

**A STUDY ON MULTI-CRITERIA CROPPING PATTERN  
PLANNING USING ANALYTICAL HIERACHY PROCESS (AHP):  
A CASE STUDY OF THUNG KU LA RONG HAI**



**A THESIS SUBMITTED IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR  
THE DEGREE OF MASTER OF SCIENCE  
(ENVIRONMENTAL MANAGEMENT)  
FACULTY OF GRADUATE STUDIES  
MAHIDOL UNIVERSITY  
2007**


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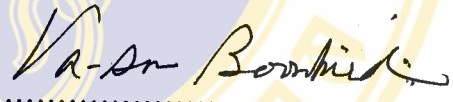
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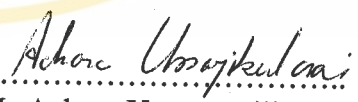
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A CASE STUDY OF THUNG KU LA RONG HAI**

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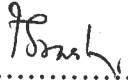
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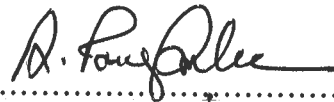
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## ACKNOWLEDGEMENT

The success of this thesis was attributed to the extensive support and assistance of my major advisors, Associate Professor Dr. Kampanad Bhaktikul and my co-advisor, Mr. Vason Boonkird, Dr. Thongplew Kongjun. I deeply thank them for their kindness, valuable advice and guidance in this research.

I am grateful to thank the chiefs of Provincial Irrigation Offices in Thung Ku La Rong Hai area, for their generous support during the data collecting period for this study, and thanks Mr. Attawit Puentawee and Mr. Arthon Suttigarn their assistance in interviewing the farmers in 5 provinces. I would like to thank Ms. Wasaporn Techapeerapanich and Mr. Arthon Suttigarn for improving English language in my thesis.

I am grateful to all the lecturers and staff of the Faculty of Environment and Resource Studies for their valuable advice and kind support.

I would like to thank my friends, Mr. Annop Arirat and Mr. Rattapan Pattanarangsarn for their encouragement and friendship throughout my study.

Finally, I am grateful to my family for their financial support, entirely care, understanding, encouragement and love. The usefulness of this thesis, I dedicate to my family and all teachers who taught me since my childhood.

Ewisan Kukiattisuk

A STUDY ON MULTI-CRITERIA CROPPING PATTERN PLANNING USING ANALYTICAL HIERACHY PROCESS (AHP): A CASE STUDY OF THUNG KU LA RONG HAI

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ABSTRACT

The most appropriate alternative for cropping pattern planning in Thung Ku La Rong Hai is one that provides the most satisfaction to farmers and is suitable to the characteristics of the area. In this study, economic, social, and engineering criteria were used to evaluate the proposed 4 alternatives and the Analytical Hierarchy Process (AHP) was used to rank them. The proposed alternatives were paddies, upland crops, vegetable and fruit trees respectively. The analysis found that alternative 1 (paddies) was the ranked first during the wet season, accounted for 50.8% of the total weighting scores. In the dry season, upland crops were ranked first, accounting for 29.3% of the total weighting scores.

The sensitivity analysis suggests that alternative 1 is the most appropriate solution for cropping during the wet season, and alternative 2 is the most appropriate solution for dry season cropping due to its insensitivity to fluctuation and adjustments of priority weighting scores of each criterion.

KEY WORD: ANALYTICAL HIERACHY PROCESS (AHP) /

THUNG KU LA RONG HAI / CROPPING PATTERN PLANNING

127 pp.

การศึกษาการวางแผนการปลูกพืชแบบหลายเกณฑ์โดยใช้กระบวนการลำดับชั้น (AHP)  
กรณีศึกษา: ทุ่งกุลาร้องไห้ (A STUDY ON MULTI-CRITERIA CROPPING  
PATTERN PLANNING USING ANALYTICAL HIERACHY PROCESS (AHP):  
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### บทคัดย่อ

ทางเลือกที่เหมาะสมในการวางแผนการปลูกพืชที่เหมาะสมในพื้นที่ทุ่งกุลาร้องไห้ คือ  
ทางเลือกที่เกษตรกรผู้ทำการเพาะปลูกมีความพึงพอใจ และเหมาะสมกับสภาพพื้นที่ที่ทำการ  
เพาะปลูก การศึกษาในครั้งนี้จึงใช้เกณฑ์ 3 เกณฑ์ คือ ด้านเศรษฐกิจ ด้านสังคม และด้าน  
วิศวกรรม ตามลำดับ สำหรับเกณฑ์ดังกล่าวใช้วิเคราะห์เพื่อคัดเลือกหาทางเลือกที่ดีที่สุด ใน 4  
ทางเลือก ดังนี้ ทางเลือกที่ 1 คือ ข้าว ทางเลือกที่ 2 คือ พืชไร่ ทางเลือกที่ 3 คือ พืชผัก และ  
ทางเลือกที่ 4 คือ ไม้ผล/ไม้ยืนต้น โดยใช้กระบวนการวิเคราะห์ตามลำดับชั้นในการวิเคราะห์  
เพื่อคัดเลือกทางเลือกที่ดีที่สุด โดยในฤดูฝนทางเลือกที่ 1 ได้น้ำหนักความสำคัญมากที่สุด  
เท่ากับ 50.8% และในฤดูแล้ง ทางเลือกที่ 2 ได้น้ำหนักความสำคัญมากที่สุด เท่ากับ 29.3%

โดยเมื่อทำการวิเคราะห์ความอ่อนไหว พบว่า ทางเลือกที่ 1 เหมาะสมกับฤดูฝน และ  
ทางเลือกที่ 2 เหมาะสมกับฤดูแล้ง เนื่องจากไม่อ่อนไหวต่อน้ำหนักความสำคัญของเกณฑ์ทั้ง 3  
เกณฑ์ ไม่ว่าจะเป็นเกณฑ์ด้านเศรษฐกิจ เกณฑ์ด้านสังคม และเกณฑ์ด้านวิศวกรรม แม้จะมีการ  
เปลี่ยนแปลงน้ำหนักความสำคัญของเกณฑ์ทั้ง 3 เกณฑ์จากน้อยที่สุดถึงมากที่สุด

127 หน้า

## CONTENTS

	Page
ACKNOWLEDGEMENT.....	iii
ABSTRACT.....	iv
LIST OF TABLES.....	viii
LIST OF FIGURES.....	x
CHAPTER	
1 INTRODUCTION.....	1
1.1 Introduction and Background of the Study.....	1
1.2 Conceptual Framework.....	5
1.3 Objectives of the Study.....	6
1.4 Scope of the Study.....	6
1.5 Expected Outcomes.....	7
2 LITERATURE REVIEW.....	8
2.1 Thung Ku La Rong Hai Area.....	8
2.2 Water Management.....	15
2.3 Water User Association.....	16
2.4 Multi-Objective Decision Making (MODM).....	17
2.5 Analytical Hierarchy Process (AHP).....	19
2.6 Relevant studies of Analytical Hierarchy Process (AHP).....	24
3 METHODOLOGY.....	32
3.1 Selection of Sample Populations.....	32
3.2 Analytical Tools.....	33
3.3 Data Collection.....	33
3.4 Data Analysis.....	34

## CONTENTS (cont.)

CHAPTER		Page
4	RESULTS.....	36
	4.1 Problem of Cropping Pattern Planning.....	36
	in Thung Ku La Rong Hai	
	4.2 General Data from Questionnaire Part I.....	36
	4.3 Level of Hierarchical Structure.....	56
	4.4 Calculation Results of Relative Priority Ranking .....	56
	in Cropping Pattern Planning	
	4.5 Statement of Alternative Options from the Analysis.....	57
	of Relative Priority Ranking	
	4.6 Sensitivity Analysis.....	59
5	CONCLUSION AND RECOMMENDATIONS.....	68
	5.1 Conclusion.....	68
	5.2 Recommendation.....	68
	REFERENCES.....	70
	APPENDIX.....	73
	BIOGRAPHY.....	127

## LIST OF TABLES

	<b>Page</b>
<b>Table 2.1:</b> Ratio of Thung Ku La Rong Hai Area	9
<b>Table 2.2:</b> Sub-basin in Thung ku La Rong Hai	10
<b>Table 2.3:</b> Shown Characteristic of Weather in Thung Ku La Rong Hai	11
<b>Table 2.4:</b> Stream in Thung Ku La Rong Hai Area	13
<b>Table 2.5:</b> Land use of Thung Ku La Rong Hai Area	14
<b>Table 2.6:</b> Pairwise comparison Scale	21
<b>Table 2.7:</b> Values of Random Consistency Index	23
<b>Table 4.1:</b> Age of sampling in in Roi-et	36
<b>Table 4.2:</b> Cropping area of sampling in Roi-et	37
<b>Table 4.3:</b> Number of cropping type of sampling in Roi-et	37
<b>Table 4.4:</b> Type of cropping of sampling in Roi-et	37
<b>Table 4.5:</b> Number of produce of sampling in Roi-et	38
<b>Table 4.6:</b> Cropping time of sampling in Roi-et	38
<b>Table 4.7:</b> Age of sampling in Surin	39
<b>Table 4.8:</b> Cropping area of sampling in Surin	40
<b>Table 4.9:</b> Number of cropping type of sampling in Surin	40
<b>Table 4.10:</b> Type of cropping of sampling in Surin	40
<b>Table 4.11:</b> Number of produce of sampling in Surin	41
<b>Table 4.12:</b> Cropping time of sampling in Surin	41
<b>Table 4.13:</b> Age of sampling in Si Sa Ket	42
<b>Table 4.14:</b> Cropping area of sampling in Si Sa Ket	43
<b>Table 4.15:</b> Number of cropping type of sampling in Si Sa Ket	43
<b>Table 4.16:</b> Type of cropping of sampling in Si Sa Ket	43
<b>Table 4.17:</b> Number of produce of sampling in Si Sa Ket	44
<b>Table 4.18:</b> Cropping time of sampling in Si Sa Ket	44
<b>Table 4.19:</b> Age of sampling in Mahasarakham	46
<b>Table 4.20:</b> Cropping area of sampling in Mahasarakham	46

## LIST OF TABLES (cont.)

	<b>Page</b>
<b>Table 4.21:</b> Number of cropping type of sampling in Mahasarakham	46
<b>Table 4.22:</b> Type of cropping of sampling in Mahasarakham	47
<b>Table 4.23:</b> Number of produce of sampling in Mahasarakham	47
<b>Table 4.24:</b> Cropping time of sampling in Mahasarakham	48
<b>Table 4.25:</b> Age of sampling in Yasothon	49
<b>Table 4.26:</b> Cropping area of sampling in Yasothon	49
<b>Table 4.27:</b> Number of cropping type of sampling in Yasothon	50
<b>Table 4.28:</b> Type of cropping of sampling in Yasothon	50
<b>Table 4.29:</b> Number of produce of sampling in Yasothon	50
<b>Table 4.30:</b> Cropping time of sampling in Yasothon	51
<b>Table 4.31:</b> Age of sampling in Thung Ku La Rong Hai	52
<b>Table 4.32:</b> Cropping area of sampling in Thung Ku La Rong Hai	52
<b>Table 4.33:</b> Number of cropping type of sampling in Thung Ku La Rong Hai	53
<b>Table 4.34:</b> Type of cropping of sampling in Thung Ku La Rong Hai	53
<b>Table 4.35:</b> Number of produce of sampling in Thung Ku La Rong Hai	53
<b>Table 4.36:</b> Cropping time of sampling in Thung Ku La Rong Hai	54
<b>Table 4.37:</b> Results of the Total Priority Ranking Scores of all Criteria in Wet Season	59
<b>Table 4.38:</b> Results of the Total Priority Ranking Scores of all Criteria in Dry Season	59

## LIST OF FIGURES

	<b>Page</b>
<b>Figure 1.1:</b> Khong basin	2
<b>Figure 1.1:</b> Chi basin	3
<b>Figure 1.3:</b> Mun basin	3
<b>Figure 1.4:</b> Conceptual Framework	6
<b>Figure 1.5:</b> Thung Ku La Rong Hai	7
<b>Figure 2.1:</b> Map of Thung Ku La Rong Hai	8
<b>Figure 2.2:</b> Map of Sub-basin in Thung ku La Rong Hai	9
<b>Figure 2.3:</b> Ratio of Rain Distribution	12
<b>Figure 2.4:</b> Structure of Analytical Hierarchy Process	20
<b>Figure 3.1:</b> Nine phases of analytical hierarchy process	34
<b>Figure 3.2:</b> Priority Setting of Analytical Hierarchy Process	35
<b>Figure 4.1:</b> Cropping period of sampling in Roi-Et	39
<b>Figure 4.2:</b> Cropping period of sampling in Surin	42
<b>Figure 4.3:</b> Cropping period of sampling in Si Sa Ket	45
<b>Figure 4.4:</b> Cropping period of sampling in Mahasarskham	48
<b>Figure 4.5:</b> Cropping period of sampling in Yasothon	51
<b>Figure 4.6:</b> Cropping period of sampling in Thung Ku La Rong Hai	55
<b>Figure 4.7:</b> The level of Hierarchical Structure in the Analytical Hierarchy Process	56
<b>Figure 4.8:</b> Relative Priority Ranking of Each Level of Hierarchical Structure in Wet Season	57
<b>Figure 4.9:</b> Relative Priority Ranking of Each Level of Hierarchical Structure in Dry Season	58
<b>Figure 4.10:</b> Sensitivity Analysis of Alternative (Wet Season)	60
<b>Figure 4.11:</b> Sensitivity Analysis of Alternative in case of equal Scores (Wet Season)	60

## LIST OF FIGURES (cont.)

	<b>Page</b>
<b>Figure 4.12:</b> Sensitivity Analysis of Alternative in case Economic Criteria has maximum priority weighting scores (Wet Season)	61
<b>Figure 4.13:</b> Sensitivity Analysis of Alternative in case Economic Criteria has minimum priority weighting scores (Wet Season)	61
<b>Figure 4.14:</b> Sensitivity Analysis of Alternative in case Social Criteria has maximum priority weighting scores (Wet Season)	62
<b>Figure 4.15:</b> Sensitivity Analysis of Alternative in case Social Criteria has minimum priority weighting scores (Wet Season)	62
<b>Figure 4.16:</b> Sensitivity Analysis of Alternative in case Engineering Criteria has maximum priority weighting scores (Wet Season)	63
<b>Figure 4.17:</b> Sensitivity Analysis of Alternative in case Engineering Criteria has minimum priority weighting scores (Wet Season)	63
<b>Figure 4.18:</b> Sensitivity Analysis of Alternative (Dry Season)	64
<b>Figure 4.19:</b> Sensitivity Analysis of Alternative in case of equal scores (Dry Season)	64
<b>Figure 4.20:</b> Sensitivity Analysis of Alternative in case Economic Criteria has maximum priority weighting scores (Dry Season)	65
<b>Figure 4.21:</b> Sensitivity Analysis of Alternative in case Economic Criteria has minimum priority weighting scores (Dry Season)	65
<b>Figure 4.22:</b> Sensitivity Analysis of Alternative in case Social Criteria has maximum priority weighting scores (Dry Season)	66
<b>Figure 4.23:</b> Sensitivity Analysis of Alternative in case Social Criteria has minimum priority weighting scores (Dry Season)	66
<b>Figure 4.24:</b> Sensitivity Analysis of Alternative in case Engineering Criteria has maximum priority weighting scores (Dry Season)	67
<b>Figure 4.25:</b> Sensitivity Analysis of Alternative in case Engineering Criteria has minimum priority weighting scores (Dry Season)	67

## CHAPTER 1

### INTRODUCTION

#### 1.1 Introduction and Background of the Study

Thailand is an agricultural country having rice as main crop. This is because of the abundance of water for use in Thailand for centuries. The shortage of water in the past usually happens during the dry season. Water and agriculture go hand in hand. Water resources are important for agricultural development. Due to the rapid growth of population and concentration of economic activities, the shortage of water becomes a phenomenon which occurs more often in the present. The conflicts of water demands among farmers or between farmer and government officer has become on problem. So, if an irrigation system is well developed to meet the water demand for current and future agricultural use, these problems can be decreased.

The development of water sources for agricultural purposes in Thailand have been advanced done for a very long time. There were written records relating to the development of water sources for agriculture in the North of Thailand at the time of Khun Mang Rai of Lanna Thai Kingdom. These records described irrigation ditches to channel from the rivers and brooks to the rice fields. At later periods, these developments were continued. During the reign of King Rama V, Thailand entered the Bowring Contract with England in 1855. This was the origin of irrigation system to enhance the production of rice for export and eventually the government granted a concession in the Rangsit Project to the private sector to implement the digging of canals for use as an inundation canal for the development of water sources for agricultural purposes. (Khao-SaAard et al., 2001)

The northeastern region covers three major basins, which are Khong basin, Chi basin, and Mun basin (Figure 1.1, 1.2 and 1.3). All of which consists of 68 sub-river basin covering the total area of 176,599 sq.km. (110.374 million rais). The average rainfall

in this area is higher than other regions by 237,578 millions cubic meters per year. In addition, the average usable water rate per person per year is lower than the standard rate by 828 cubic meters. The current water storage in reservoirs can collect rainwater of 4,374 million cubic meters per year or only 5.8% of the annual runoff. This rainwater can be irrigated to 5.5 millions rais of agricultural land, or equally to 10% of the total agricultural land. Despite having higher rainfall than other regions, scatter rains and loose soils make it difficult to store sufficient rainwater for the rest of the agricultural areas in northeastern Thailand, which have more than of 57.43 millions rais. This affected the areas of Mun basin, Chi basin and Khong basin.

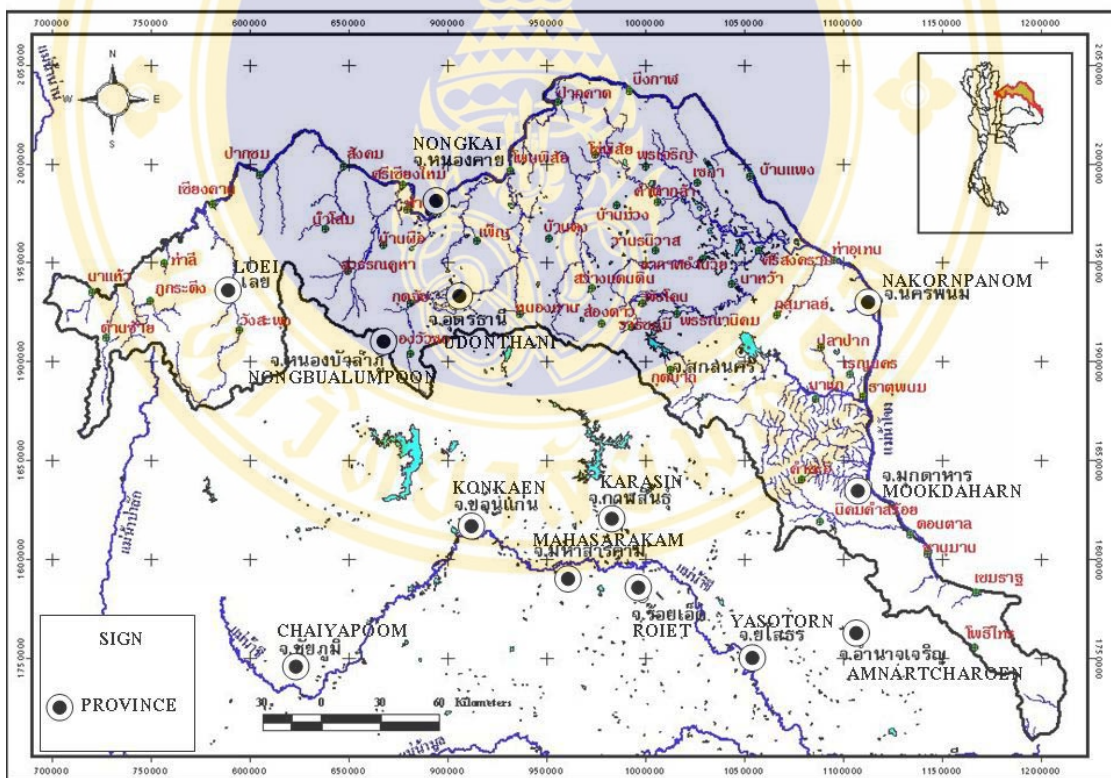


Figure 1.1: Khong basin

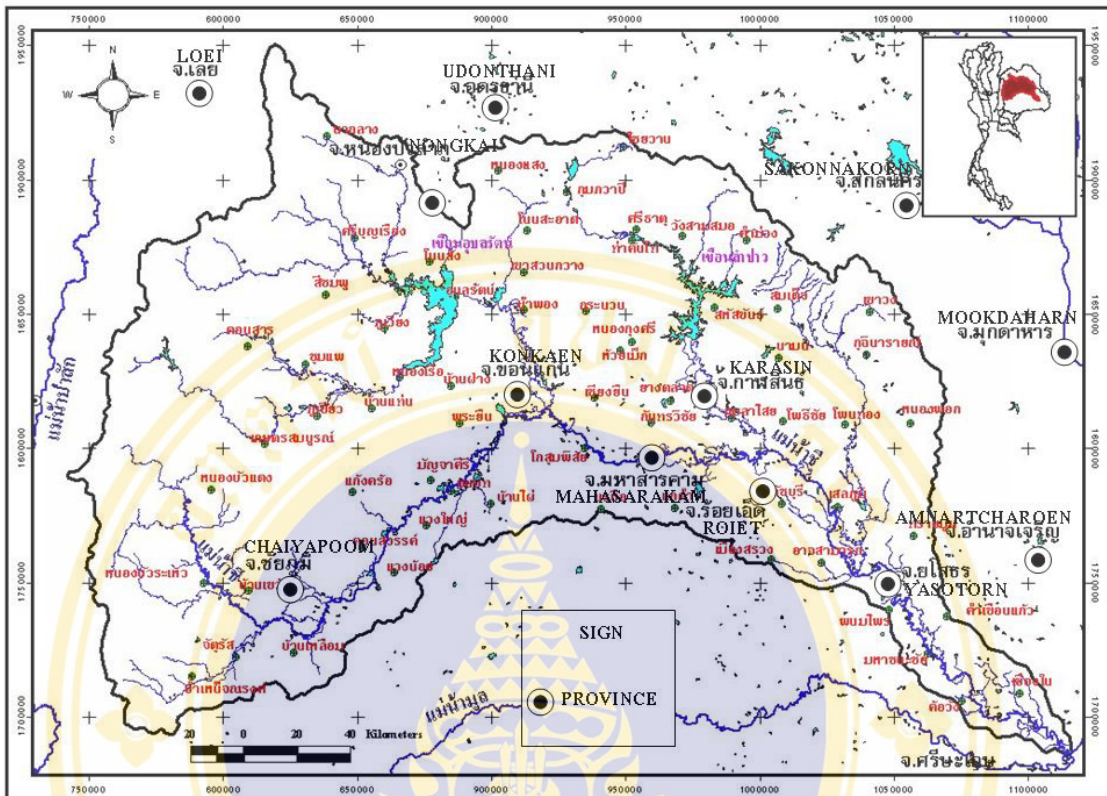


Figure 1.2: Chi basin

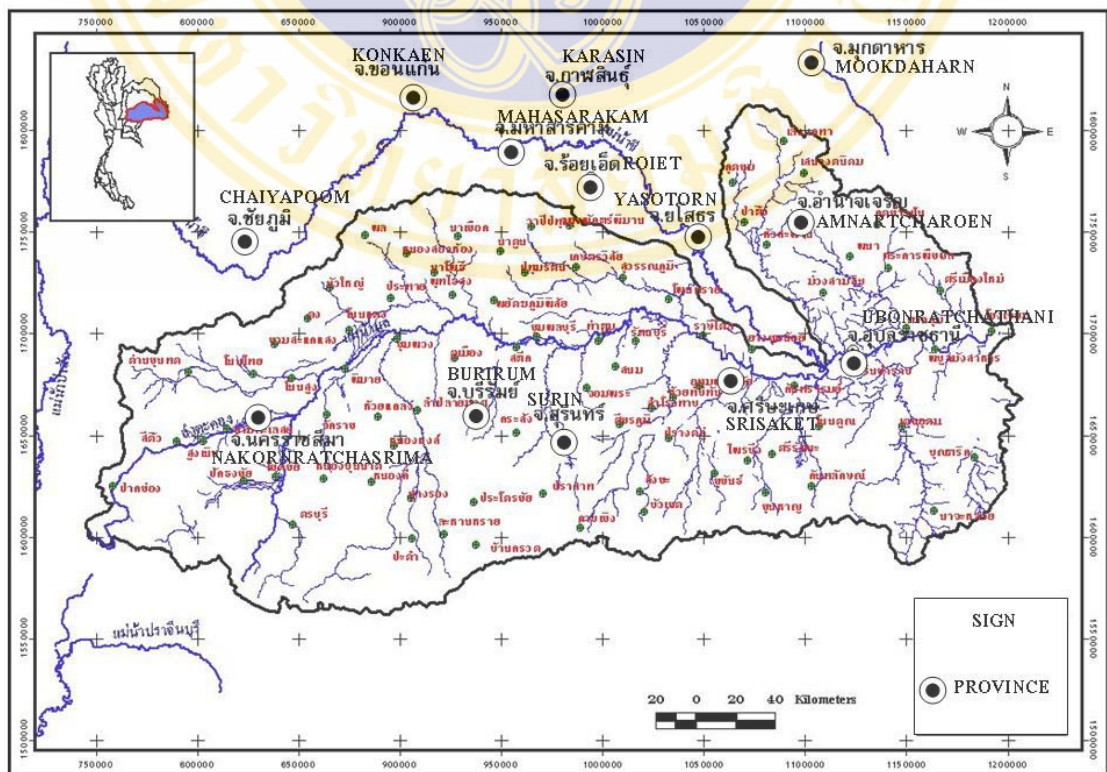


Figure 1.3: Mun basin

At present, resources in the world are being used continuously and due to the rapid growth of populace combined with more modern technology. Resources are being used at an even greater rate. The lack of resources is now intensifying –especially with water which is one of the most important resources. Water is a core factor for the living of humans in the terms of consumables, comestibles, agriculture, industry, livestock, trade, water creatures, wild animals, recreation and ecosystems. In Thailand, there are several state agencies running the control of water, for instance, the Department of Water Resource, the Royal Irrigation Department, the Department of Pollution Control, etc. In this paper there will be a reference to the Royal Irrigation Department only as it plays the principal role in providing water for farmers and mitigating floods.

