be kept anonymous and the results will be used to analyze the *coping strategy of the Livelihoods if is suitable fore the village* to fill the requirement of our academic study. Thank you for your participation.

I. Background information

- 1.1 Name of head of household (optional):....
- 1.2 Gender of head of household : Male Female
- 1.3 Age of head of householdyears old
- 1.4 Education of head of household

□ Illiterate □ Primary school □ Secondary □ High school □ University

- 1.5 Ethnicity/language.....
- 1.6 How many adults in the household?.....person
- 1.7 How many children/minors in the household?.....person
- 1.8 Year of establishment in the village?....

II. Salaried work

How many members of the household have salaried employment?	person
Type of salaried work	a. off-farm b. on-farm c. mix of both types

III. Credit, loans

	Amount of	Interest rate
	money	
Did you borrow money from a middleman		
last year (for contract farming)?		
Yes No		
Did you borrow money from a village		
association last year?		
Yes 🗌 👘 No 🗌		

IV. Land rights (number of rais owned, rented, sold)

Amount of land owned with a PBT5 title?	Rais
Amount of land owned with a SPK4-01?	Rais
Amount of land rented last year?	Rais
Amount of land "sold" in the past 5 years?	Rais

V. Livestock production

How many heads of cattle do you own?	
How many pigs?	
How many chickens?	
How many sheep?	
How many goats?	
Do you have a fish pond?	Yes No

VI. Agricultural productions

	N Crop	Crop			0.11	Drive	Species use				Hire	Plough		
Ν			D (ried	Consumption	Sell	Price	kg	Туре	Fertilizer	Manue	labor harvest	Own	High
	Maizo	Own	Rent										tractor	tractor
1	Cassava													
2	Cassava													
3	Rice													
4	Groundnut													
5	Tomato													
6	Chili													
7	Sugar cane													
8	Soya bean													
9	Agar wood													
10	Coconut													
11	Banana													
12	Papayas													
13	Thai apple													
14	Tamarind													
15	Leechees													
16	Longan													
17	Mango													
18	Mushrooms													
	Rattan													
19														
20	ватроо shoots													
21	Firewood													
22	Other please specify													

7. Agricultural inputs

Rais
kg
kg/ton
Tractor Animal

8. Constraints

What do you think as major constraints in you productions? Please rank from 1 to 5 where 1 is not the problem and 5 is really a problem.

N	Major problems		Score							
IN		1	2	3	4	5				
1	Low price									
2	Poor soil fertility									
3	Limitted market acess									
4	Inefficient production method									
5	Lack of access to water									
6	Crop pests and disease									
7	Livestock diseases									
8	Lack of capital or cash resource									
9	Lack of extension service									
10	Other (Please specify)									

Thank you very much for participation, I really appreciate you time!

No.	Farmer 's	Field description						Ν	Р	K	pН	Al
	Name	Soil	Texture	Structure	Color	Depth						
		type										

Appendix D Soil sampling data collection sheet