In the past, it was believed that irrigation was essential for agricultural productivity. The development of water sources in the past was to increase farmers income. This was implemented through a number of large, medium and small scale projects. Although the conceptual thought was not wrong, its assumption that when farmers had more water they would increase productivity and earn more income was not entirely correct. This overlooked the farmers' problems such as no plan for farmers organization's development. The requirement here is the need to make an analysis examining plan of water resource development to be suitable with. It is also required to take a look at the huge budget investment, whether the farmers are really the actual beneficiary of such projects. Are there any guidelines to help improve the development projects to truly benefit the farmers? (Anukul-Aumpai, 1999)

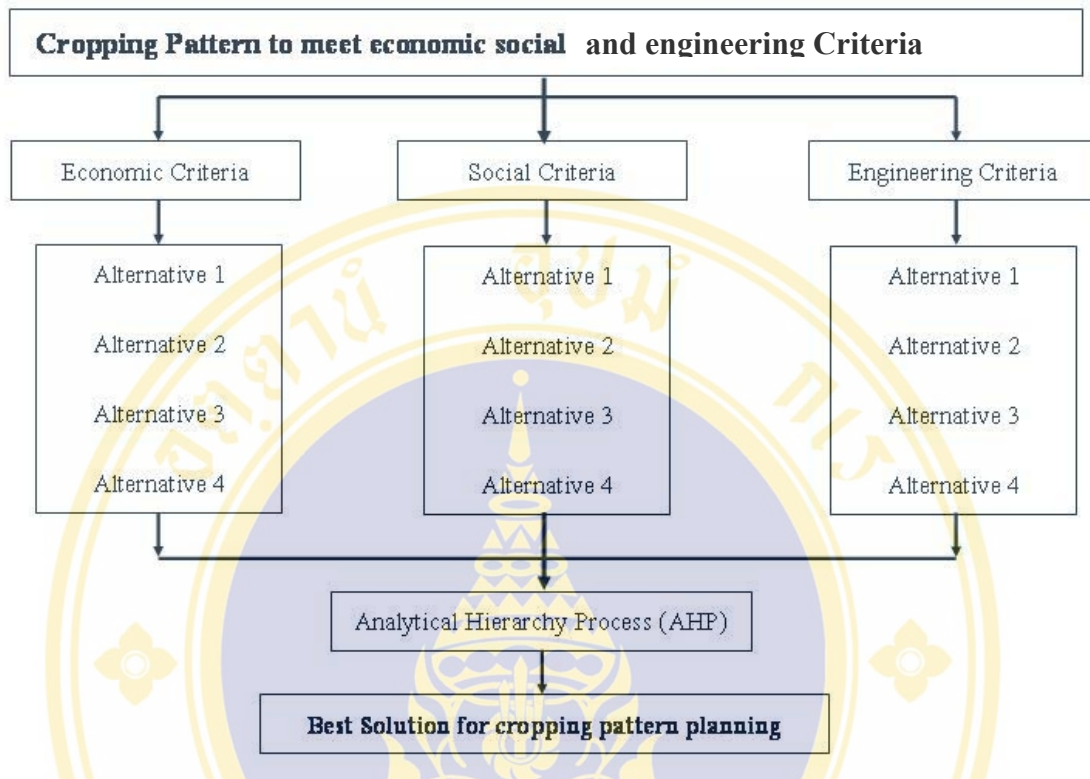
The development of economy in the northeastern of Thailand has been extended in every aspect, especially agriculture, industry, transportation, commerce and service. Income from agriculture is the major economy of the northeast. At present, cropping area can hardly be extended, thus it is necessary to develop areas such as backward-agricultural areas and deteriorated natural resource area such as Thung Ku La Rong Hai. For these reasons the structural agriculture policy has been adjusted from extending cropping area to increasing efficiency of agricultural land use.

The Thung Kula Rong Hai is a flat area, located in the Mun basin in the middle of region. It has land area of 2.1 million rai (3,360 km.<sup>2</sup>) covering 5 provinces which are Roi-Et, Surin, Si Sa Ket, Mahasarakham, and Yasothon with the population of 622,188.

At present, the Royal Irrigation Department (RID), the core governmental agency in the field of water development for agriculture, has continually conducted the development programs under the Department's vision. RID is determined to develop and manage water use for quality of life and sustained development of the country, through the means of reformation in development and management of water with efficiency and appropriately applied technology, create management mechanisms for the organization and contributory public, and enhance all parties' coordination to get optimal benefits in development work and water management. (RID, 2000)

## **1.2 Conceptual Framework**

This study focuses on the factors relating agricultural land use and irrigation systems. The in part comprises of the relationship between water, land use and plants. (Figure 1.4)



**Figure 1.4: Conceptual Framework**

### 1.3 Objectives of the Study

The objectives of the study of an integrated Decision Making for Multi-Criteria Cropping Pattern Planning Using Analytical Hierarchy Process: A case Study of Thung Ku La Rong Hai, are;

- 1.3.1 To investigate the problem of cropping Pattern in Thung Ku La Rong Hai.
- 1.3.2 To evaluate the most suitable cropping pattern by using Analytical Hierarchy Process (AHP).

### 1.4 Scope of the Study

This research is a comparative study between theory and field study. A literature survey relating to cropping plantation and water demand are comprehensively came out while the field study is comprises of structured interviews with farmers about their behavioral use of water. Finally the field study is analyzed and evaluated together with

the theoretical knowledge to seek the most cropping pattern in correspondence to the need of farmers in the plantation of dry season cropping and most useful irrigation system development. The followings are scopes of the study:

- 1.4.1 The study area is covers the area of Thung Ku La Rong Hai. (Figure 1.5)
- 1.4.2 The study samples are farmers in Thung Ku La Rong Hai.

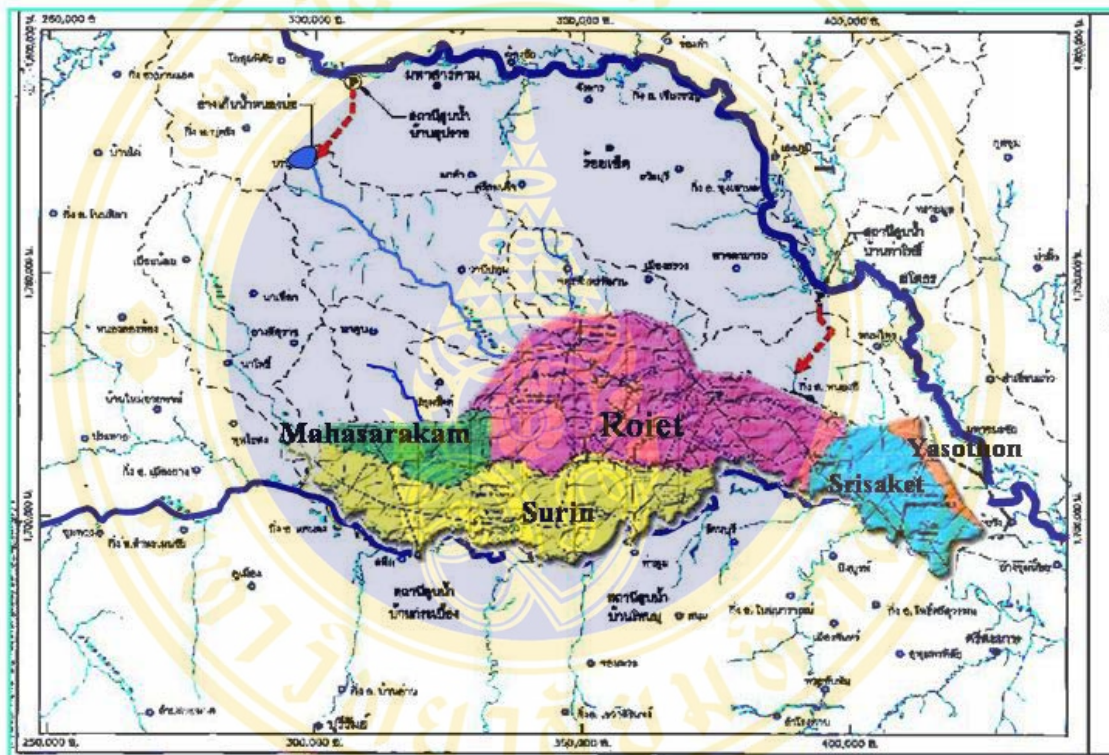


Figure 1.5: Thung Ku La Rong Hai

### 1.5 Expected Outcomes

- 1.5.1 To know the problem of cropping Pattern in Thung Ku La Rong Hai
- 1.5.2 The better alternatives for selection of cropping pattern.

## CHAPTER 2

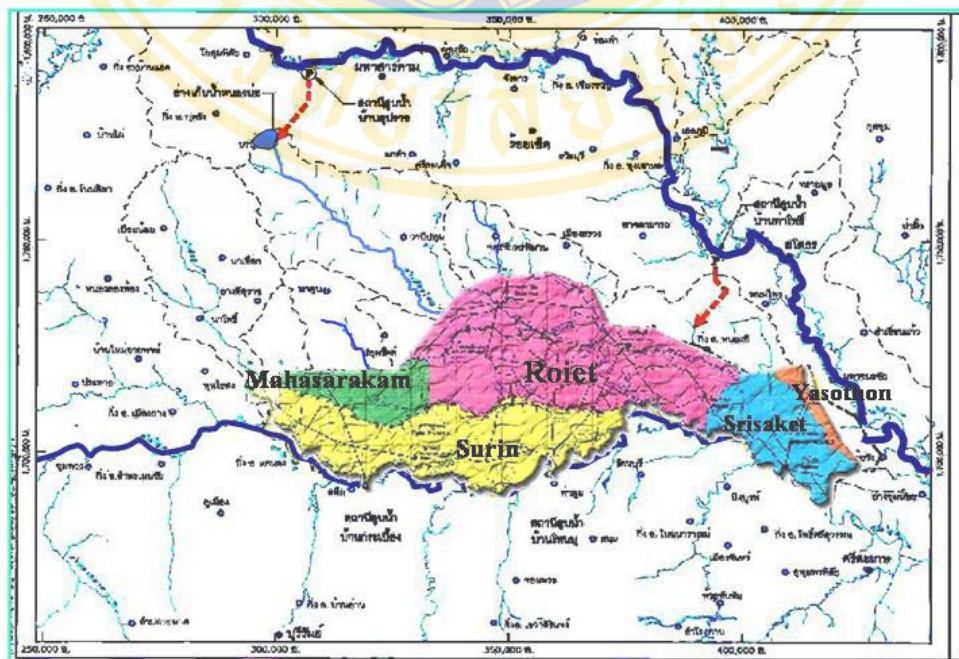
### LITERATURE REVIEW

Thailand is one of the major exporter of agribusiness in the world. However, agriculture sector has been accused for a large volume of water for the plantation. The availability of water resource of Thailand is challenging the country's ability to compete in the world market. This chapter is a comprehensive literature survey and theoretical concept covering the geographical conditions of the study area, current water management practices and theories concerning MODM, AHP.

#### 2.1 Thung Ku La Rong Hai

##### 2.1.1 Location and General Description

The Tung Kula Rong Hai is a flat area, located about the middle of the Mun basin. It has land area of 2.1 million rai (3,360 km.2) covering 5 provinces which are Roi-Et, Surin, Si Sa Ket, Maha Sarakham, and Yasothon. (Figure 2.1)



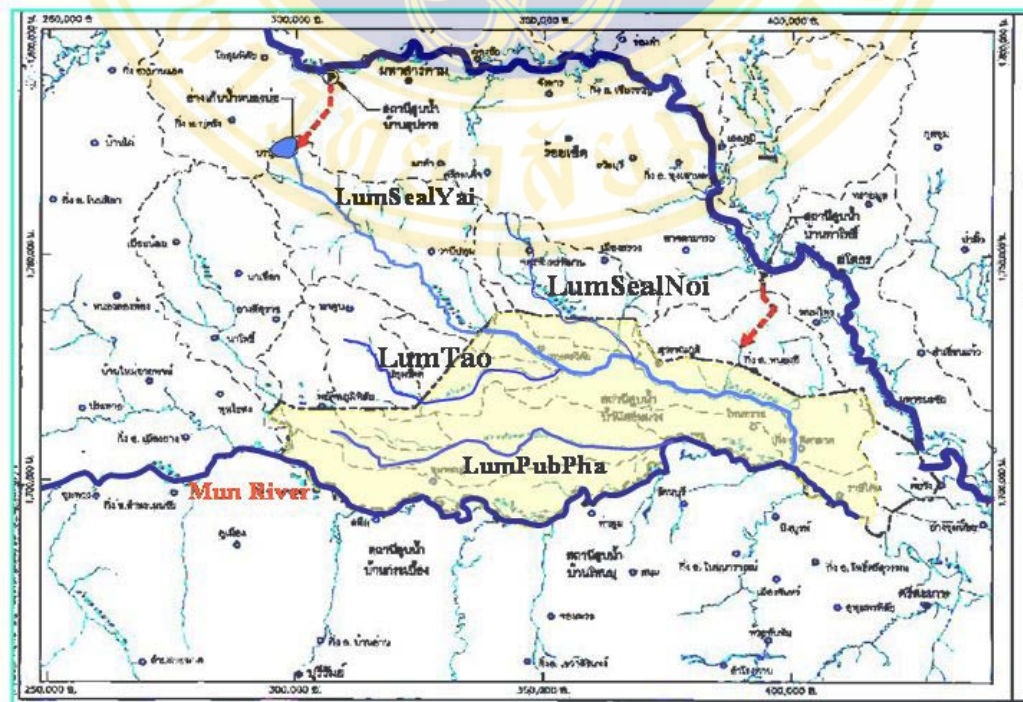
Source: Rid,2003

Figure 2.1 Map of Thung Ku La Rong Hai

**Table 2.1:** Ratio of Thung Ku La Rong Hai Area

Province	Sub-Province (Ampore)	Area	
		Rai	%
Roi-Et	Kasetvisai, Suwannapoom, Patoomrat,	986,807	46.8
Surin	Ponsai	575,993	27.3
Si Sa Ket	Ta-Toom, Chumponburi	287,000	13.6
Maharakham	Rasrisalai, Silalad	193,890	9.2
Yasothon	Payakpoompisai Mahachanachai, Korwang	64,000	3.1
Total		2,107,690	100.0

The area of Thung Ku La Rong Hai covers 9 river basins as shown in Figure 2.2 and Table 2.2. The two main river basins are Mun basin and SealYai basin which account for 27-29 % of the total area of Thung Ku La Rong Hai. The third largest river basin is Lum-Pub Pla which covers approximately 26% of the Thung Ku La Rong Hai area. Meanwhile, Lum Pung Chu has the least river basin area in the Thung Ku La Rong Hai area at around 0.6%.



Source: Rid,2003

**Figure 2.2:** Map of Sub-basin in Thung ku La Rong Hai

**Table 2.2:** Sub-basin in Thung ku La Rong Hai

BASIN	WATERSHED AREA OF TUNG KU LA RONG HAI		
	Rai	Km <sup>2</sup>	%
Lum Seal Noi	78,886	126.22	3.74
Lum Seal Yai	618,720	989.95	29.36
Lum Pub Pla	550,098	880.16	26.10
Lum Tao	135,856	217.37	6.45
Lum Pung Chu	12,321	19.71	0.58
Lum Chi	130,471	208.75	6.19
Mun Basin Part I (Lum Pung Chu – Lum Pub Pla)	365,135	584.22	17.32
Mun Basin Part II (Lum Pub Pla - Lum Seal Yai)	124,729	199.57	5.92
Mun Basin Part III (Lum Seal Yai – Boundary of Area)	91,474	146.36	4.34
<b>Total</b>	<b>2,107,690</b>	<b>3,372.31</b>	<b>100.00</b>

Source: Rid,2003

### 2.1.2 Climate

The area of Thung Ku La Rong Hai is subjected to the strong southwest monsoon and northeast monsoon. Southwest monsoon begins in May and ends in October. In general, the weather is humidly hot, cloudy with heavy rain. In October, the wind becomes stronger because the northeast monsoon comes around mid of October.

Winter begins when the northeast monsoon comes at around mid October and temperatures are lowered until the end of February. The winter weather is moderately cool, few showers, mostly clear sky with high depression.

Summer is in the period between March and April, which is the time of changing the monsoon. The Weather data, recorded at Ta-Toom weather station in Surin, which is the nearest station to Thung Ku La Rong Hai Area, are shown in table 2.3.

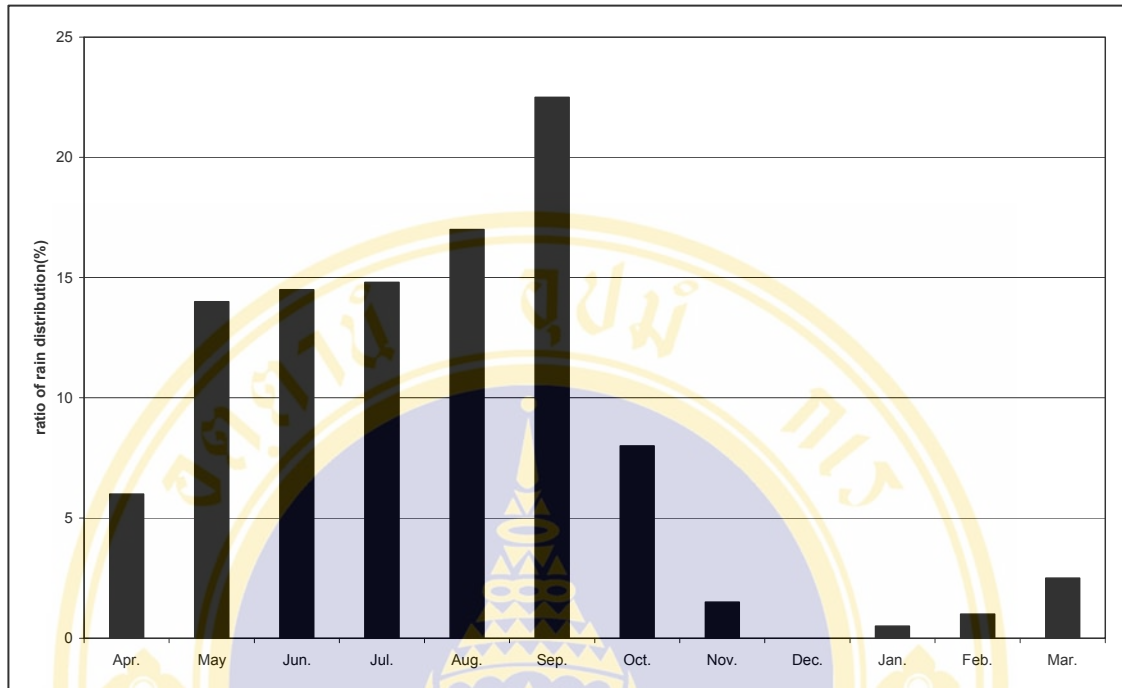
**Table 2.3:** Shown Characteristic of Weather in Thung Ku La Rong Hai

<b>Detail</b>	<b>Rainy Season (May-Oct.)</b>	<b>Winter (Nov.-Feb.)</b>	<b>Summer (Mar.-Apr.)</b>	<b>All year</b>
average atmospheric pressure (millibar)	1,007.3	1,013.0	1,008.9	1,009.5
average temperature (celsius)	28.2	24.7	29.7	27.3
average relativity humidity (%)	79.5	69.3	65.0	74.0
average pan evaporation (mm.)	145.2	143.5	191.3	1,827.5
average rainfall (mm)	204.6	9.2	63.0	1,389.9

Source: Rid,2003

### 2.1.3 Rainfall

Rainfall in the area of Thung Ku La Rong Hai is somewhat abundant. The average annual rainfall is approximately around the average annual rainfall, as shown in figure 2.3. Rainfall in this area is an influence of southwest monsoon and south china sea typhoon which pass the area between August and September. The considerable difference in the amount of rainfall between summer and rainy season is the major cause of flood and drought in the Thung Ku La Rong Hai area.



Source: Rid,2003

**Figure 2.3: Ratio of Rain Distribution**

#### 2.1.4 Runoff

In the area of Thung Ku La Rong Hai and its adjacent area have 7 importance tributaries namely, Lum Tao, Lum Seal Noi, Lum Seal Yai, Lum Pub Pla, Lum Chi and Lum Mun. The yield of these tributaries is approximately 2 to 6 litre/sec/km<sup>2</sup>. The records of average runoff in the Thung Ku La Rong Hai area are shown in Table 2.4.

**Table 2.4:** Stream in Thung Ku La Rong Hai Area

Stream	Watershed Area (sq.km.)	Annual Runoff (MCM.)	Thung Ku La Rong Hai Area		
			Watershed Area (sq.km.)	Slope	Annual Runoff (MCM.)
Lum Tao	823	70	217	1:3,053	18
Lum Seal Noi	672	90	126	1:6,185	17
Lum Seal Yai	4,285	577	990	1:10,000	133
Lum Pub Pla	1,137	192	880	-	148
Lum Pung Chu	1,152	218	20	-	4
Lum Mun	-	2,200-6,000	930	-	73
Lum Chi	-	3,700-8,200	209	-	31

**Source:** Rid,2003

#### 2.1.5 Socio Economics

The Area of Thung Ku La Rong Hai covers parts of five provinces namely, Roi-Et, Surin, Sri Sa Ket, Mahasarakham and Yasothon. This area accounted for 11 amphors, 79 tumbons, 1,028 moobans. The total population in this area is 622,188.

Main occupation in this area is farmers in rice field which each household posses land at an average of 22 rai. There is a need to hire labor for rice-growing which results in the high cost of rice production process. Besides rice-growing, other occupations are field cropping, local textile woven, livestock farms, and service sector.

#### 2.1.6 Soil and Land Use

Soil in this area is alluvial deposited by a river. In the deeper part, soils are made of decayed of fine aggregates such as limestone, shale and mudstone. At this depth, soil appears to rather be clay or silt clay, thus its color is light grey and dark red – yellow spot of salted soil.

Eighty-nine percent of land in the area of Thung Ku La Rong Hai is used for rice-growing which is accounted for 1.884 million rai. The second largest use is deteriorated area. The rest of the area is used for other types of agriculture, dwelling and water resources. Table 2.5 shows the area distribution of different land uses.

**Table 2.5:** Land use of Thung Ku La Rong Hai Area

Land Use	Area (Rai)	Ratio of Area (%)
Paddy field	1,884,733	89.42
Low-land	57,460	2.73
Degenerate forest	52,098	2.47
Low-land/Paddy field	31,918	1.51
Water body	30,988	1.47
Community	26,750	1.27
Upland crops	9,238	0.44
Shrubbery and Paddy field	4,885	0.23
Fruit crops and upland crops	4,815	0.23
Shrubbery and upland crops	4,805	0.23
<b>TOTAL</b>	<b>2,107,690</b>	<b>100.00</b>

Source: Rid,2003

### 2.1.7 Agricultural

90% of the total area of Thung Ku La Rong Hai is used for agricultural purposes. Of this amount, about 99% of the area is used for rice growing. The mostly grown rice is KDML105. Vegetation and crop growing as well as dry season cropping is hardly found in the area. However, cattle such as cows are mostly raised in-house by rural people. Due to the limitation of water availability, fishery in this area is rare.

## 2.2 Water Management

The data in 1998 revealed that Thailand has the annual internal renewable water resources at only 1,845 cubic meter/man/year, which is lower than the world's average value at 6,918 cubic meter/man/year. When comparing with the neighboring countries producing the same agricultural products, Thailand has a very much less water volume. The Lao People's Democratic Republic has the highest annual internal renewable water resource in Asia of 50,392 cubic meter/man/year and Union of Myanmar has at 22,719 cubic meter/man/year while Malaysia has at 21,259 cubic meter/man/year and Cambodia has at 8,195 cubic meter/man/year, and Vietnam has at 4,827 cubic meter/man/year. (Khao-SaAard et al., 2001)

The Meteorological Department (MET) has the figure of 1997 that Thailand has the average annual rainfall at about 1,630 mm./year, in which the rainfall volume in Northeast was lower than the Central Region. The Northeast average rainfall was at 1,407 mm/year while the South has its greatest average rainfall at 2,304 mm/year. Considering the tendencies of rain fall in regions between 1960 and 1966, it was found the gradual decrease in the amount future of rainfall in Thailand at 0.3% per year. The tendency of lesser rainfall in the Northeast at 0.1% per year and the East has the highest tendency of decrease rainwater at 0.6% per year. (Khao-SaAard et al., 2001)

The rainfall volume was calculated into water volume at 30% of the falling rainfall. The residual of 70% permeated into the underground to be underground water. Some of it evaporated into vapor while some permeated by plants and into vapor again. According to MET figure in 1997, the country's average rainfall is 1,630 mm/year and was calculated into water volume at 489 mm. per year. (Khao-SaAard et al., 2001)

The percentage of water shortage for agriculture at the upper part of Mun River Basin in each year is at an average of 6.27% per year. This resulted in a rain shortage period in July till August and in dry season from January to May. (Kongjun and Wuttivanit, 2001)

Mun River Basin is located at the lower part of Northeast region with basin areas totaling 69,700 km<sup>2</sup>, the average annual rainfall volume is equivalent to 1,226.1 mm. and the natural water volume is around 19,500.20 million cubic metre. (RID, 2003)

The need for the development of water sources for agriculture in this area is still significant as Thailand is very much dependent on agriculture sector to develop the country's economy. However, the rate of irrigation development in Thailand is yet in low criteria at about 460,000 rai per year (736 sq. km. per year). The slow rate of water sources development due to many causes such as, shortage of water cost, lack of funding, and inappropriate planning of plantations. The development of water sources for agriculture needs to consider environment maintenance and sustainable natural resources. This requires planning and design work to be suitable with capacity of natural resource and environment. (Tong-Kasem, 1999)

### **2.3 Water User Association**

The Water Users Association shall be strong if it has the same direction in the use of water and shall be able to carry out its own activities without any dependency from investor groups. (Meinzen-Dick et al., 1997)

The Water User Association can generally divided into 3 major groups, with first group is in the practice of many countries with members who are land owners who register with the representative and in full-time agricultural pattern. The second one is the practice of some countries that has allowed its content to also cover tenants and the last group is the combination of members with sufficient potential to manage water by not just looking at it as owner or tenant. (Salman, 1997)

The thinking concept of these water user associations in their management of water for rice plantations and economic crops was found to be with the need of water at almost every period, notwithstanding they are owners or tenants. (Sittilert, 2003)

## 2.4 Multi-Objective Decision Making (MODM)

The decision maker encounters complexities in identifying the best alternatives from set of optimum alternatives resulted from Linear Programming (LP) model because the alternatives fulfill a set of objectives. Presumably, the better these complexities are decomposed and transparent, the better his prediction or decision will be. Therefore, AHP and Compromising Programming. (Sahoo, 1998)

Two objectives maximization of net economic benefit and maximization of irrigated area aspired by both the irrigation authority and the farmers of the study area were considered in the analysis. To account for uncertainty in water resources availability, the model was solved for three levels of reliability of rainfall and ground water resources. The effect of deficit irrigation on the net benefit and cropping intensity as well as on the yield of crops were also assessed by considering three levels of water application to crops. To select the best alternative plan, a multi-objective analysis was carried out using the Analytical Hierarchy Process (AHP) considering the preference of the decision makers, including farmers and irrigation project managers. (Mainuddin et al., 1997)

Deficiencies in proper planning and management with the limited water availability preclude the realization of full production potential. In order to utilize this important resource fully, It is a formidable challenge for planners and engineers to select an optimum crop plan with the application of scientific approaches. Each optimal cropping pattern obtained from linear programming model (LP) indicates having specific importance over the two defined objectives of the system, the maximization of crop area and the maximization of net benefit which are conflicting to each other. The conflict is minimized by establishing a tradeoff relationship between these two objectives through multi-objective analysis. The most preferred alternative is selected by inputting the subjective preferences of the decision makers in the Analytical Hierarchy Process (AHP) and Compromising Programming. It is recommended for irrigation planning purpose by determining suitable cropping pattern. (Sahoo, 1998)

Linear programming and the analytical hierarchy process are the principal modeling tools to optimize the collective system objectives: productivity, equity and security. The results of model are compared with observed events of one dry season. The erratic water availability from the reservoir and the operational procedures inside the system are reviewed, analyzing historical data in terms of reliability, resiliency and vulnerability. These include lack of proper assessment of available water, effective farmer organization and prompt data processing and communication. Furthermore, for the effective implementation of an optimized irrigation policy, a water release pattern of the storage reservoir has been suggested. (Sahoo et.al., 2001)

The decision making process is an important but difficult task. The results of decision making may had to right or wrong consequences, any significant decision that may result in a huge amount of investment or considerable impact to people if the decision making is carried out wrongly, it can lead to a big damage to public or financial loss. Such important decision needs to be implemented through proper analysis method to achieve right alternative. The simple concept widely accepted is the method that divides the structure of a problem in levels, with initial level in setting Goal, followed by Criteria, Sub-criteria and Alternatives respectively. Then each alternatives will be given scores on importance and likeness, and will later be analysed in pairs one-by-one criterion, in order to find out the best alternative. If it is done in consistency it can be prioritized. This method is now very popular as it may be applied on every work, such as, management of irrigation water, management of agricultural lands, etc. It is called the Analytical Hierarchy Process (AHP) Method. (Wuttivanit, 2003)

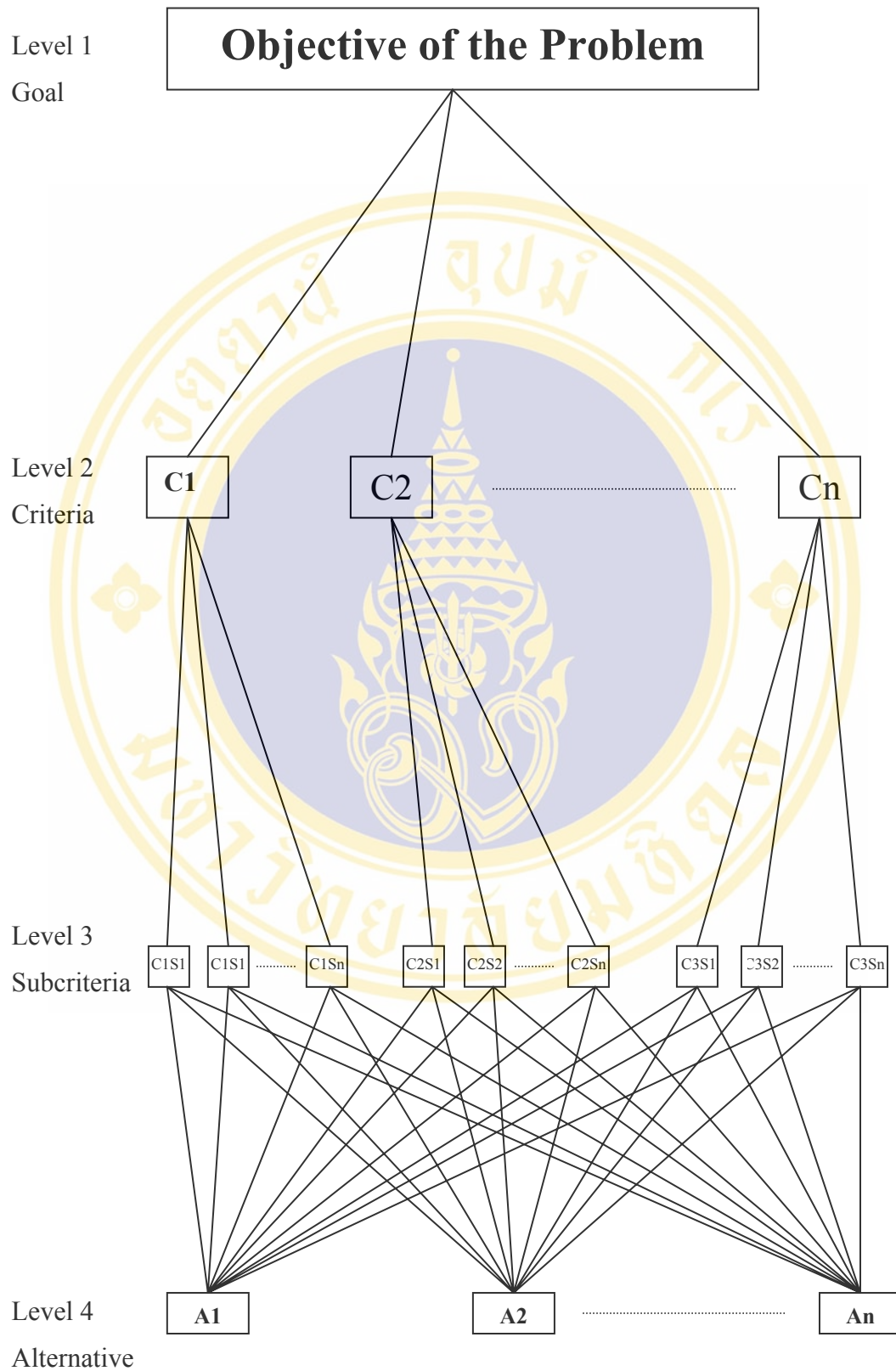
## 2.5 Analytical Hierarchy Process (AHP)

The decision making is sometimes not easy as we think, as sometimes it can be easy and sometimes difficult leading to right and wrong decisions in mix. Such decision needs to be implemented through proper channels, a means in applying analysis for the best decision in choosing the right alternative, with simple concept in dividing the structure of a problem in levels, with initial level in setting Goal, followed by Criteria, Sub-criteria and Alternatives respectively. It will then be analyzed to find out the best alternative by trade off with criteria for its pair-wise to make it easy for making a decision by giving scores on importance or likeness and analyze in pairs on one-by-one criterion. If it is done in consistency it can be prioritized. This method is now very popular as it may be applied on every work, such as, management of irrigation water, management of agricultural lands, etc. It is called the Analytical Hierarchy Process (AHP) Method. The AHP works on three basic principles of logical analysis, as following:

1. the principle of constructing hierarchies,
2. the principle of establishing priorities, and
3. the principle of consistency.

1. The principle of constructing hierarchies

To seek the best alternative is divided to three hierarchies, goal, criteria and alternatives. In each hierarchy, there might have many criteria and each criteria may have many sub-criteria as shown in figure 2.4.



**Figure 2.4:** Structure of Analytical Hierarchy Process

2. The principle of establishing priorities

In each hierarchy, farmers will give score or preference by trade off with criteria for its pair-wise it on importance or likeness. The table 2.6 is shown AHP measurement scale that divide 9 levels.

**Table 2.6:** Pairwise comparison Scale

Preference Level	Numerical value
Equally Preferred	1
Equally to Moderately	2
Moderately Preferred	3
Moderately to Strongly	4
Strongly Preferred	5
Strongly to Very Strongly	6
Very Strongly Preferred	7
Very Strongly to Extremely	8
Extremely Preferred	9

Source: Huizingh and Virolijk, 1994

After, obtaining scores or preferences from farmers then calculation to find weight or relative priority of that hierarchy. Weight of criteria or alternatives in each hierarchy, can be expressed according to the following formula;

$$A_w = \lambda_{\max} w \quad \dots 2.1$$

Where, A = Square Matrix A

w = Eigenvector

$\lambda_{\max}$  = Maximum eigenvalue

$$A = \begin{pmatrix} a_{11} & a_{12} & \cdot & \cdot & a_{1n} \\ a_{21} & a_{22} & \cdot & \cdot & a_{2n} \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ a_{n1} & a_{n2} & \cdot & \cdot & a_{nn} \end{pmatrix}$$

$$a_{ij} = \frac{1}{a_{ji}} = \text{score of comparison things, value between 0 to 1}$$

$$w = \frac{\lim_{k \rightarrow \infty} A^k e}{e^T A^k e} \quad \dots 2.2$$

where,  $k$  = Calculation time,  $k$

$e$  = Unit vector

### 3. The Principle of consistency

The scores or preferences given by farmers may be inconsistency. Additional information and data used in constructing the scale could be re-examined in order to improve consistency. It has been shown that pairwise comparison matrix,  $A$ , is consistency if only if  $\lambda_{\max} = n$  where,  $n$  is the dimension of the matrix  $A$ . But we always have  $\lambda_{\max} \geq n$ . This suggests using  $(\lambda_{\max} - 1)$  as an index of departure from consistency. Satty (1980) defined the consistency index (C.I.) as following:

$$C.I. = \frac{\lambda_{\max} - n}{n - 1} \quad \dots 2.3$$

where, C.I. = Consistency Index

$\lambda_{\max}$  = Maximum eigenvalue

$n$  = Dimension of Matrix

He also gave the value of random consistency (R.I.) for different values of n as provided in table 2.7. The Ratio of C.I. to R.I. for the same order metrics is called consistency ratio (C.R.), it can be expressed as:

$$C.R. = \frac{C.I.}{R.I.} \quad \dots 2.4$$

- where, C.R. = Consistency Ratio
- C.I. = Consistency Index
- R.I. = Random Consistency Index

**Table 2.7:** Values of Random Consistency Index

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
R.I.	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.46	1.49	1.51	1.48	1.56	1.57	1.59

Source: Satty, 1990

#### 4. Nine phases of analytical hierarchy process

The analytical hierarchy process have nine phases as follows:

##### 1. List Alternatives

In each problem, it has many alternatives to solve. In this phase is giving to collect alternatives that all relating.

##### 2. Define Threshold Level

Define threshold level that require in each alternative.

##### 3. Determine Acceptable Alternatives

Determine acceptable alternatives that collected from phase 1 and recheck with threshold level, if which alternatives are in criteria that is collect and in the opposite way, if it low than criteria then it no collect.

##### 4. Define Criteria

Define criteria that using criteria to decision the optimal alternative from phase 2 or sometimes, it may be define subcriteria.

### **5. Develop Decision Hierarchy**

Develop decision hierarchy from alternatives and criteria. It is composed of 3 levels that are goal, criteria and alternatives.

### **6. Compare Alternatives Pairwise**

Compare alternatives pairwise. In terms of comparison, it can be considered by quality or quantity.

### **7. Compare Criteria Pairwise**

Compare criteria pairwise. It has the same method as phase 6.

### **8. Calculate the Overall Priorities for the Alternatives**

Calculate the overall priorities for the alternatives by bringing the weight of each alternative multiplied by the weight of criteria after that finding the sum of values and setting priorities of alternatives from high score to low score. High score of alternative is the optimal alternative.

### **9. Sensitivity Analysis**

Before a decision to collect an alternative from phase 8, it is necessary to do a sensitivity analysis that occurs from uncertainty of data that is used for decision. If there is a change in weight or importance of criteria, then the optimal alternative may or may not be optimal. If it still is, it is necessary to ensure that the alternative is collected.

## **2.6 Relevant studies of Analytical Hierarchy Process (AHP)**

**Noppadol Horthiwong (1996)** Identifies the appropriate criteria for decision-making in a government agency that supports research, development and engineering projects in the industrial sector. The case study was selected from a government agency. Started with a survey of foreign agencies with similarities to that in the case study, an interview of the project evaluating committee, and observations of the project evaluation meeting. The decision criteria obtained were divided into groups based on theoretical considerations and the decision structure determined according to the Analytic Hierarchy Process (AHP). The criteria were divided into two sets, the first set being to screen the proposals before project evaluation and the second, to evaluate the projects that passed the screening process. The latter set of criteria may be divided into

two main criteria. (1) potential of the project which consists of (a) potential of the company that proposed the project and (b) potential of the technology in the project and (2) benefits of the project which consists of (a) technology development benefits (b) financial benefits and (c) social benefits. In order to test the software and the sample projects by this decision structure, the next step was weighing the importance of the evaluation criteria by pairwise comparisons. From the results, the project evaluating committee, on average, found that the importance of the potential of the project was close to importance of benefits of the project. Applying the same procedure to the two subcriteria under the project potential criterion showed that the potential of the company that proposed the project was more important than the potential of the technology in the project. As for the subcriteria under the project benefits criterion, it was found that the technology development benefits subcriterion was most important, while the financial benefits criterion was close in importance to the social benefits. This decision structure was applied to the case examples. When the committee was asked of its opinion concerning this decision-making process, most members responded that AHP and the criteria used to evaluate the project produce results that conform to the results obtained when not using AHP, and it is a very good decision-making process. Although the result of weighing the importance of the criteria may not be used in general since the sample size is small and the results are statistically insignificant, it may be concluded from this research that AHP is a good method in evaluating the research, development, and engineering project proposals.

**Rutjarek Kanjanarutjawiwat (1999)** Quality function Deployment (QFD) is a technique used for assisting manufacturers in planning their products. The mechanism of QFD begins with identifying customers' requirements and deploying through their demands at any time. Technical demand, design demand, critical characteristics of parts of the product, critical processes, and operational planning needs are facilitated by putting them in matrix format. These plans are arranged according to their importance depending on the relationships between demand and its associated weight of importance of the demand. Important values are obtained from opinion of customers and team of manufacturers. Conventionally, important values are given in absolute points. This approach has many disadvantages, for example, decision

inconsistency, different bases used while making difference decisions, and that decision makers can't consider many needs at the same time and hence think that all the needs are of equal important. This research is focused on the improvement of mechanism used in conventional QFD. It is recommend that the decision makers should provide points of importance by using AHP (analytical hierarchy process). Although this approach can reduce the weakness of the conventional point scoring, from the research experiments, it is found that this approach has disadvantages. Complicated calculations are needed while perhaps causing confusion to the users who do not have much knowledge about the theory of AHP. In addition, the characteristics of pairwise-comparison that bring about the limitation in terms of the number of needs that can be compared for each question of interest. The research finds that using AHP in making decisions in QFD is better than what is doing in conventional QFD. This can facilitate better data collection and reflect the real feeling of decision makers and customers. Their drawbacks can be reduced by sending more questionnaires to customers and choosing only data that are consistent and acceptable as well as using computers in reducing the burden in complex calculations.

**Jirachai Sakchanalaya (1999)** To identify the criteria for adapting the manufacturing and distribution plans in the adjustment of linear programming (LP) solutions. The research began by studying the problems in the process of adjusting LP solutions by the decision makers, who used certain criteria other than those formulated in the LP model. To clear up the LP solutions adjustment process and make sure that it is the result of the group decisions, this study will analyze the data and establish the decision criterial according to the analytic hierarchy process (AHP), by applying them to a case study of cement distribution management in the Logistics Division of a large cement company in Thailand. The objective of the decision is to select cement distribution centers according to the establish criteria. The study started with the interviewing the managers of the Logistics Division and gathering those results and grouping them using the affinity diagram and the decision structure constructed by the AHP model. The model consists of two main criteria. The first main criterion is Distribution service level with the two sub-criteria : (1.1) Capability of distribution management, which consists of (a) Scheduling capability (b) Fleet management capability (c) Fleet

Controlling difficulty (d) Shipment volume suitability (e) Communication and coordination comfort and (1.2) Readiness of facilities which consists of (a) Truck fleet available (b) Parking area available (c) Truck ban constraint. The second main criterion is Transportation Cost constraints which consists of (a) Minimum truck load capacity (b) Task Allocation to each transportation sub-contractors. The next step was weighing the importance of the evaluation criteria by pairwise comparisons. After that an AHP software was used to test the consistency ratio and calculate the weight for each criterion based on the sample group of decision makers and get the scale of intensities for evaluating the choices under the various criteria. This decision structure was applied to the case example. Results obtained from the opinions concerning this decision making process show that the assessors see benefits of having consistent and clear decision criteria, improving the customer service level, and enabling more accurate production and distribution planning.

**Juthaporn Booranaosot (2000)** The purposes of this thesis were (1) to develop the factors for evaluating students' theses of the Faculty of Education, Chulalongkorn University; (2) to determine the weight of importance assigned to each factor using the average weight and AHP techniques; (3) to compare the difference of the weights between average weight and AHP techniques; (4) to compare the quality of the two techniques using factor analysis method as a criterion; (5) to determine the criteria for evaluating students' theses for each department of the Faculty of Education, and (6) to study the opinions of the experts regarding credibility and satisfaction of the two techniques. Subjects of the study were 159 faculty members of the Faculty of Education in Chulalongkorn University, Kasetsart University, Silpakorn University, and Srinakharinwirot University, and 67 faculty members in graduate programs of the Faculty of Education, Chulalongkorn University. The results of the study were as follows: 1. Six factors for evaluating students' these were (1) statement of research problem and objectives, (2) review of literature, (3) conceptual framework, (4) research method, (5) presentation of research findings, and (5) significance of the study. 2. The most important weights given by factor analysis, average weight and AHP techniques were research method factor (research design, sampling design, measurement design, data analysis design, and data interpretation). The weights

assigned by each of the three techniques were 49.81%, 45.90%, and 41.25%, respectively. 3. The weights given to review of literature factor as derived by the three methods, i.e. factor analysis, average weight, and AHP techniques, yielded similar results (10.70%, 10.40% and 11.63%, respectively). 4. The weighting results given by AHP technique was closer to those by factor analysis than the average weight techniques. 5. The criteria used for judging the quality of the students' theses were different among departments. As a whole, the range of scores representing the 3 levels of thesis quality were: very good ( $85 < \text{very good} < 100$ ), good ( $70 < \text{good} < 85$ ), and pass ( $60 < \text{pass} < 70$ ). 6. The experts were satisfied with both techniques. Upon their opinions, average weight technique was easier and more convenient than AHP technique. But, the latter was more suitable for the complex decision.

**Thoedtida Thipparat (2001)** To introduce a safety index model used in construction by applying the fault tree analysis and the analytical hierarchy process. By use of fault tree analysis, the safety index is derived by means of the relationship between the probability of accidents calculated from the fault tree analysis and the severity from accidents calculated from lost working days. By use of analytical hierarchy process, the probability of causes of accidents can be calculated from the fault tree diagram. Safety index model can analyze the probability of causes of accidents, fault tree diagram and safety index values which can be used to assess risks of accidents as well as the effectiveness of safety management. As a result of the application of the analytical model for accidents from a form scaffolding from 8 construction sites in Bangkok, the significant causes of accident are recklessness, lack of personal protection equipment (PPE), lack of training of safety, and lack of controlling, respectively. Finally, the probability of accident from working with scaffolding is 0.078 occurrence per 200,000 man-hour and safety index is 0.803 workday per 200,000 man-hour.

**Manatsawee Nonhuwro (2002)** To assess the composite indicators for sub educational standards that's learners standards, process standards, factor standards and the composite indicators major educational standards an application of analytical hierarchy process technique. The sample were 867 director and teachers from 3 sectors :Office of the National Primary Education Commission (ONPEC), Department of

General Education (DGE) and Office of the Private Education Commission (OPEC). The research instruments were questionnaire developed by the researcher, using indicators for educational standards assessment of basic education institution as a framework. Data were analyzed by frequencies, percentage, mean, eigenvector and Pairwise Comparisons Matrix. The research findings were summarized as follows:

- 1) A composite of important weights for major standards: the findings for a first rank were learners standards with a weight of .400, second rank were process standards with a weight of .332 and last were factor standards with a weight of .269.
- 2) A composite of important weights for sub standards: the findings for learners standards in sub standards 11, 9 and 1 have weights of .101, .092 and .091, respectively; process standards in sub standards 18, 16 and 17 have weights of .203, .169 and .169, respectively; and factor standards in sub standards 22, 23 and 21 have weights of .126, .126 and .125, respectively.
- 3) An assessment composite of indicators for sub educational standards: the findings for learners standards have 19 indicators, process standards have 12 indicators and factor standards have 11 indicators.
- 4) The composite indicators for major educational standards have 42 indicators, with the most important weights being .060 and .041, respectively. This indicates a development curriculum that should be in line with local position and needs to share with the community. It should not be a drug to be free from drugs and not to seek benefit. Use of resources should be to save and worthwhile.

**Thongplew Kongjun and Varawoot Vudhivanich (2003)** Their research was to develop the methodology for water allocation during the water shortage in the multipurpose-multireservoir system. The water shortage of the multireservoir system was first identified. The water allocation alternatives taken into account the profitability, equity and reliability of the multireservoir system and allowing the stakeholders involved in diagnosis and making decision for the water allocation were developed. The alternatives were ranked by the AHP based on the three criteria as profitability, equity and reliability. The results indicated that the priority of water allocation criteria were ranked as profitability (41%), reliability (32.3%) and equity (26.7%). The first ranked alternative (29.38%) was the alternative which did not allow water shortage in the municipal and industrial sectors, the downstream requirements for the ecological system would lack water by 43.99% of demand (55.43 million cubic

meters) and allow the yield for agriculture reducing to 56% of the maximum yield. Thus, the water allocation methodology developed in this study can help the priority setting in water allocation and define the most preferable alternative for concerned stakeholders.

**Tuangthong Wetsanarat (2003)** To study the factors which are important for customers in medium sized car buying selection in Bangkok using the Analytic Network Process. This research is to study the medium sized car market for the cars in 2002-2003 models, engine size 1.6-1.8 liters, having seats for five persons with two-wheel drive. This research is to study car buying selection of Toyota, Honda, Nissan in Toyota Corolla Altis, Honda Civic 1.7, Nissan Sunny Neo, Nissan Sunny Almera because of these cars are representatives of the most popular among customers of each car company. The first method of this research is to select the factors which are important for customers in medium sized car buying selection in Bangkok by interview with using questionnaires. The target groups are the persons who use those cars, the persons who are deciding to buy cars, the persons who admire cars within the scope of this research and the specialists in car industrial market. After that, the specialists in car industrial market group the criteria and create the name of criteria in order to get clusters and elements. Then the specialists in car industrial market consider the meaning of criteria and the criteria grouping in order to get the most suitable criteria, All data are then collected for analysis and evaluation using to the program of the ANP. The analysis and evaluation of result reveals how important each factor is to car buyer in Bangkok Metropolitan Area. Moreover the score of each alternative is almost equal to the market share in 2003 and the priority of each alternative is similar with the market share in those years also. Moreover the result of this research is similar with the recent research. So this research demonstrates that the Analytic Network Process is an approach which can be applied well in the analysis of the decision structure of the medium sized car selection problem of customers in Bangkok and should be further considered for improvement to use in a wider scale.

**Nareerat Pothikun (2005)** To apply the analytic hierarchy process to warehouse location selection for a manufacturer and distributor of food products. The analytic hierarchy process is a tool designed to support the decision making process in which quantitative factors and qualitative factors are simultaneously examined. It also has a capability to investigate the inconsistency in the decision makers' stated preferences. This study considers four location candidates in the Greater Bangkok area and nine key factors including concern about truck ban, transport cost, labor cost, possibility for further expansion, transport system accessibility, land acquisition cost, proximity to customers, availability of utilities and social and environmental concern. In this research, a multi-level structure selection process is created. The analysis results indicate the concern about truck ban is the most critical consideration in selecting warehouse location followed in the order importance by transportation cost, labor cost, possibility for further expansion, transport system accessibility, land acquisition cost, proximity to customers, availability of utilities, and social and environmental concern.

**Prapatsinee Suk-aphinya (2005)** The most appropriate alternative for water allocation of the Lam Pra Plerng Irrigation Project during water shortage is an alternative that generates maximum satisfaction and water utilization for all activities. The alternative should also be capable of minimizing water conflicts among users.

In her study, economic, social, and engineering criteria are used to evaluate the best solution out of 8 alternative options. It is found that alternative 3, which allows maximum water supply for consumption purposes, results in 44% and 7.56% reduction in the total agricultural productivity and minimum level of water storage of reservoirs, is ranked as the best alternative.

The sensitivity analysis suggests that alternative option 3 is the most appropriate solution to the current problems in water management at the Upper Mun River Basin due to its insensitivity to fluctuation and adjustment of priority weighting scores of each criteria.

## CHAPTER 3

### METHODOLOGY

A study of agricultural land use and irrigation system development, it requires multi studies on knowledge body in management of water, management of organization, participation of farmers, economic and society including the government policy in order to obtain information which will support on decision making that will be lead support the decision making. The study uses Analytic Hierarchy Process (AHP) as a tool to obtain the best alternatives. A series of the study are as follows:

- 3.1 Selection of Sample Populations
- 3.2 Analytical Tools
- 3.3 Data Gathering
- 3.4 Data Analysis

#### **3.1 Selection of Sample Populations**

Farmer residing in the study area of Thung Ku La Rong Hai is selected as sample populations.

The sample size of the study is obtained through Yamane formula (Yamane, 1973, cited in Ekakul, 2000).

$$n = \frac{N}{1 + Ne^2}$$

Where n = Sample size

N = Population number

e = Variations (0.05 or 0.01)

As the population in Thung Ku La Rong Hai is 622,188 (N), and variation (e) is 0.05, the sample size calculated with the formula earlier is 400.

### 3.2 Analytical Tools

Questionnaire is used as a tool to collect data required for the analysis. The questionnaire includes open questions and relative weighting priority of each criterion and consists of two parts as follows:

Part I includes general information regarding name, occupation, address, land holder, cropping calendar, current problems and recommendations.

Part II includes relative weighting priority of multi criteria for cropping pattern planning of Thung Ku La Rong Hai. Those criteria are based on economic, social, and engineering factors aiming on achieving maximum satisfaction of farmer, in which key indicators should be set as follows:

1. Economic Satisfaction, which uses profitability as a key indicator, such as, what activity is the maximum profits or return.
2. Social Satisfaction uses crop intensity as a key indicator, for example frequency of cropping period per year.
3. Engineering Satisfaction, which uses efficiency to achieve as a key indicator.

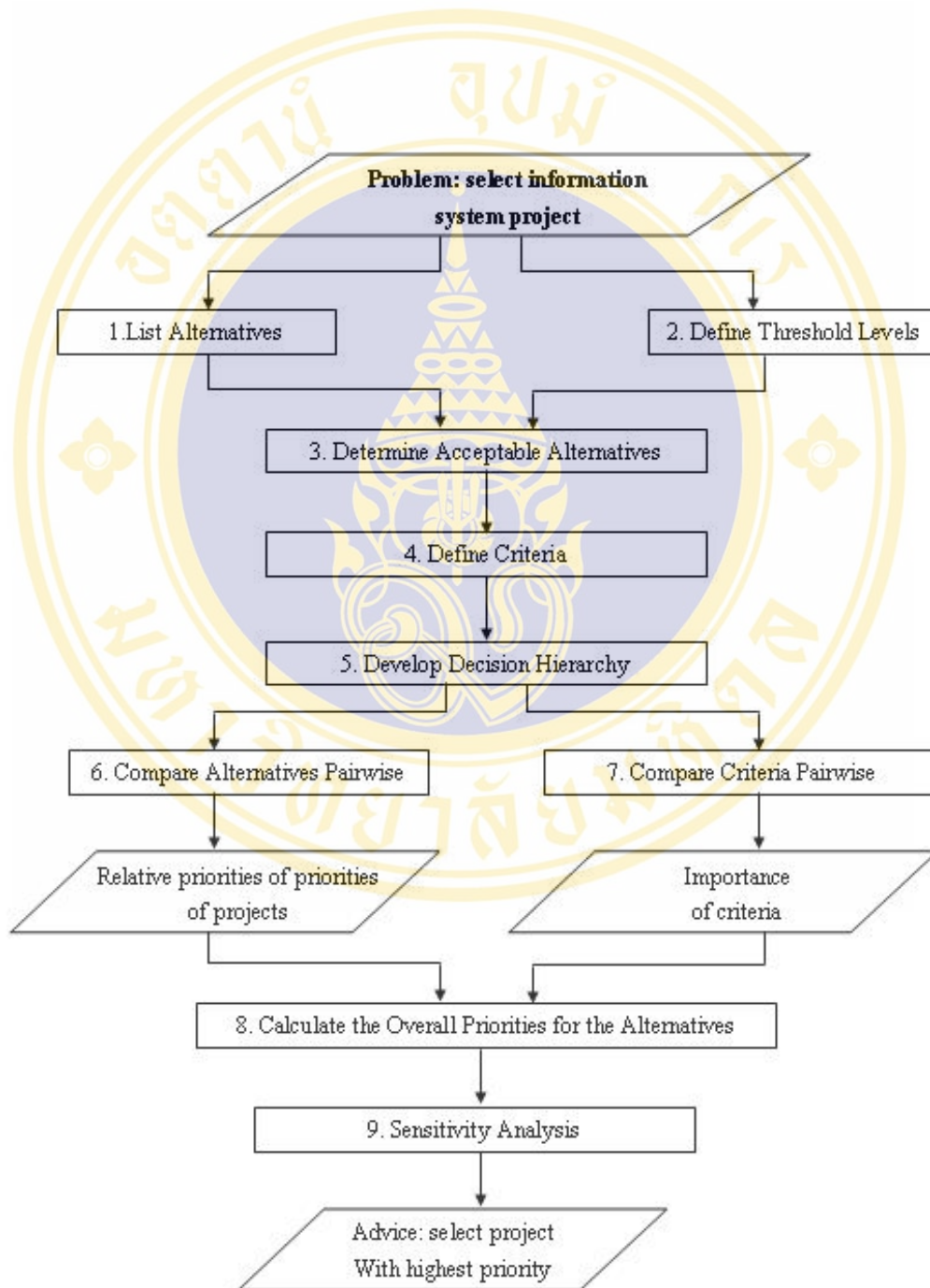
### 3.3 Data Collection

In this study, data collection is divided into two approaches, which are:

1. General data collection, which is a process that collects secondary data from all related agencies include:
  - a. Physical characteristics of Thung Ku La Rong Hai Area.
  - b. General information of Thung Ku La Rong Hai Area.
  - c. Information on meteorology and hydrology including volume of rainfall and runoff.
2. The collection of data in the study field is divided into two parts
  - a. Surveying of study areas to make study on the nature of plantation lands, canals, water-channeling ditch, behavioral use of water including the loss of water in plantation lands.
  - b. In-depth Interviewing with the designed questionnaire to be consistent with objectives in the study and present situations which issue on agriculture.

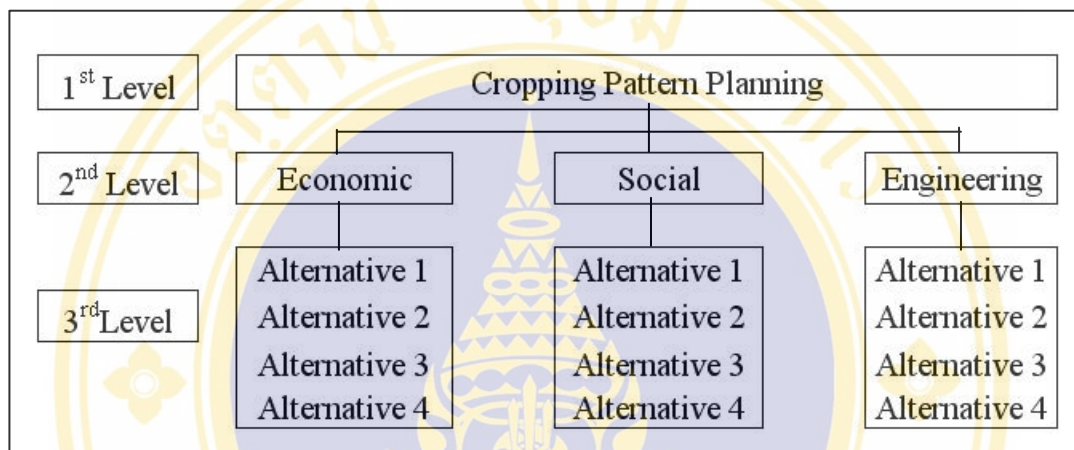
### 3.4 Data Analysis

Analytical Hierarchy Process (AHP) is used to analyze alternatives of the data collection. AHP is used to ensure the ultimate satisfaction of cropping pattern planning of all activities. AHP consists of nine phases as shown in figure 3.1.



**Figure 3.1:** A flow chart of Analytical Hierarchy Process (Huizingh & Vrolijk, 1994)

**3.4.1 Hierarchical Structure:** Hierarchical structure is divided into 3 levels. The top level is the objective of the research, which is to cropping pattern planning. The second level includes economic, social, and engineering criteria. The third level presents alternative options for applied cropping pattern planning. The hierarchy structure is shown in figure 3.2



**Figure3.2:** Priority Setting of Analytical Hierarchy Process

**3.4.2 Priority Setting:** Priority setting can be done after completing the collection of primary data from questionnaires. The analysis will be conducted by comparing each factor under the particular criterion. The analysis begins from the top level of the hierarchy. The weighting scales vary from 1 to 9 representing the levels of satisfaction.

Once the levels of satisfaction are identified, the relative priority of each level of alternative option can be developed. It is noted that the top priority option should undertake consistency test at all levels. The consistency Ratio (CR) should not exceed 0.1.

**3.4.3 Sensitivity Analysis:** Reliability of data is critical in evaluating the best solution. The inconsistent data may cause changes in priority setting. In order to ensure the soundness of the selected option, sensitivity analysis should be conducted.

## CHAPTER 4

### RESULTS

#### 4.1 Problem of Cropping Pattern Planning in Thung Ku La Rong Hai (TKLH)

TKLH is located in central area of northeastern region and in Mun Basin. It has the land area of 2.1 million rai (3,360km<sup>2</sup>) covering 5 provinces which are Roi-Et, Surin, Si Sa Ket, Mahasarakham, and Yasothon. The population in this study area is approximately 622,188. It has two main problems as follows:

- a) Soil Problem: Almost soils in TKRH is sandy in which nutrition is not enough for plantation and in some areas, soils is acid and salty.
- b) Water Problem: Poor water management causes the shortage of water at the beginning of cropping and the flooding at the end of cropping.

#### 4.2 General Data from Questionnaire in Part I

Part I consists of general information i.e., name, occupation, address, land holder, cropping calendar, problems and recommendation. The data analysis in Part I are conducted in each province as follows:

##### Roi-Et

From 169 questionnaires obtained, interviewees who are farmers in Roi-Et. Consist of 112 males and 57 females and have the ages of 45 years old in average. The interviewees aging between 30 and 40 years old account for 65.08%, where as no interviewees was under 30 years old. The classification of age of sampling is shown in Table 4.1.

**Table 4.1:** Age of sampling in Roi-Et

Age	Frequency	Percent	Cumulative Percent
between 30 - 39 yrs	55	32.54	32.54
between 40 - 49 yrs	55	32.54	65.08
between 50 - 59 yrs	47	27.81	92.89
more than 60 yrs	12	7.01	100
Total	169	100	

The result from 169 questionnaires show that farmers in Roi-Et province have cropping areas on average at 19 rai per person, which involve at 50.29% of cropping areas between 11 and 20 rai, where as farmers have the cropping areas more than 31 rai at only 7.71%. The result is shown in Table 4.2.

**Table 4.2:** Cropping area of sampling in Roi-Et

Cropping Area	Frequency	Percent	Cumulative Percent
under 10 rai	22	13.01	13.01
between 11 - 20 rai	85	50.29	63.3
between 21 - 30 rai	49	28.99	92.29
more than 31 rai	13	7.71	100
Total	169	100	

In order to know the number of cropping type in Roi-Et, the results show that farmers mostly plant on one type of cropping, accounting for 79.88%, two-type cropping of 17.16% and more than two-type cropping of only 2.96% as shown on Table 4.3

**Table 4.3:** Number of cropping type of sampling in Roi-Et

Number of cropping type	Frequency	Percent	Cumulative Percent
1 type	135	79.88	79.88
2 type	29	17.16	97.04
more than 2 type	5	2.96	100
Total	169	100	

The results show that farmers in Roi-Et mostly grow rice, especially Rice KDML105 accounting for 80.77% and Rice RD6 accounting for 13.46%, where as they grow other plants such as vegetables and fruit tree, about 5.77% as shown in Table 4.4.

**Table 4.4:** Type of cropping of sampling in Roi-Et

Type of cropping	Frequency	Percent	Cumulative Percent
Rice KDML 105	168	80.77	80.77
Rice RD6	28	13.46	94.23
Other	12	5.77	100
Total	208	100	

The output of rice plantation had been surveyed. The yield of rice production in Roi-Et is in range of 301 to 400 kilograms/rai, accounting for 54.32%, where as the rice production greater than 501 kilograms/rai is only 5.78%. The result is shown in Table 4.5.

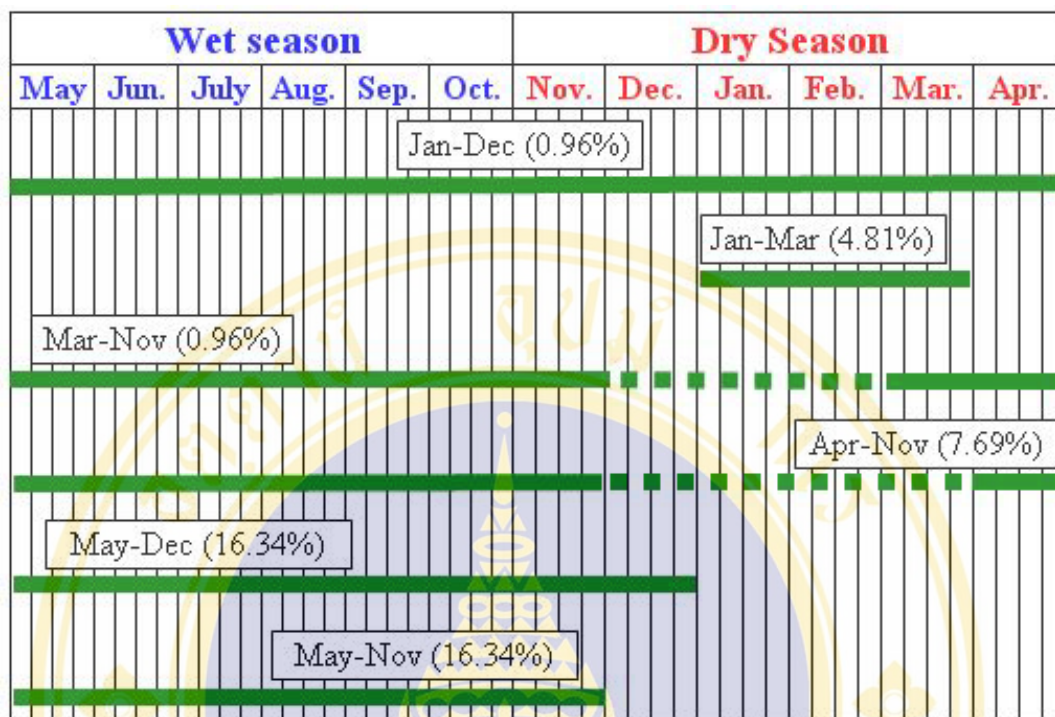
**Table 4.5:** Number of produce of sampling in Roi-Et

Number of produce	Frequency	Percent	Cumulative Percent
between 0 - 100 kg/rai	0	0.00	0.00
between 101-200 kg/rai	3	1.44	1.44
between 201-300 kg/rai	70	33.65	35.09
between 301-400 kg/rai	113	54.32	89.41
between 401-500 kg/rai	10	4.81	94.22
more than 501 kg/rai	12	5.78	100
Total	208	100	

The survey of 169 questionnaires in Roi-Et shows that farmers grow rice in a duration between May and November up to 68.76% and December up to 16.34% where as the rest of the year, they grow other plants such as vegetables and fruit trees. Table 4.6 and Figure 4.1 shows cropping period of farmers in Roi-Et.

**Table 4.6:** Cropping period of sampling in Roi-Et

Cropping period	Frequency	Percent	Cumulative Percent
Jan-Dec	2	0.96	0.96
Jan-Mar	10	4.81	5.77
Jan-Apr	0	0.00	5.77
Jan-May	0	0.00	5.77
Mar-Nov	2	0.96	6.73
Apr-Dec	0	0.00	6.73
Apr-Nov	16	7.69	14.42
May-Dec	34	16.34	30.76
May-Nov	143	68.76	99.52
May-Oct	1	0.48	100
Jun-Nov	0	0.00	100
Jun-Dec	0	0.00	100
Jul-Dec	0	0.00	100
Aug-Nov	0	0.00	100
Oct-Dec	0	0.00	100
Nov-Dec	0	0.00	100
Total	208	100	



**Figure 4.1:** Cropping period of sampling in Roi-Et

**Surin**

From 94 questionnaires obtained, interviewees who are farmers in Surin. Consist of 47 males and 47 females and have the ages of 48 years old in average. The interviewees aging between 40 and 49 years old account for 41.49%, where as no interviewees was under 30 years old. The classification of age of sampling is shown in Table 4.7.

**Table 4.7:** Age of sampling in Surin

Age	Frequency	Percent	Cumulative Percent
between 30 - 39 yrs	13	13.83	13.83
between 40 - 49 yrs	39	41.49	55.32
between 50 - 59 yrs	31	32.97	88.29
more than 60 yrs	11	11.71	100
Total	94	100	

The result from 94 questionnaires show that farmers in Surin province have cropping areas on average at 16 rai per person, which involve at 38.29% of cropping areas between 11 and 20 rai, where as farmers have the cropping areas more than 31 rai at only 4.26%. The result is shown in Table 4.8.

**Table 4.8** Cropping area of sampling in Surin

Cropping Area	Frequency	Percent	Cumulative Percent
under 10 rai	32	34.04	34.04
between 11 - 20 rai	36	38.29	72.33
between 21 - 30 rai	22	23.41	95.74
more than 31 rai	4	4.26	100
Total	94	100	

In order to know the number of cropping type in Surin, the results show that farmers mostly plant on one type of cropping, accounting for 97.87%, two-type cropping of 2.13% and more than two-type cropping of only 95.74% as shown on Table 4.3

**Table 4.9** Number of cropping type of sampling in Surin

Number of cropping type	Frequency	Percent	Cumulative Percent
1 type	92	97.87	97.87
2 type	2	2.13	100
more than 2 type	0	0	100
Total	94	100	

The results show that farmers in Surin mostly grow rice, especially Rice KDML105 accounting for 97.91% and Rice RD6 accounting for 0%, where as they grow other plants such as vegetables and fruit tree, about 2.09% as shown in Table 4.10.

**Table 4.10** Type of cropping of sampling in Surin

Type of cropping	Frequency	Percent	Cumulative Percent
Rice KDML 105	94	97.91	97.91
Rice RD6	0	0.00	97.91
Other	2	2.09	100.00
Total	96	100	

The output of rice plantation had been surveyed. The yield of rice production in Surin is in range of 301 to 400 kilograms/rai, accounting for 52.10%, where as the rice production greater than 501 kilograms/rai is only 16.66%. The result is shown in Table 4.11.

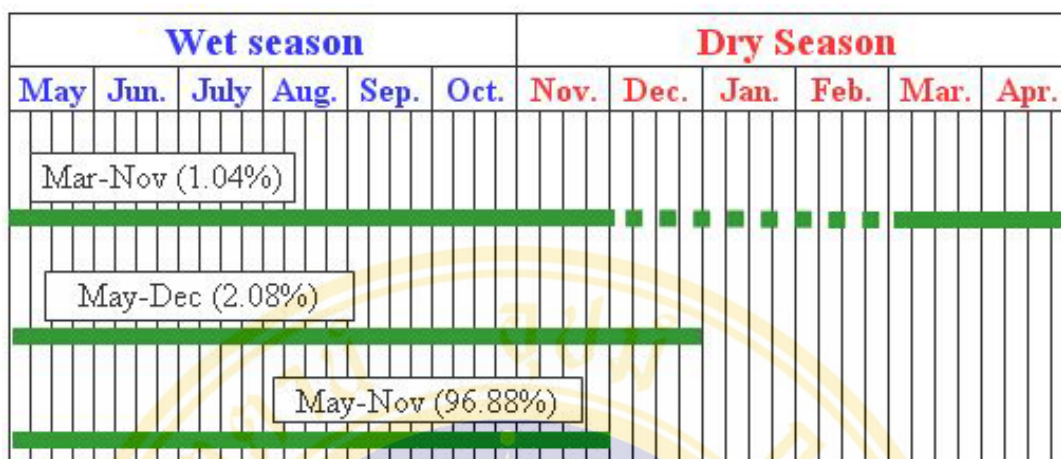
**Table 4.11** Number of produce of sampling in Surin

Number of produce	Frequency	Percent	Cumulative Percent
between 0 - 100 kg/rai	1	1.04	1.04
between 101-200 kg/rai	0	0.00	1.04
between 201-300 kg/rai	7	7.29	8.33
between 301-400 kg/rai	50	52.10	60.43
between 401-500 kg/rai	22	22.91	83.34
more than 501 kg/rai	16	16.66	100.00
Total	96	100.00	

The survey of 94 questionnaires in Surin shows that farmers grow rice in a duration between May and November up to 96.88% and December up to 2.08% where as the rest of the year, they grow other plants such as vegetables and fruit trees. Table 4.12 and Figure 4.2 shows cropping period of farmers in Surin.

**Table 4.12** Cropping period of sampling in Surin

Cropping period	Frequency	Percent	Cumulative Percent
Jan-Dec	0	0.00	0.00
Jan-Mar	0	0.00	0.00
Jan-Apr	0	0.00	0.00
Jan-May	0	0.00	0.00
Mar-Nov	1	1.04	1.04
Apr-Dec	0	0.00	1.04
Apr-Nov	0	0.00	1.04
May-Dec	2	2.08	3.12
May-Nov	93	96.88	100
May-Oct	0	0.00	100
Jun-Nov	0	0.00	100
Jun-Dec	0	0.00	100
Jul-Dec	0	0.00	100
Aug-Nov	0	0.00	100
Oct-Dec	0	0.00	100
Nov-Dec	0	0.00	100
Total	96	100.00	



**Figure 4.2** Cropping period of sampling in Surin

### Si Sa Ket

From 59 questionnaires obtained, interviewees who are farmers in Si Sa Ket. Consist of 55 males and 4 females and have the ages of 47 years old in average. The interviewees aging between 40 and 49 years old account for 45.76%, where as no interviewees was under 30 years old. The classification of age of sampling is shown in Table 4.13.

**Table 4.13** Age of sampling in Si Sa Ket

Age	Frequency	Percent	Cumulative Percent
between 30 - 39 yrs	12	20.34	20.34
between 40 - 49 yrs	27	45.76	66.1
between 50 - 59 yrs	17	28.82	94.92
more than 60 yrs	3	5.08	100
Total	59	100	

The result from 54 questionnaires show that farmers in Si Sa Ket province have cropping areas on average at 16 rai per person, which involve at 49.16% of cropping areas between 11 and 20 rai, where as farmers have the cropping areas more than 31 rai at only 6.77%. The result is shown in Table 4.14.

**Table 4.14** Cropping area of sampling in Si Sa Ket

<b>Cropping Area</b>	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
under 10 rai	17	28.82	28.82
between 11 - 20 rai	29	49.16	77.98
between 21 - 30 rai	9	15.25	93.23
more than 31 rai	4	6.77	100
Total	59	100	

In order to know the number of cropping type in Si Sa Ket, the results show that farmers mostly plant on one type of cropping, accounting for 64.41%, two-type cropping of 11.86% and more than two-type cropping of only 23.73% as shown on Table 4.15

**Table 4.15** Number of cropping type of sampling in Si Sa Ket

<b>Number of cropping type</b>	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
1 type	38	64.41	64.41
2 type	7	11.86	76.27
more than 2 type	14	23.73	100
Total	59	100	

The results show that farmers in Si Sa Ket mostly grow rice, especially Rice KDML105 accounting for 61.71% and Rice RD6 accounting for 4.26%, where as they grow other plants such as vegetables and fruit tree, about 34.03% as shown in Table 4.16.

**Table 4.16** Type of cropping of sampling in Si Sa Ket

<b>Type of cropping</b>	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
Rice KDML 105	58	61.71	61.71
Rice RD6	4	4.26	65.97
Other	32	34.03	100.00
Total	94	100	

The output of rice plantation had been surveyed. The yield of rice production in Si Sa Ket is in range of 301 to 400 kilograms/rai, accounting for 41.49%, where as the rice production greater than 501 kilograms/rai is only 35.11%. The result is shown in table 4.17.

**Table 4.17** Number of produce of sampling in Si Sa Ket

Number of produce	Frequency	Percent	Cumulative Percent
between 0 - 100 kg/rai	0	0.00	0.00
between 101-200 kg/rai	2	2.13	2.13
between 201-300 kg/rai	17	18.08	20.21
between 301-400 kg/rai	39	41.49	61.70
between 401-500 kg/rai	3	3.19	64.89
more than 501 kg/rai	33	35.11	100.00
Total	94	100	

The survey of 59 questionnaires in Si Sa Ket shows that farmers grow rice in a duration between May and November up to 32.98% and December up to 14.90% where as the rest of the year, they grow other plants such as vegetables and fruit trees. Table 4.18 and Figure 4.3 shows cropping period of farmers in Si Sa Ket.

**Table 4.18** Cropping period of sampling in Si Sa Ket

Cropping period	Frequency	Percent	Cumulative Percent
Jan-Dec	0	0.00	0.00
Jan-Mar	21	22.34	22.34
Jan-Apr	7	7.45	29.79
Jan-May	2	2.12	31.91
Mar-Nov	0	0.00	31.91
Apr-Dec	0	0.00	31.91
Apr-Nov	13	13.83	45.74
May-Dec	14	14.90	60.64
May-Nov	31	32.98	93.62
May-Oct	2	2.12	95.74
Jun-Nov	0	0.00	95.74
Jun-Dec	0	0.00	95.74
Jul-Dec	0	0.00	95.74
Aug-Nov	1	1.06	96.80
Oct-Dec	2	2.13	98.93
Nov-Dec	1	1.07	100.00
Total	94	100.00	

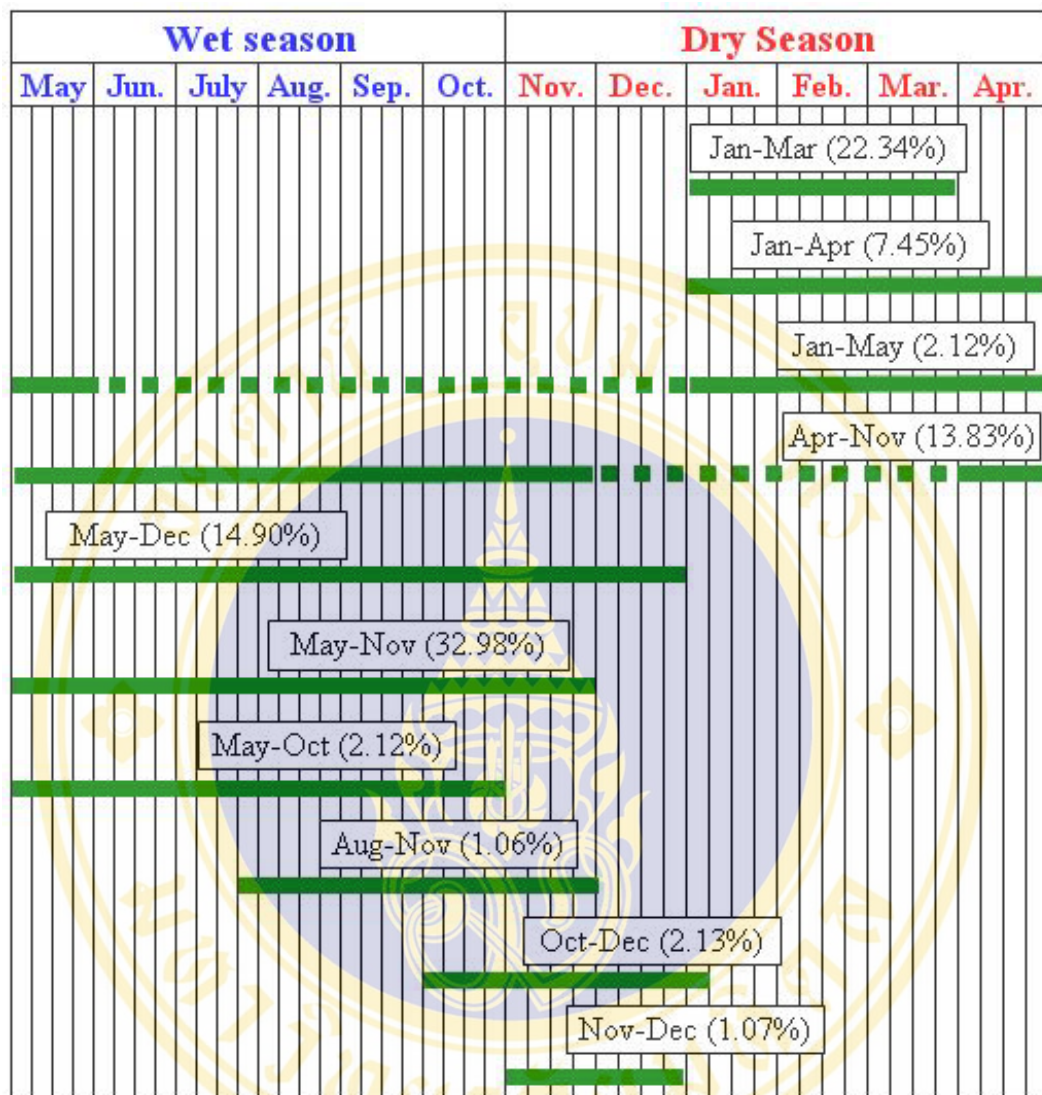


Figure 4.3 Cropping period of sampling in Si Sa Ket

**Maharakham**

From 99 questionnaires obtained, interviewees who are farmers in Maharakham. Consist of 25 males and 4 females and have the ages of 47 years old in average. The interviewees aging between 50 and 59 years old account for 37.94%, where as no interviewees was under 30 years old. The classification of age of sampling is shown in table 4.19.

**Table 4.19** Age of sampling in Mahasarakham

Age	Frequency	Percent	Cumulative Percent
between 30 - 39 yrs	9	31.03	31.03
between 40 - 49 yrs	6	20.68	51.71
between 50 - 59 yrs	11	37.94	89.65
more than 60 yrs	3	10.35	100
Total	29	100	

The result from 29 questionnaires show that farmers in Mahasarakham province have cropping areas on average at 18 rai per person, which involve at 58.62% of cropping areas between 11 and 20 rai, where as farmers have the cropping areas more than 31 rai at only 6.90%. The result is shown in table 4.20.

**Table 4.20** Cropping area of sampling in Mahasarakham

Cropping Area	Frequency	Percent	Cumulative Percent
under 10 rai	3	10.34	10.34
between 11 - 20 rai	17	58.62	68.96
between 21 - 30 rai	7	24.14	93.1
more than 31 rai	2	6.9	100
Total	29	100	

In order to know the number of cropping type in Mahasarakham, the results show that farmers mostly plant on one type of cropping, accounting for 41.38%, two-type cropping of 55.18% and more than two-type cropping of only 3.44% as shown on table 4.21

**Table 4.21** Number of cropping type of sampling in Mahasarakham

Number of cropping type	Frequency	Percent	Cumulative Percent
1 type	12	41.38	41.38
2 type	16	55.18	96.56
more than 2 type	1	3.44	100
Total	29	100	

The results show that farmers in Mahasarakham mostly grow rice, especially Rice KDML105 accounting for 61.71% and Rice RD6 accounting for 34.04%, where as they grow other plants such as vegetables and fruit tree, about 4.25% as shown in table 4.22.

**Table 4.22** Type of cropping of sampling in Mahasarakham

Type of cropping	Frequency	Percent	Cumulative Percent
Rice KDML 105	29	61.71	61.71
Rice RD6	16	34.04	95.75
Other	2	4.25	100.00
Total	47	100	

The output of rice plantation had been surveyed. The yield of rice production in Mahasarakham is in range of 301 to 400 kilograms/rai, accounting for 44.68%, where as the rice production greater than 501 kilograms/rai is only 12.77%. The result is shown in table 4.23.

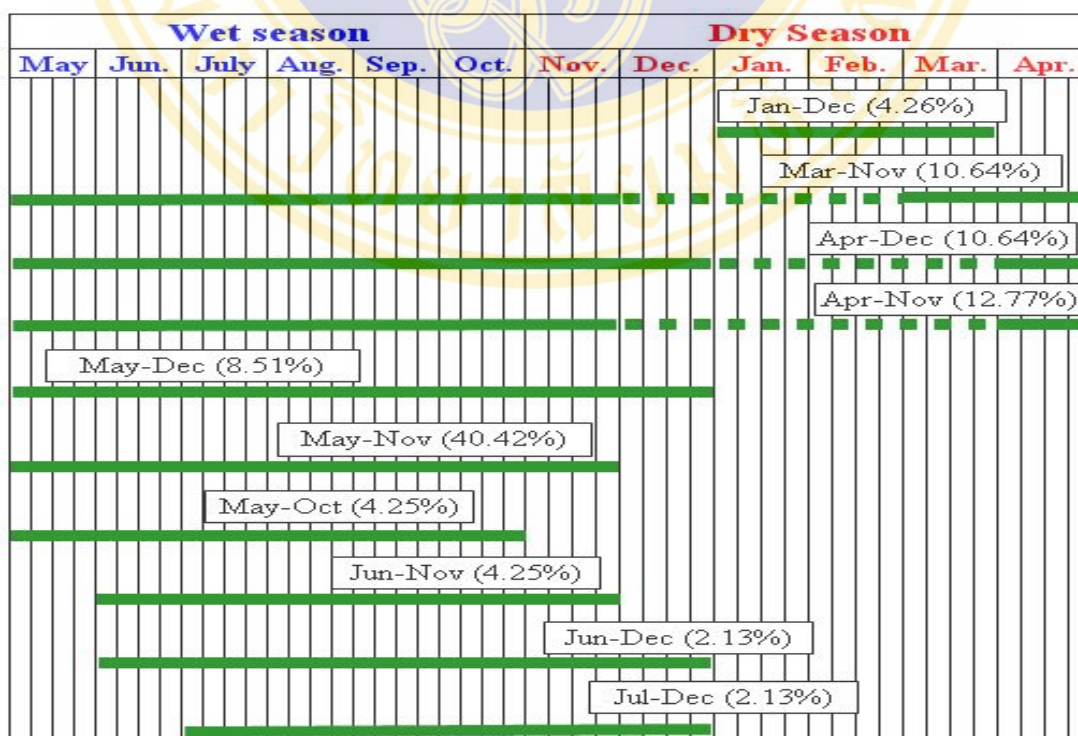
**Table 4.23** Number of produce of sampling in Mahasarakham

Number of produce	Frequency	Percent	Cumulative Percent
between 0 - 100 kg/rai	0	0.00	0.00
between 101-200 kg/rai	1	2.13	2.13
between 201-300 kg/rai	11	23.40	25.53
between 301-400 kg/rai	21	44.68	70.21
between 401-500 kg/rai	8	17.02	87.23
more than 501 kg/rai	6	12.77	100.00
Total	47	100.00	

The survey of 29 questionnaires in Mahasarakham shows that farmers grow rice in a duration between May and November up to 40.42% and December up to 8.51% where as the rest of the year, they grow other plants such as vegetables and fruit trees. Table 4.24 and Figure 4.4 shows cropping period of farmers in Mahasarakham.

**Table 4.24** Cropping period of sampling in Mahasarakham

Cropping period	Frequency	Percent	Cumulative Percent
Jan-Dec	2	4.26	4.26
Jan-Mar	0	0.00	4.26
Jan-Apr	0	0.00	4.26
Jan-May	0	0.00	4.26
Mar-Nov	5	10.64	14.90
Apr-Dec	5	10.64	25.54
Apr-Nov	6	12.77	38.31
May-Dec	4	8.51	46.82
May-Nov	19	40.42	87.24
May-Oct	2	4.25	91.49
Jun-Nov	2	4.25	95.74
Jun-Dec	1	2.13	97.87
Jul-Dec	1	2.13	100
Aug-Nov	0	0.00	100
Oct-Dec	0	0.00	100
Nov-Dec	0	0.00	100
Total	47	100.00	

**Figure 4.4** Cropping period of sampling in Mahasarakham

### Yasothon

From 49 questionnaires obtained, interviewees who are farmers in Yasothon. Consist of 31 males and 18 females and have the ages of 49 years old in average. The interviewees aging between 50 and 59 years old account for 38.78%, where as no interviewees was under 30 years old. The classification of age of sampling is shown in table 4.25.

**Table 4.25** Age of sampling in Yasothon

Age	Frequency	Percent	Cumulative Percent
between 30 - 39 yrs	7	14.29	14.29
between 40 - 49 yrs	16	32.65	46.94
between 50 - 59 yrs	19	38.78	85.72
more than 60 yrs	7	14.28	100
Total	49	100	

The result from 49 questionnaires show that farmers in Yasothon province have cropping areas on average at 17 rai per person, which involve at 42.85% of cropping areas between 11 and 20 rai, where as farmers have the cropping areas more than 31 rai at only 12.25%. The result is shown in table 4.26.

**Table 4.26** Cropping area of sampling in Yasothon

Cropping Area	Frequency	Percent	Cumulative Percent
under 10 rai	14	28.57	28.57
between 11 - 20 rai	21	42.85	71.42
between 21 - 30 rai	8	16.33	87.75
more than 31 rai	6	12.25	100
Total	49	100	

In order to know the number of cropping type in Yasothon, the results show that farmers mostly plant on one type of cropping, accounting for 97.95%, two-type cropping of 2.05% and no more than two-type cropping as shown on table 4.27.

**Table 4.27** Number of cropping type of sampling in Yasothon

Number of cropping type	Frequency	Percent	Cumulative Percent
1 type	48	97.95	97.95
2 type	1	2.05	100
more than 2 type	0	0	100
Total	49	100	

The results show that farmers in Yasothon mostly grow rice, especially Rice KDML105 accounting for 98.00% and Rice RD6 accounting for 2.00%, as shown in table 4.28.

**Table 4.28** Type of cropping of sampling in Yasothon

Type of cropping	Frequency	Percent	Cumulative Percent
Rice KDML 105	49	98.00	98.00
Rice RD6	1	2.00	100.00
Other	0	0.00	100.00
Total	50	100	

The output of rice plantation had been surveyed. The yield of rice production in Yasothon is in range of 301 to 400 kilograms/rai, accounting for 60.00%, where as the rice production greater than 501 kilograms/rai is only 2.00%. The result is shown in table 4.29.

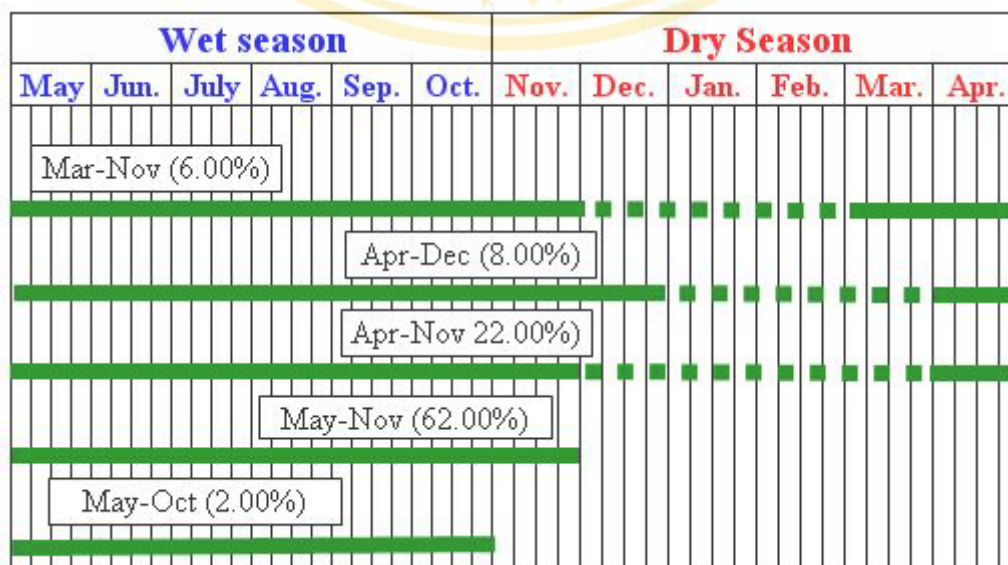
**Table 4.29** Number of produce of sampling in Yasothon

Number of produce	Frequency	Percent	Cumulative Percent
between 0 - 100 kg/rai	0	0.00	0.00
between 101-200 kg/rai	3	6.00	6.00
between 201-300 kg/rai	14	28.00	34.00
between 301-400 kg/rai	30	60.00	94.00
between 401-500 kg/rai	2	4.00	98.00
more than 501 kg/rai	1	2.00	100.00
Total	50	100.00	

The survey of 49 questionnaires in Yasothon shows that farmers grow rice in a duration between May and November up to 62% where as the rest of the year, they grow other plants such as vegetables and fruit trees. Table 4.30 and Figure 4.5 shows cropping period of farmers in Yasothon.

**Table 4.30** Cropping period of sampling in Yasothon

Cropping period	Frequency	Percent	Cumulative Percent
Jan-Dec	0	0.00	0.00
Jan-Mar	0	0.00	0.00
Jan-Apr	0	0.00	0.00
Jan-May	0	0.00	0.00
Mar-Nov	3	6.00	6.00
Apr-Dec	4	8.00	14.00
Apr-Nov	11	22.00	36.00
May-Dec	0	0.00	36.00
May-Nov	31	62.00	98.00
May-Oct	1	2.00	100.00
Jun-Nov	0	0.00	100.00
Jun-Dec	0	0.00	100.00
Jul-Dec	0	0.00	100.00
Aug-Nov	0	0.00	100.00
Oct-Dec	0	0.00	100.00
Nov-Dec	0	0.00	100.00
Total	50	100.00	



**Figure 4.5** Cropping period of sampling in Yasothon

### **Thung Ku La Ra Hai**

From 400 questionnaires obtained, interviewees who are farmers in Thung Ku la Rong Hai. Consist of 270 males and 130 females and have the ages of 47 years old in average. The interviewees aging between 40 and 49 years old account for 35.75%, where as no interviewees was under 30 years old. The classification of age of sampling is shown in table 4.31.

**Table 4.31** Age of sampling in Thung Ku La Rong Hai

Age	Frequency	Percent	Cumulative Percent
between 30 - 39 yrs	96	24	24
between 40 - 49 yrs	143	35.75	59.75
between 50 - 59 yrs	125	31.25	91
more than 60 yrs	36	9	100
Total	400	100	

The result from 400 questionnaires show that farmers in Thung Ku la Rong Hai area have cropping areas on average at 17 rai per person, which involve at 47% of cropping areas between 11 and 20 rai, where as farmers have the cropping areas more than 31 rai at only 7.25%. The result is shown in table 4.32.

**Table 4.32** Cropping area of sampling in Thung Ku La Rong Hai

Cropping Area	Frequency	Percent	Cumulative Percent
under 10 rai	88	22	22
between 11 - 20 rai	188	47	69
between 21 - 30 rai	95	23.75	92.75
more than 31 rai	29	7.25	100
Total	400	100	

In order to know the number of cropping type in Thung Ku la Rong Hai, the results show that farmers mostly plant on one type of cropping, accounting for 81.25%, two-type cropping of 13.75% and more than two-type cropping of only 5% as shown on table 4.33.

**Table 4.33** Number of cropping type of sampling in Thung Ku La Rong Hai

Number of cropping type	Frequency	Percent	Cumulative Percent
1 type	325	81.25	81.25
2 type	55	13.75	95
more than 2 type	20	5	100
Total	400	100	

The results show that farmers in Thung Ku la Rong Hai mostly grow rice, especially Rice KDML105 accounting for 80.40% and Rice RD6 accounting for 9.90%, as shown in table 4.34.

**Table 4.34** Type of cropping of sampling in Thung Ku La Rong Hai

Type of cropping	Frequency	Percent	Cumulative Percent
Rice KDML 105	398	80.40	80.40
Rice RD6	49	9.90	90.30
Other	48	9.70	100
Total	495	100	

The output of rice plantation had been surveyed. The yield of rice production in Thung Ku la Rong Hai is in range of 301 to 400 kilograms/rai, accounting for 51.32%, where as the rice production greater than 501 kilograms/rai is only 13.39%. The result is shown in table 4.35.

**Table 4.35** Number of produce of sampling in Thung Ku La Rong Hai

Number of produce	Frequency	Percent	Cumulative Percent
between 0 - 100 kg/rai	1	0.20	0.20
between 101-200 kg/rai	9	1.83	2.03
between 201-300 kg/rai	119	24.14	26.17
between 301-400 kg/rai	253	51.32	77.48
between 401-500 kg/rai	45	9.13	86.61
more than 501 kg/rai	68	13.39	100
Total	495	100	

The survey of 400 questionnaires in Thung Ku la Rong Hai shows that farmers grow rice in a duration between May and November up to 64.04% where as the rest of the year, they grow other plants such as vegetables and fruit trees. Table 4.36 and Figure 4.6 shows cropping period of farmers in Thung Ku la Rong Hai.

**Table 4.36** Cropping period of sampling in Thung Ku La Rong Hai

<b>Cropping period</b>	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
Jan-Dec	4	0.81	0.81
Jan-Mar	31	6.26	7.07
Jan-Apr	7	1.41	8.48
Jan-May	2	0.40	8.89
Mar-Nov	11	2.22	11.11
Apr-Dec	9	1.82	12.93
Apr-Nov	46	9.29	22.22
May-Dec	54	10.91	33.13
May-Nov	317	64.04	97.17
May-Oct	6	1.21	98.38
Jun-Nov	2	0.40	98.79
Jun-Dec	1	0.20	98.99
Jul-Dec	1	0.20	99.19
Aug-Nov	1	0.20	99.39
Oct-Dec	2	0.40	99.80
Nov-Dec	1	0.20	100
Total	495	100	



### 4.3 Level of Hierarchical Structure

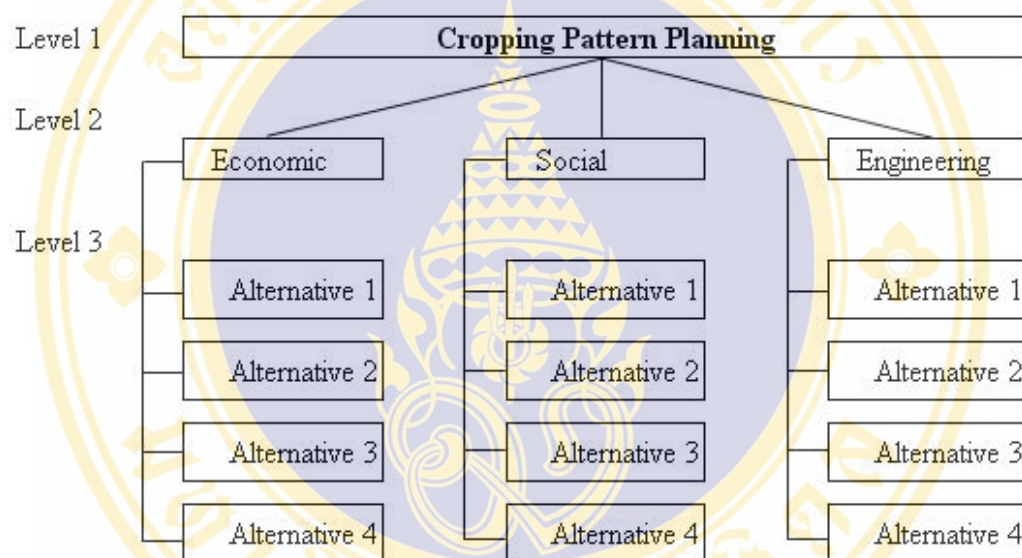
As mentioned in chapter 3, the hierarchical structure can be divided into 3 levels.

Level 1 Goal is cropping pattern planning.

Level 2 Criteria include economic, social and engineering.

Level 3 Top-Down ordering of four alternative options.

The level of hierarchical structure is shown in Figure 4.7



**Figure 4.7:** The level of Hierarchical Structure in the Analytical Hierarchy Process

### 4.4 Calculation Results of Relative Priority Ranking in Cropping Pattern Planning

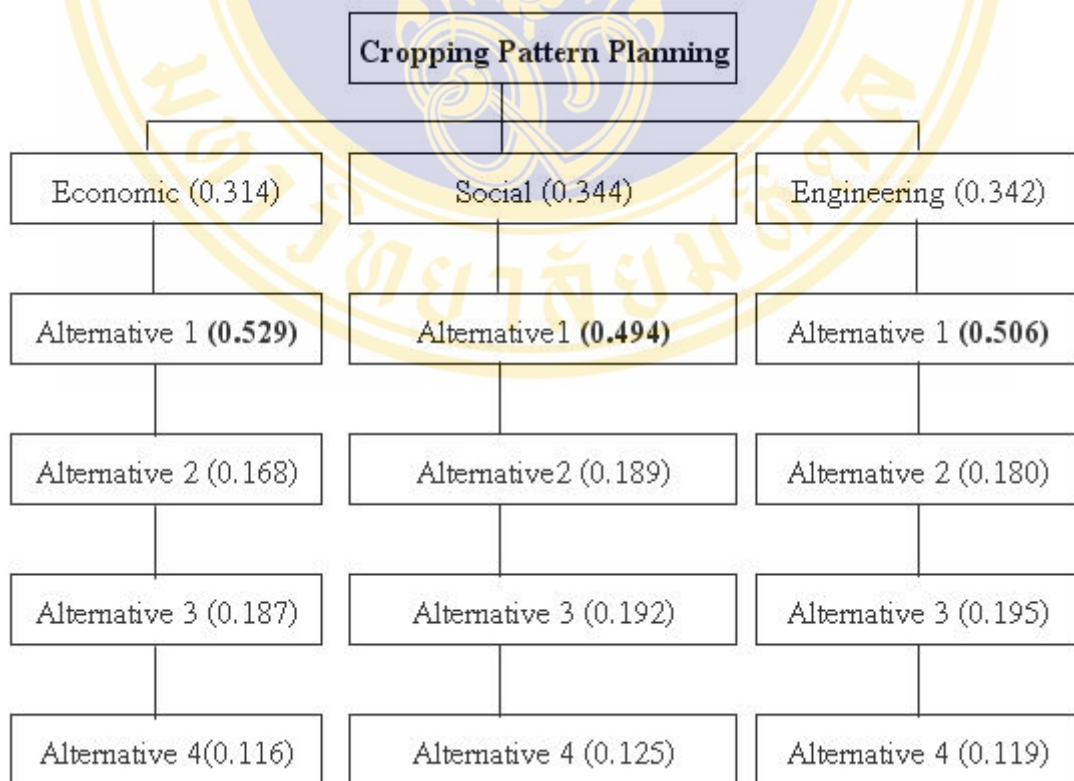
Data gathered from 400 questionnaires in study areas were used to determine for relative priority ranking in cropping pattern planning. The consistency test is undertaken by allowing CR rate at 0.1 or lower. The calculation results of relative priority of cropping pattern planning obtained from AHP are depicted in Appendix 1.

### 4.5 Statement of Alternative Options from the Analysis of Relative Priority

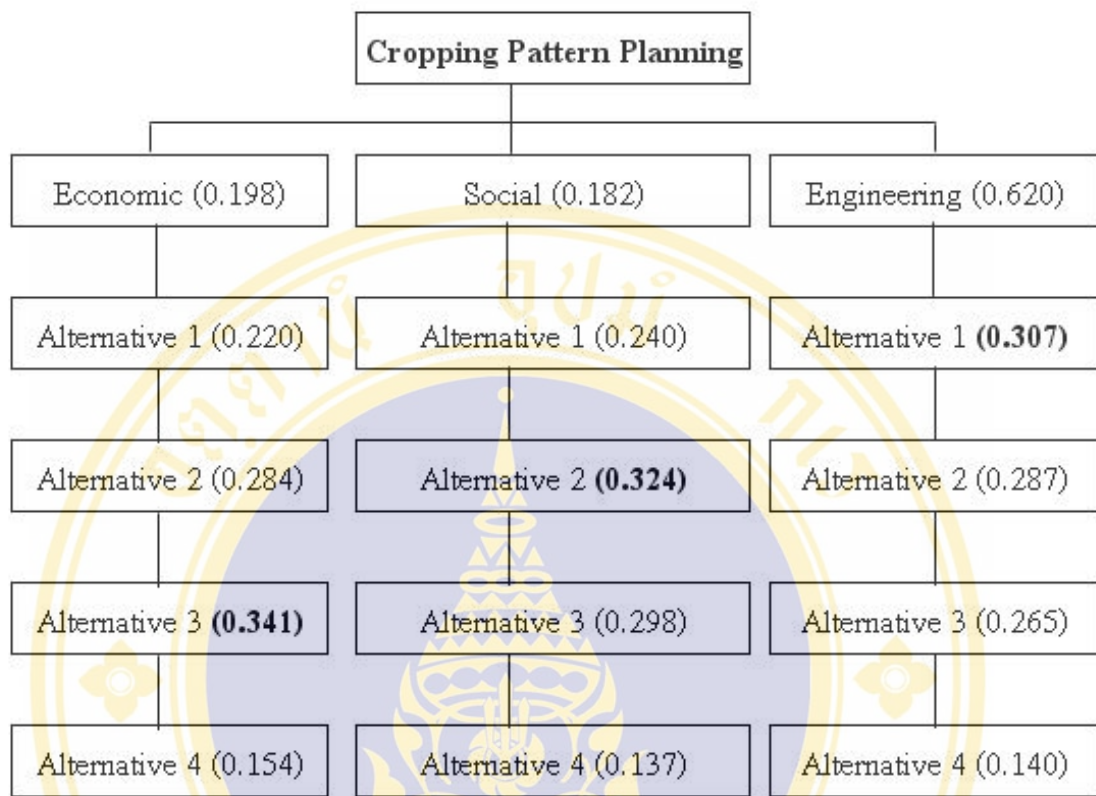
#### Raking

Criteria used in this study are economic, social and engineering criteria. Each of which is weighed at 0.314, 0.344 and 0.342 in wet season and at 0.198, 0.182 and 0.620 in dry season respectively (Appendix 1).

The farmers were asked to select four alternatives in questionnaires and then rank the selected alternatives by prioritizing of the importance of evaluating criteria, which are economic, social, and engineering. The calculation on wet season reveals that for alternative 1, economic, social, and engineering criteria were ranked at the highest priority level, accounting for 52.9%, 49.4% and 50.6% respectively, as shown in Figure 4.8. The calculation on dry season reveals that for alternative 3 on economic criteria, alternative 2 on social criteria, and alternative 1 on engineering criteria were ranked at the highest priority level, accounting for 34.1%, 32.4% and 30.7% respectively (Figure 4.9).



**Figure 4.8:** Relative Priority Ranking of Each Level of Hierarchical Structure in Wet Season



**Figure 4.9:** Relative Priority Ranking of Each Level of Hierarchical Structure in Dry Season

The total priority ranking scores of all criteria illustrated in Table 4.37 and 4.38 are obtained by multiplying alternative priority weighting scores with criteria weighting scores. The results were added to the total priority ranking scores of each criterion. It is found that alternative 1 is ranked as a top priority in wet season, accounting for 50.8% of the total weighting scores, whereas in dry season alternative 2 is ranked as a top priority, accounting for 29.3% of the total weighting scores. (Appendix 2 to 5).

**Table 4.37:** Results of the Total Priority Ranking Scores of all Criteria in Wet Season

Alternatives	Economic (0.314)	Social (0.344)	Engineering (0.342)	Total Priority Ranking Scores	Order
1	0.529	0.494	0.506	$[(0.314*0.529)+(0.344*0.494)+(0.342*0.506)]$ = 0.508	<b>1</b>
2	0.168	0.189	0.180	$[(0.314*0.168)+(0.344*0.189)+(0.342*0.180)]$ = 0.180	3
3	0.187	0.192	0.195	$[(0.314*0.187)+(0.344*0.192)+(0.342*0.195)]$ = 0.192	2
4	0.116	0.125	0.119	$[(0.314*0.116)+(0.344*0.125)+(0.342*0.119)]$ = 0.120	4

**Table 4.38:** Results of the Total Priority Ranking Scores of all Criteria in Dry Season

Alternatives	Economic (0.198)	Social (0.182)	Engineering (0.620)	Total Priority Ranking Scores	Order
1	0.220	0.240	0.307	$[(0.198*0.220)+(0.182*0.240)+(0.620*0.307)]$ = 0.279	3
2	0.284	0.324	0.287	$[(0.198*0.284)+(0.182*0.324)+(0.620*0.287)]$ = 0.293	<b>1</b>
3	0.341	0.298	0.265	$[(0.198*0.341)+(0.182*0.298)+(0.620*0.265)]$ = 0.285	2
4	0.154	0.137	0.140	$[(0.198*0.154)+(0.182*0.137)+(0.620*0.140)]$ = 0.142	4

#### 4.6 Sensitivity Analysis

Sensitivity analysis is a process used for testing the robustness of a selected alternative option to see the extent to which the result will change if priority weighting scores are changed. As shown in Figure 4.10 to 4.17 for wet season and Figure 4.18 to 4.25 for dry season, economic, social, and engineering criteria are not sensitive to fluctuation of priority ranking scores ranging from high to low.

The sensitivity analysis can also be conducted through the adjustment of priority weighting scores of each criterion. The adjustment will rank from maximum to minimum scores to determine for all situations. The analysis show that, alternative 3 remains at the top priority and is proved to be the best solution for the cropping pattern planning.

The solution suggested this report can be applied for the cropping pattern planning of Thung Ku La Rong Hai area in wet and dry season.

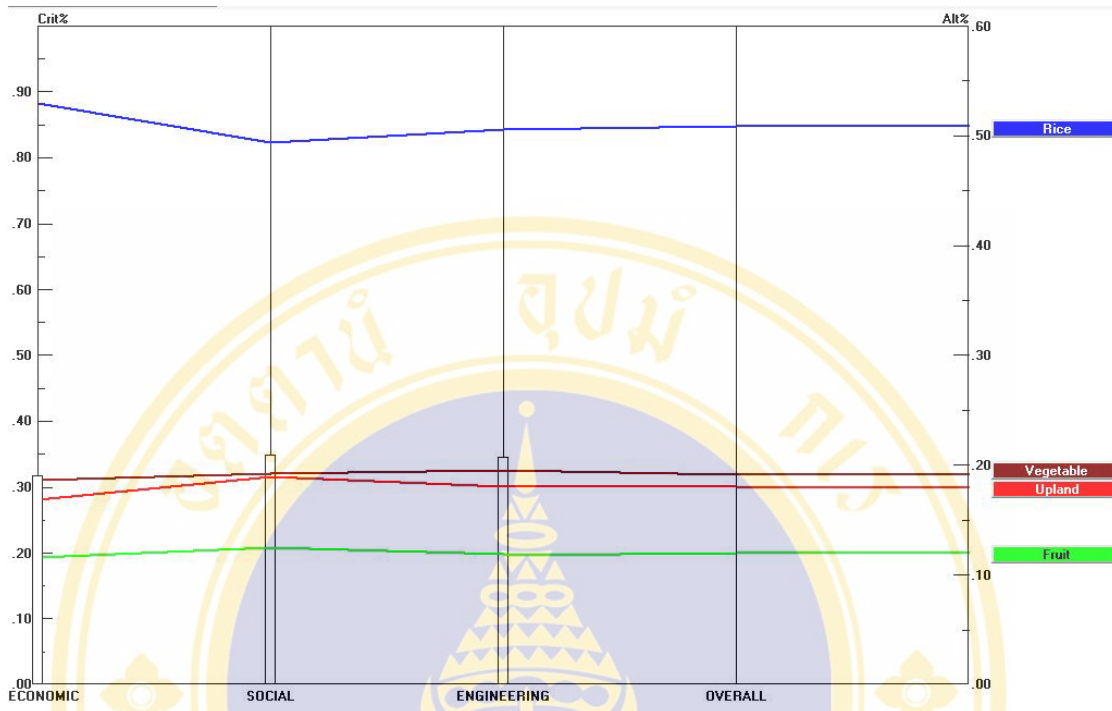


Figure 4.10: Sensitivity Analysis of Alternatives (Wet Season)

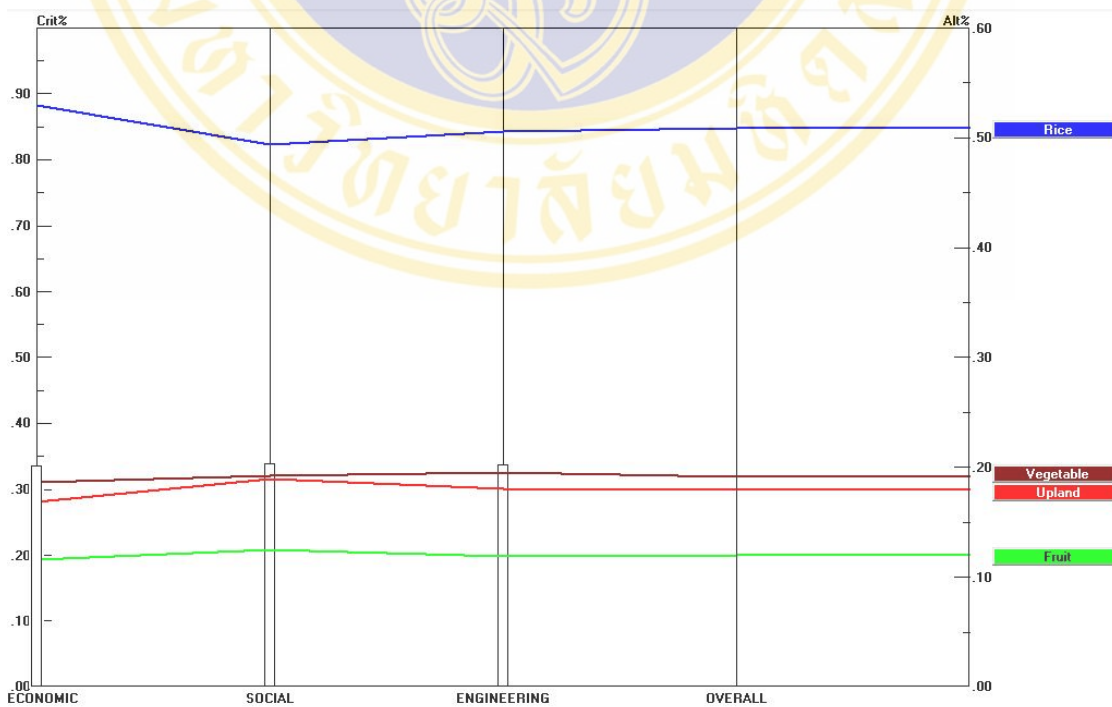
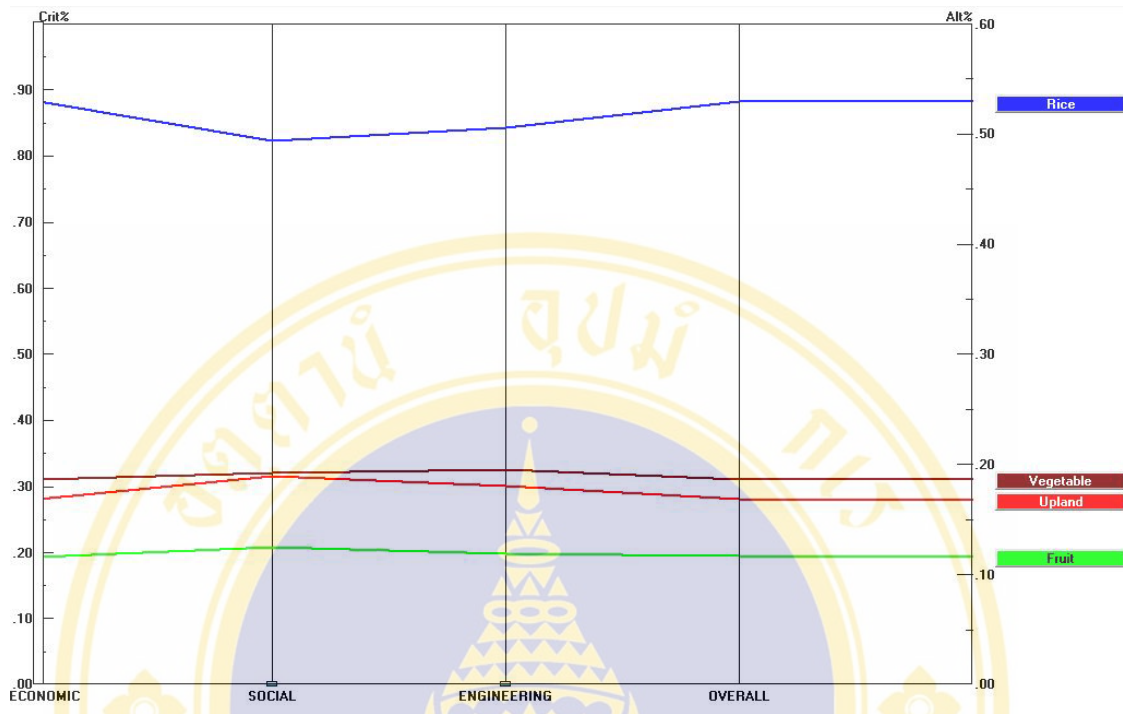
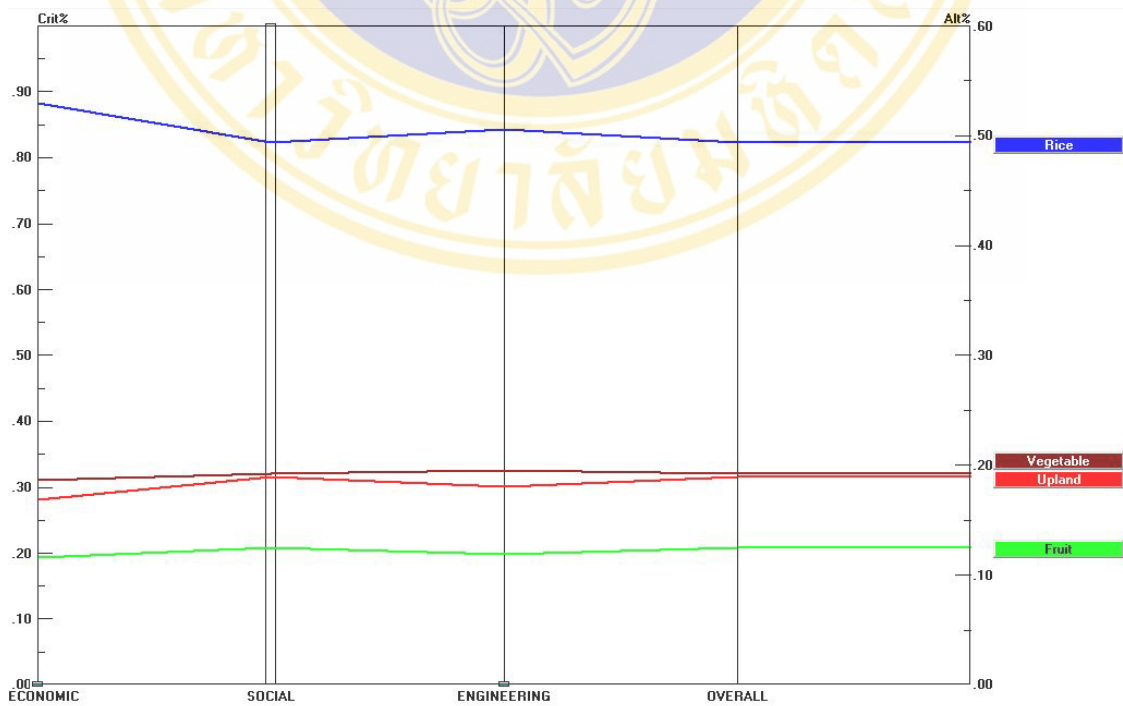


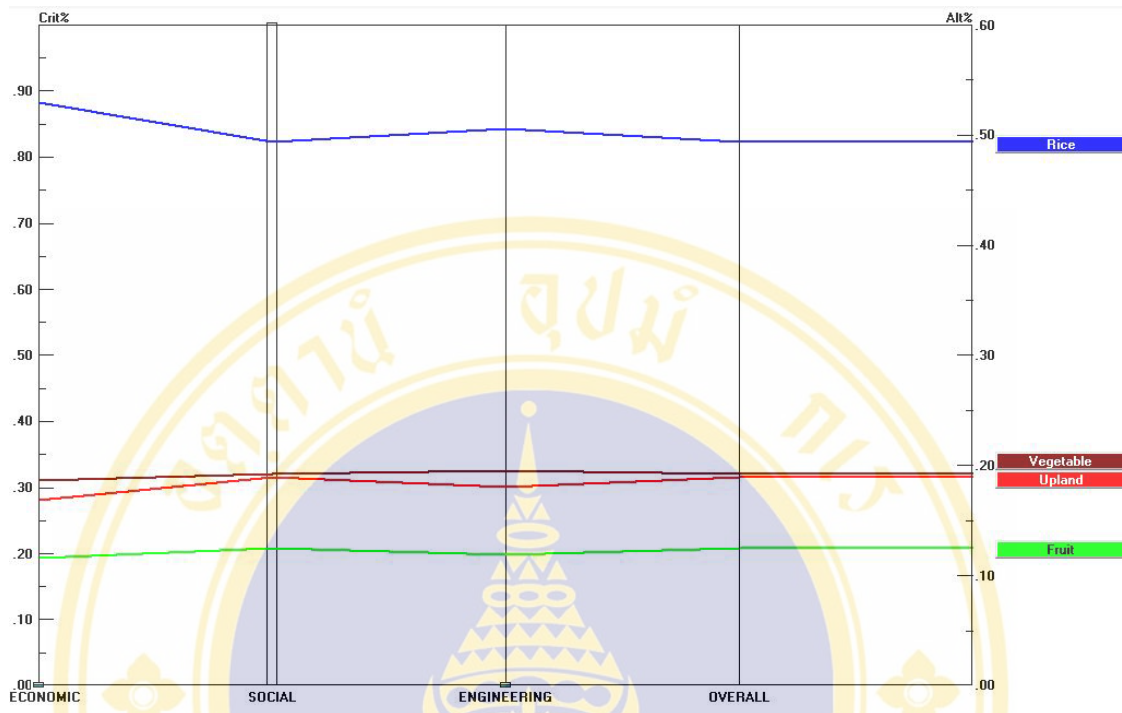
Figure 4.11: Sensitivity Analysis of Alternatives in case of equal scores (Wet Season)



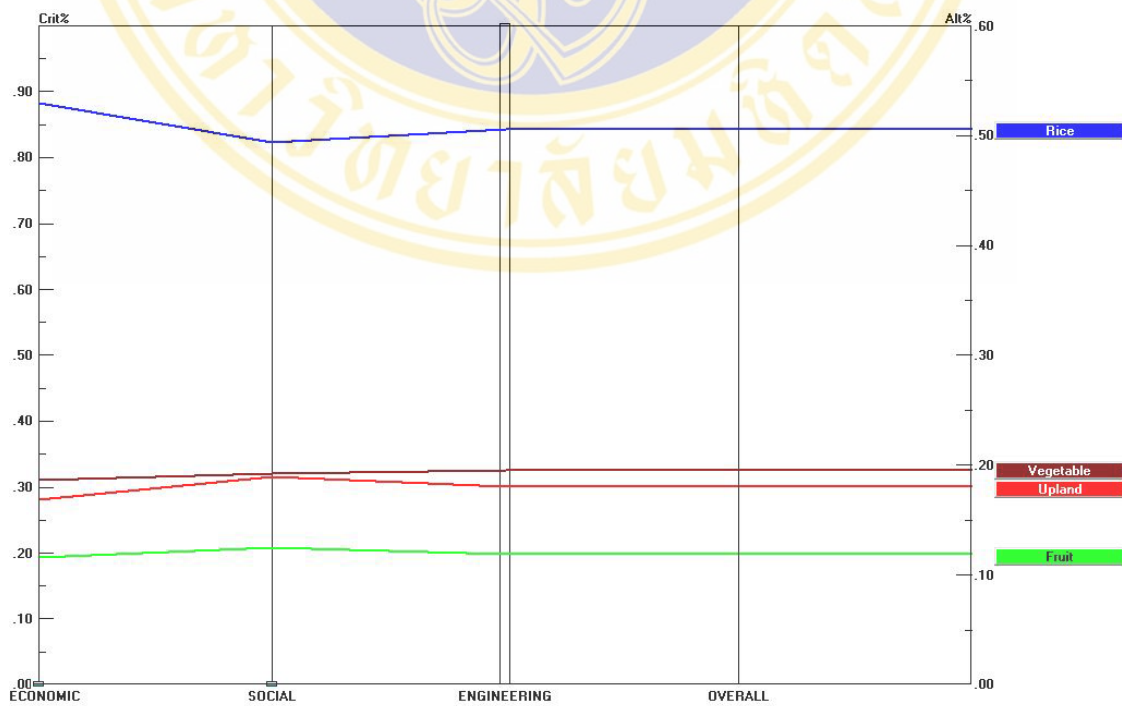
**Figure 4.12:** Sensitivity Analysis of Alternative in case Economic Criteria has maximum priority weighting scores (Wet Season)



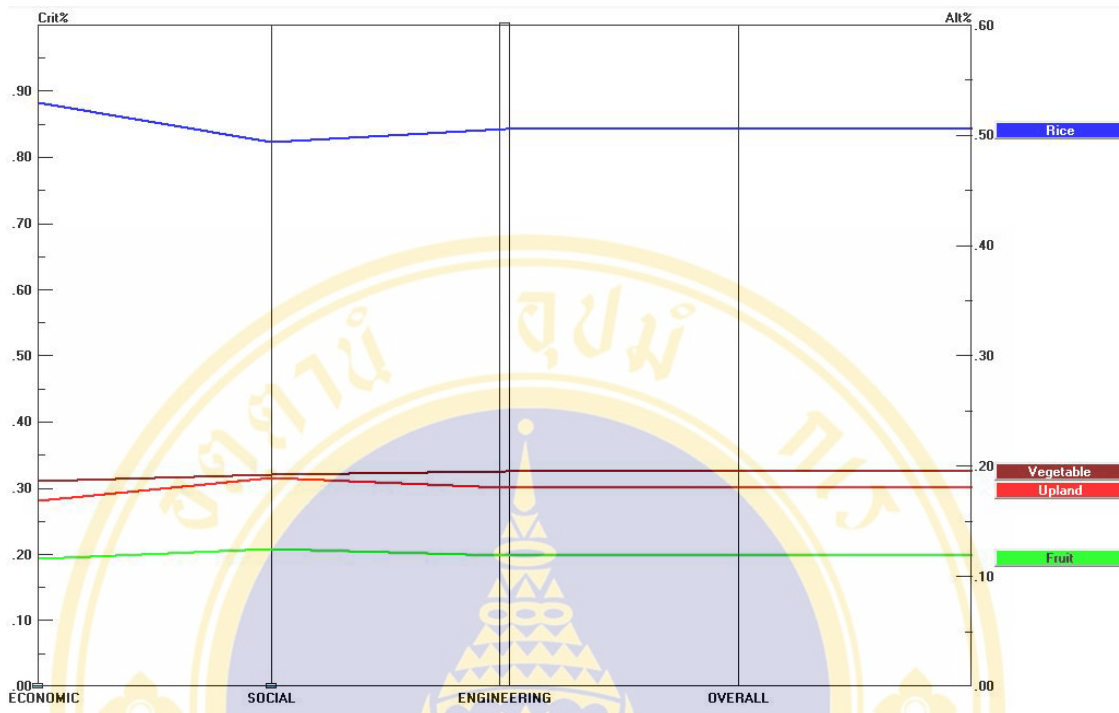
**Figure 4.13:** Sensitivity Analysis of Alternative in case Economic Criteria has minimum priority weighting scores (Wet Season)



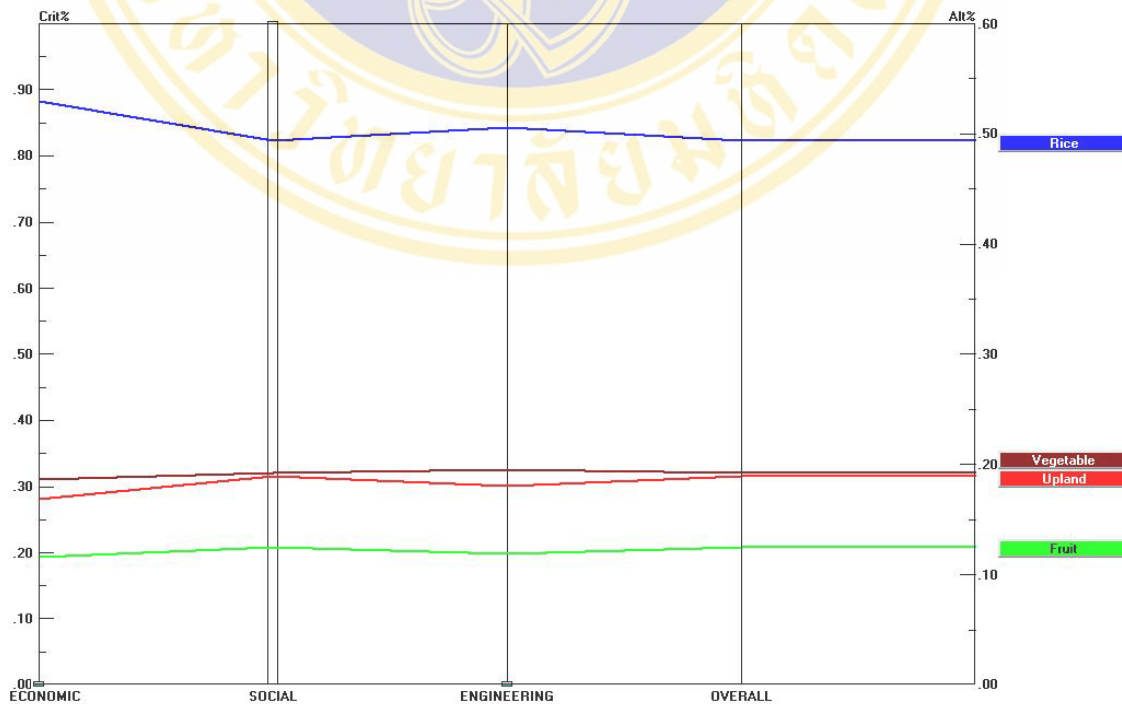
**Figure 4.14:** Sensitivity Analysis of Alternative in case Social Criteria has maximum priority weighting scores (Wet Season)



**Figure 4.15:** Sensitivity Analysis of Alternative in case Social Criteria has minimum priority weighting scores (Wet Season)



**Figure 4.16:** Sensitivity Analysis of Alternative in case Engineering Criteria has maximum priority weighting scores (Wet Season)



**Figure 4.17:** Sensitivity Analysis of Alternative in case Engineering Criteria has minimum priority weighting scores (Wet Season)

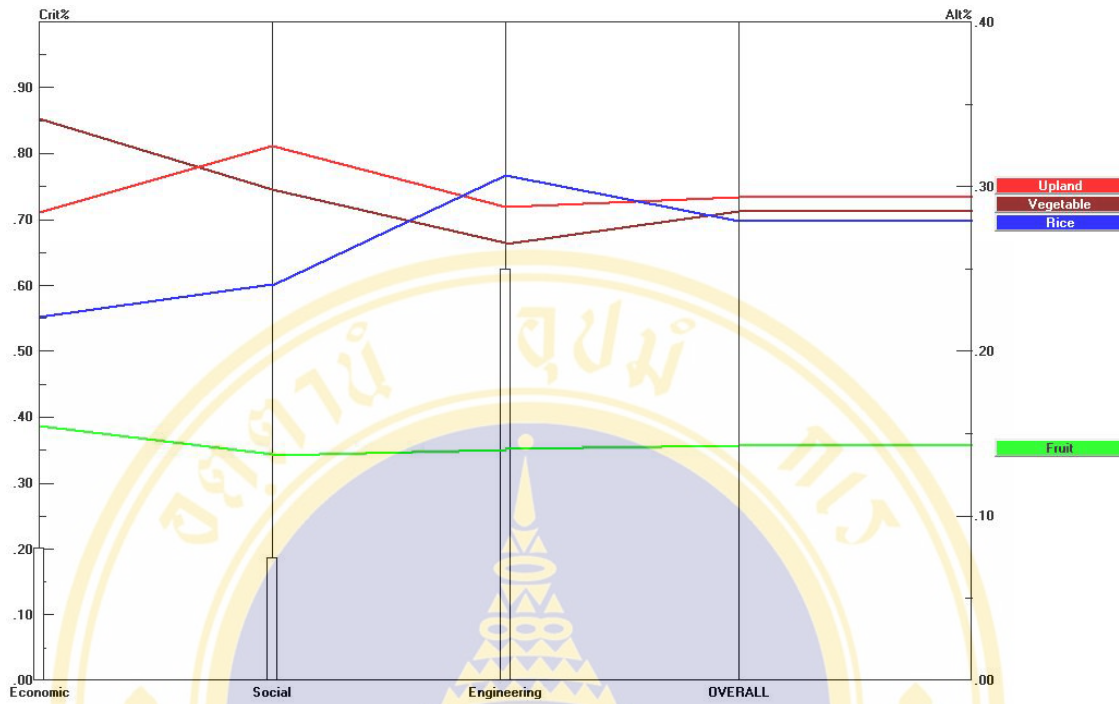


Figure 4.18: Sensitivity Analysis of Alternative (Dry Season)

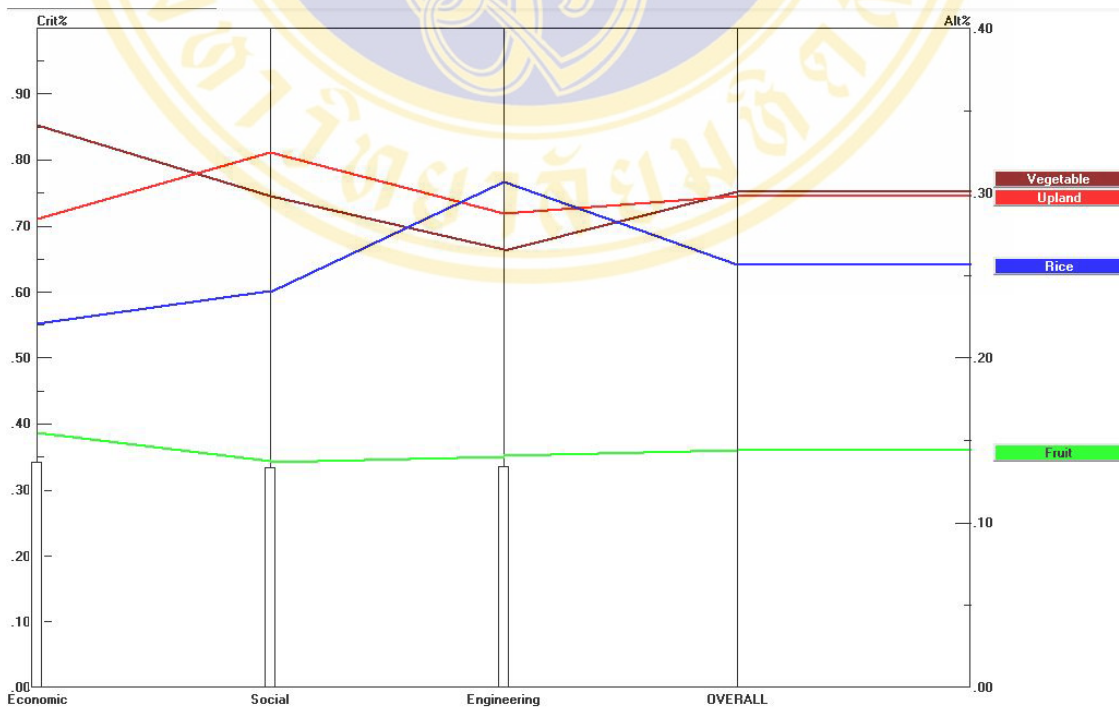
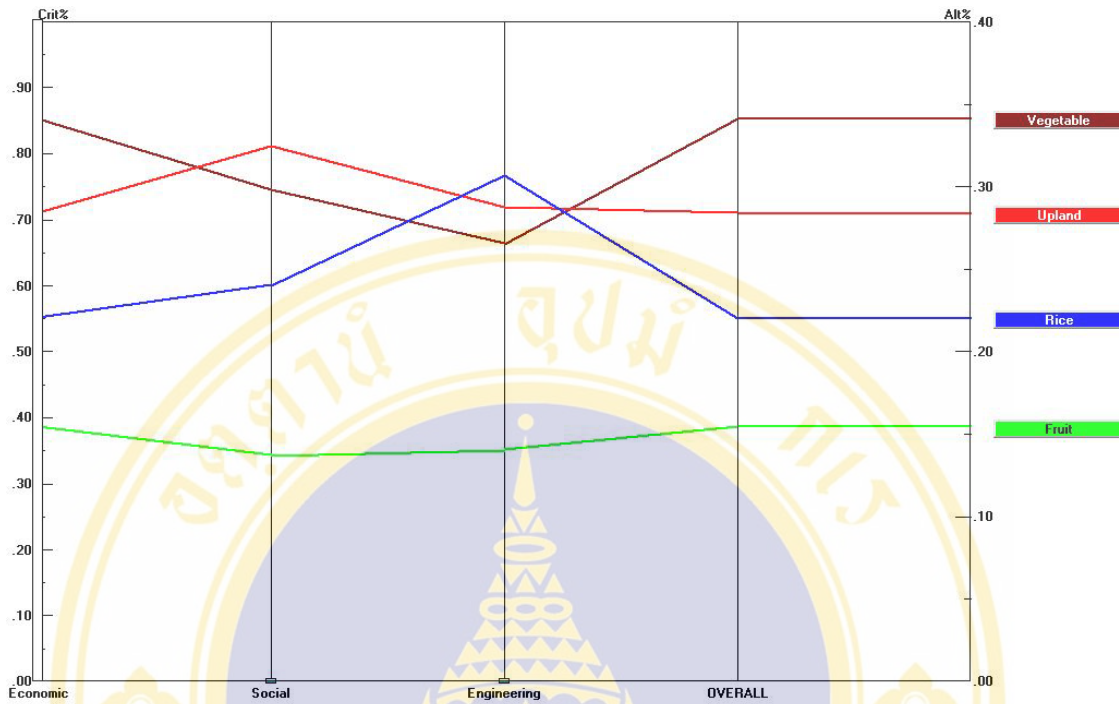
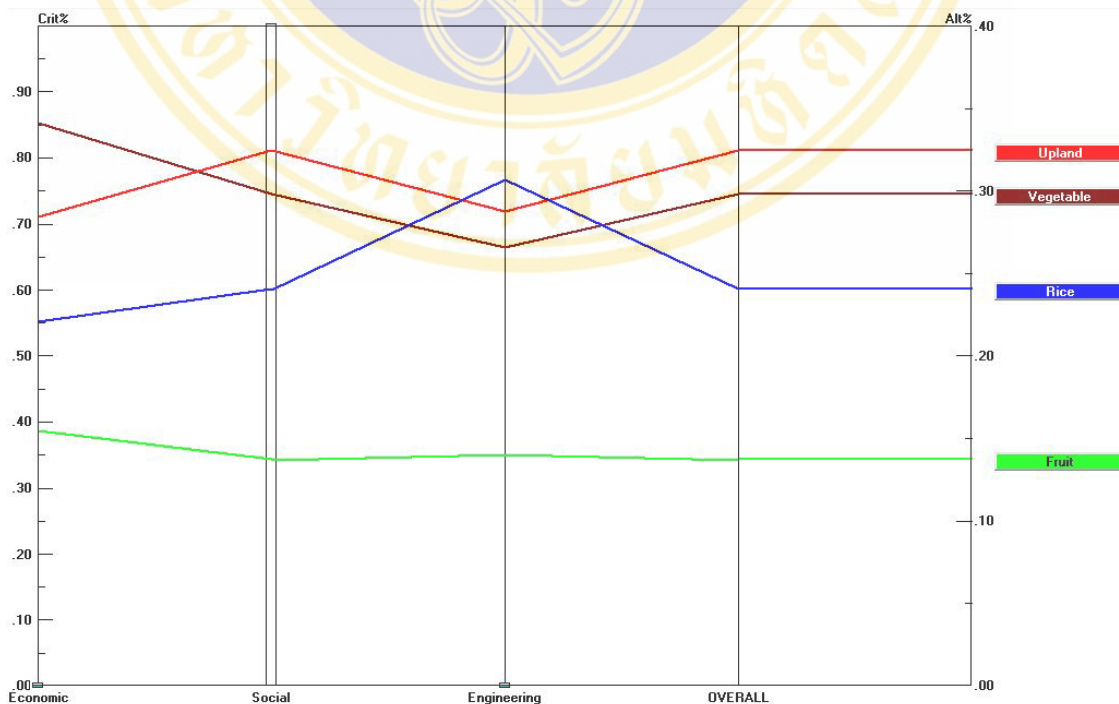


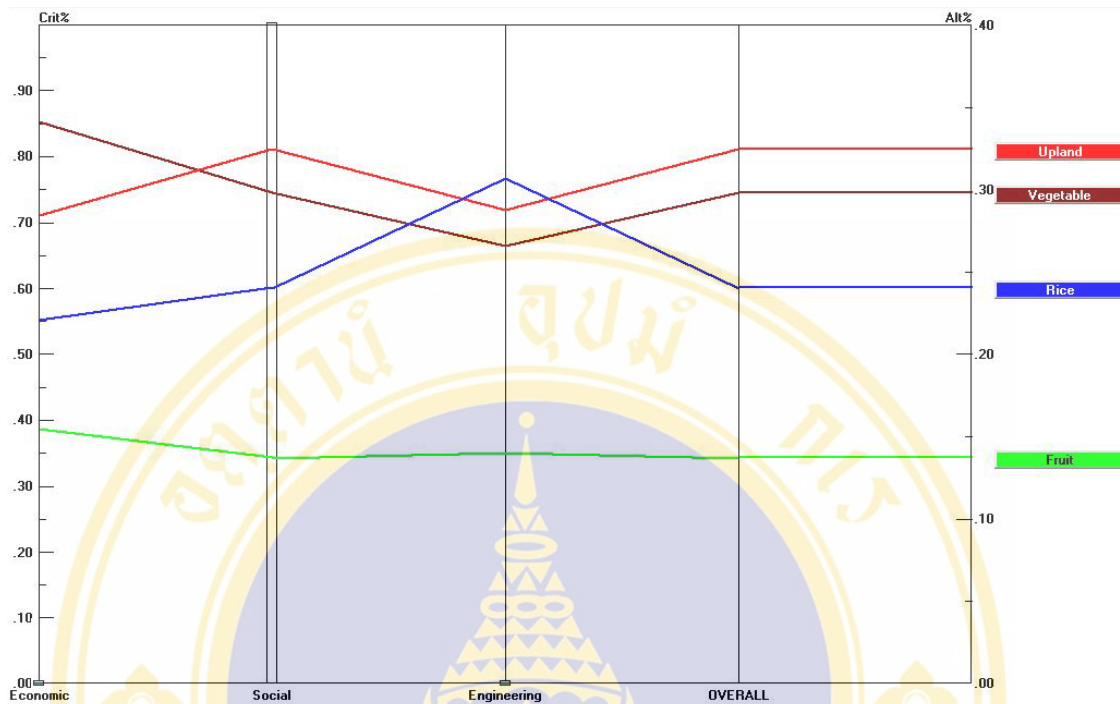
Figure 4.19: Sensitivity Analysis of Alternative in case of equal scores (Dry Season)



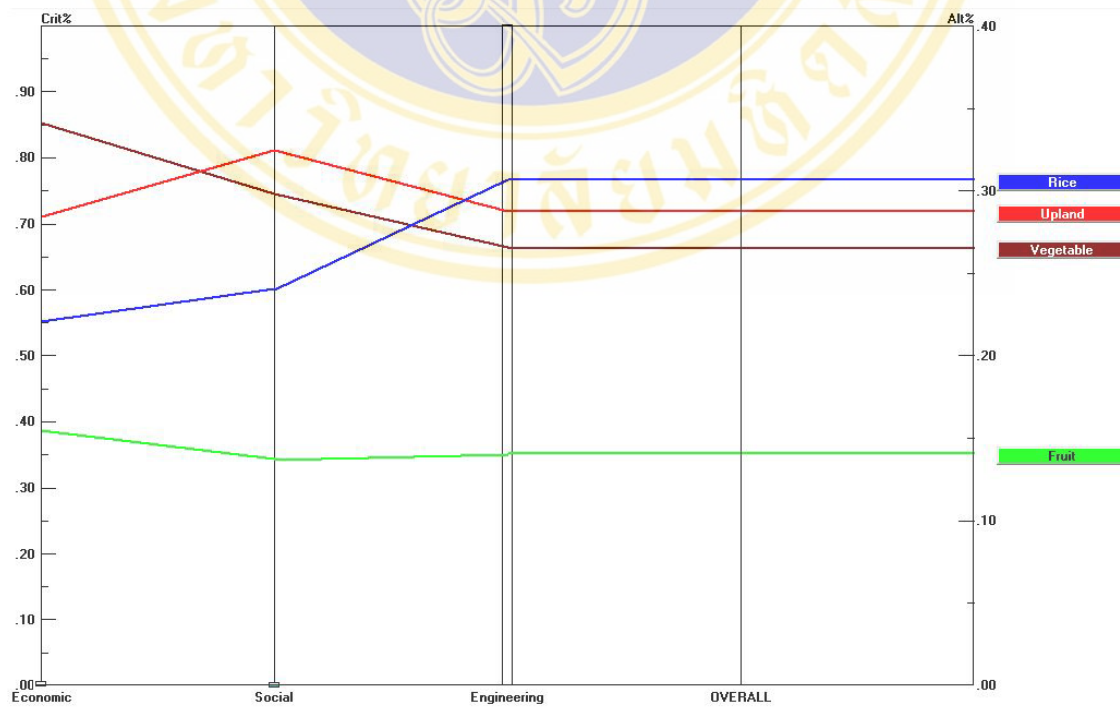
**Figure 4.20:** Sensitivity Analysis of Alternative in case Economic Criteria has maximum priority weighting scores (Dry Season)



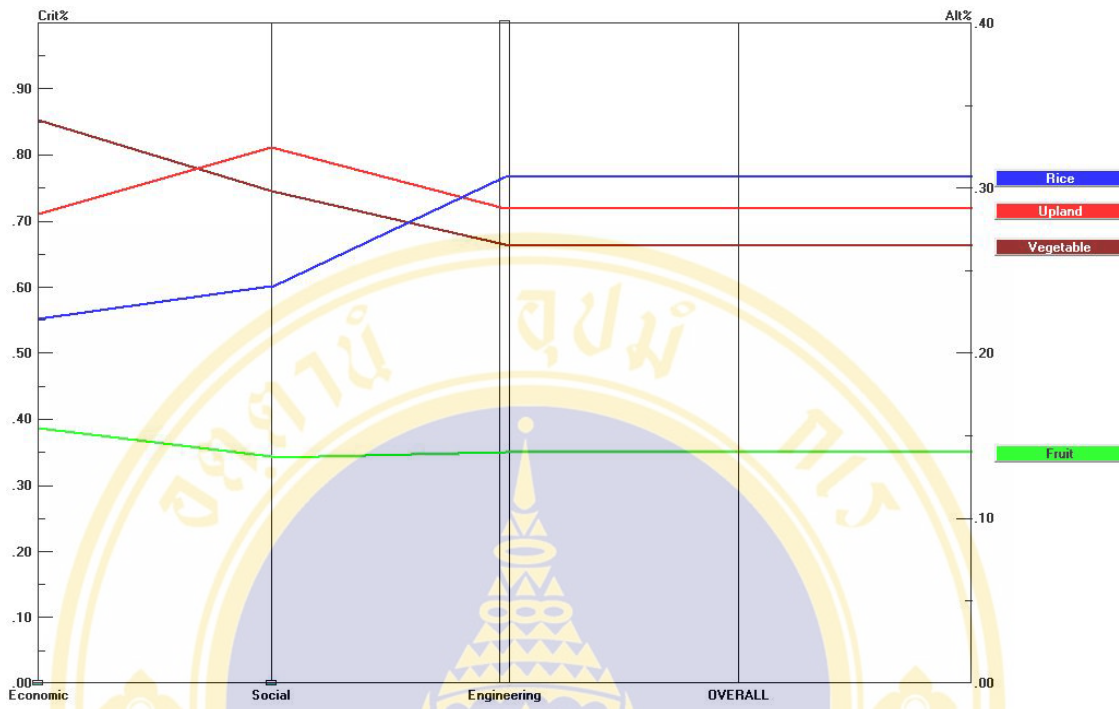
**Figure 4.21:** Sensitivity Analysis of Alternative in case Economic Criteria has minimum priority weighting scores (Dry Season)



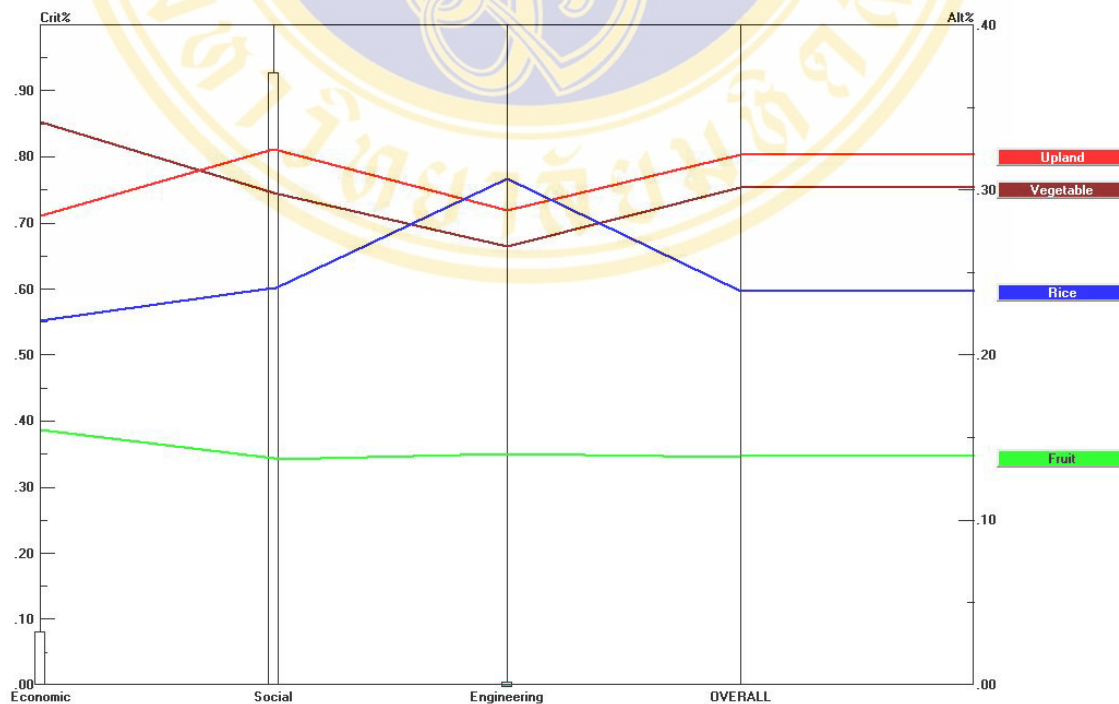
**Figure 4.22:** Sensitivity Analysis of Alternative in case Social Criteria has maximum priority weighting scores (Dry Season)



**Figure 4.23:** Sensitivity Analysis of Alternative in case Social Criteria has minimum priority weighting scores (Dry Season)



**Figure 4.24:** Sensitivity Analysis of Alternative in case Engineering Criteria has maximum priority weighting scores (Dry Season)



**Figure 4.25:** Sensitivity Analysis of Alternative in case Engineering Criteria has minimum priority weighting scores (Dry Season)

## CHAPTER 5

### CONCLUSION AND RECOMMENDATIONS

#### 5.1 Conclusion

Farmers in Thung Ku La Rong Hai who have the ages between 40 and 49 years old, have the cropping areas between 11 and 20 rai and grow only KDML105, which yields at between 301 and 400 kg per rai and has been planted in between May and November.

The Analytical Hierarchy Process is used for determining the best alternative out of 4 options. In wet season, it is found that relative priority scores of economic, social and engineering criteria are 31.4%, 34.4% and 34.2%, respectively. It is noted that social and engineering criteria should be evenly considered against the decision on alternative options. In dry season, it is found that relative priority scores of economic, social and engineering criteria and are 19.8%, 18.2% and 6.2%, respectively.

In wet season, the highest priority scores are given to alternative 1, which cropping is rice, accounting for 50.6% of the total scores. In dry season, the highest priority scores are given to alternative 2, which cropping is upland, accounting for 29.3% of the total scores.

#### 5.2 Recommendations

1. The sample size of the study in terms of number of participants in consumption and ecosystem stability groups should be extended to representatives from village chiefs, officials and local authorities to achieve greater equilibrium of data.
2. The Analytical Hierarchy Process should be applied to the cropping pattern planning for most cropping required activity.
3. The Analytical Hierarchy Process be applied to water distribution for cropping.
4. Data collecting process should be well-defined in scope and time frame due to complexity of questionnaire.

5. The alternative options should be different upon specify the condition of farmer knowledge and government policy.
6. Field water management extension activity should be exercised to improve the effective bund height for lowland rice crop.
7. Restructuring agricultural production should be in line with local market and nation market demand.
8. It should formulate system to inform farmers of demand and prices of agricultural products.
9. Criteria should include water resource development project in the future.
10. More promoting of news interchange among farmers and officials should be provided.
11. Joining hands and participating between farmers and officials should be done continuously.
12. Government should educate farmers on agriculture and promote alternative to cropping for them.

## REFERENCES

- Anukul-Aumpai, A., 1999. Alternatives of Agriculture Development in Irrigation Area for Sustainable Development. Seminar on integrated water resources planning and management for sustainable development (for small farm holders) (in Thai)
- Doorenbos, j. and Pruitt, W.O., 1984. Guidelines for Predicting Crop Water Requirement, Irrigation and Drainage Paper 24. FAO of the United Nations, Rome.
- Booranaosot, J., 2000. A development of factors and criteria for evaluating students' thesis of the Faculty of Education, Chulalongkorn University : a comparison between average weight and AHP techniques. Thesis (M.Ed.)--Chulalongkorn University.
- Horthiwong, N., 1996. Evaluation criteria for research, development and engineering project proposals from the industrial sector. Thesis (M.Eng.)--Chulalongkorn University.
- Kanjanarutjawiwat, R., 1999. Improvement of quality function deployment by the analytical hiererachy process. Thesis (M.Eng.)--Chulalongkorn University.
- Khao-SaAard et al., 2001. Policies in Water Resource Management for Thailand. Book 1. Supported by The Office of research Fund. (in Thai)
- Kongjun, T. and Vudhivanich, V., 200. Shortage of Water Resource in Upper Mun Basin. Proceedings of the first National Convention on water Resources Engineering. (in Thai)
- Kongjun, T. and Vudhivanich, V., 2003. Multicriteria Decision Making for Multireservoir Water Allocation During Shortage: A Case Study of Upper Mun Basin. Journal of Suranaree University Vol.11. pp. 30-38.
- Meinzen-Dick, R., Subramanian, A., and Jagannathan, N. 1997. User Organization for Sustainable Water Services. World Bank Technical Paper No.354 Washington, D.C.: World Bank.

- Mainuddin, M., Das Gupta, A. and Onta, P.R., 1997. Optimal Crop Planning Model for An Existing Ground Irrigation Project in Thailand, *Agricultural Water Management*, Vol.33, No. 1, pp. 43.
- National Economics and Social Development Board (NESDB), 1994. The study of data and potential for Mun river basin development Project. (in Thai)
- Nonhuwro, M., 2002. An Assessment of composite indicators for educational standards of basic education institution : an applicaion of analytic hierarchy process technique. Thesis (M.Ed.)--Chulalongkorn University.
- Pothikun, N., 2005. Applying analytic hierarchy process (AHP) to warehouse location selection / Nareerat Pothikun. Thesis (M.Sc.)--Chulalongkorn University.
- Royal Irrigation Department (RID), 2003. The study of main planning to support water resource development and improve of irrigation project for the ninth National Economic and Social Development Plan: Mun River Basin. (in Thai)
- Royal Irrigation Department (RID), 2003. The study of main planning: Thung Ku La Rong Hai Development Project. (in Thai)
- Royal Irrigation Department (RID), 2003. Report study of Agriculture Management on Integrated Project: A Case Study of Surin Province. (in Thai)
- Sahoo, G.B., 1998. Multi-criteria Irrigation Planning: Phitsanulok Irrigation Project, Thailand. M.Eng. Thesis, Asian Institute of Technology, Bangkok, Thailand.
- Sahoo, G.B., Loof, R., Albernethy, C.L., and Kazama, S. 2001. Reservoir Release Policy for Large Irrigation System. *Journal of Irrigation and Drainage Engineering*, Vol. 127, No. 5, pp. 302-310.
- Sakchanalaya, J., 1999. An application of the analytic hierarchy process in adjusting linear programming solutions for cement production and distribution planning Thesis (M.Ed.)--Chulalongkorn University.
- Salman, S. 1997. The Legal Framwork for Water Users' Associations: A Comparitive Study. World Bank Technical Paper No.360 Washington, D.C.: World Bank., pp. 8-9.

- Sittilert, Chutiwan. 2003. A capability study of water users' organizations in water management: A case study of Mae-Taeng irrigation project. Master's thesis of Faculty of Environment and Resources Studies, Mahidol University, Nakhon Pathom.
- Suk-Aphinya, P., 2005. An integrated decision making for water allocation using analytical hierarchy process: A case study of Lam Pra Plerng Irrigation Project. Thesis (MSc.)--Mahidol University.
- Thipparat, T., 2001. An analytical safety index model with fault tree analysis (FTA) and the analytical hierarchy process (AHP). Thesis (M.Eng.)--Chulalongkorn University.
- Tongkasem, J. 1999. Environment of Agriculture and Water Resource Development. Seminar on integrated water resources planning and management for sustainable development (for small farm holders) (in Thai)
- Wetsanarat, T., 2003. An Analysis of the decision structure of the medium sized car buying selection problem of customers in Bangkok using the analytic network process. Thesis (M.Eng.)--Chulalongkorn University.
- Vudhivanich, V., 2003. Decision Making by Analytic Hierachy Process. Journal of Chonlakovorn: Wan Chu Chat. (in Thai), pp. 57-76.



**Appendix 1:** The analytical of priority ranking scores

No.	Code of questionnaire	Wet Season			Dry Season		
		Economic	Social	Engineering	Economic	Social	Engineering
1	M001	0.479	0.063	0.458	0.111	0.111	0.778
2	M002	0.081	0.188	0.731	0.071	0.194	0.735
3	M003	0.229	0.075	0.696	0.199	0.065	0.736
4	M004	0.070	0.223	0.707	0.202	0.065	0.733
5	M005	0.223	0.070	0.707	0.319	0.375	0.306
6	M006	0.223	0.070	0.707	0.216	0.075	0.709
7	M007	0.070	0.223	0.707	0.071	0.209	0.720
8	M008	0.699	0.064	0.237	0.066	0.206	0.728
9	M009	0.229	0.075	0.696	0.192	0.099	0.709
10	M010	0.085	0.271	0.644	0.080	0.207	0.713
11	M011	0.226	0.101	0.674	0.176	0.092	0.732
12	M012	0.070	0.223	0.707	0.061	0.211	0.728
13	M013	0.111	0.111	0.778	0.115	0.121	0.764
14	M014	0.195	0.088	0.717	0.174	0.069	0.757
15	M015	0.070	0.223	0.707	0.063	0.198	0.739
16	M016	0.068	0.199	0.733	0.061	0.217	0.722
17	M017	0.070	0.223	0.707	0.077	0.163	0.760
18	M018	0.064	0.699	0.237	0.075	0.694	0.231
19	M019	0.072	0.452	0.476	0.091	0.455	0.454
20	M020	0.627	0.094	0.280	0.537	0.091	0.372
21	M021	0.070	0.223	0.707	0.071	0.207	0.722
22	M022	0.064	0.237	0.699	0.076	0.195	0.729
23	M023	0.068	0.733	0.199	0.056	0.686	0.258
24	M024	0.280	0.388	0.332	0.272	0.378	0.350
25	M025	0.105	0.258	0.637	0.066	0.202	0.732
26	M026	0.707	0.070	0.223	0.061	0.215	0.724
27	M027	0.134	0.119	0.747	0.130	0.138	0.732
28	M028	0.208	0.131	0.661	0.195	0.088	0.717
29	M029	0.068	0.199	0.733	0.103	0.186	0.711
30	SI001	0.111	0.111	0.778	0.111	0.111	0.778
31	SI002	0.237	0.699	0.064	0.151	0.066	0.783
32	SI003	0.237	0.699	0.064	0.168	0.062	0.770
33	SI004	0.260	0.413	0.327	0.234	0.444	0.322
34	SI005	0.260	0.413	0.327	0.236	0.442	0.322
35	SI006	0.064	0.699	0.237	0.236	0.442	0.322
36	SI007	0.100	0.100	0.800	0.069	0.160	0.771
37	SI008	0.199	0.733	0.068	0.062	0.199	0.739
38	SI009	0.223	0.707	0.070	0.061	0.127	0.812
39	SI010	0.333	0.333	0.333	0.333	0.333	0.334
40	SI011	0.280	0.627	0.094	0.322	0.233	0.445
41	SI012	0.223	0.070	0.707	0.333	0.333	0.334
42	SI013	0.226	0.101	0.674	0.333	0.333	0.334
43	SI014	0.333	0.333	0.333	0.440	0.322	0.238
44	SI015	0.111	0.111	0.778	0.222	0.062	0.716
45	SI016	0.068	0.199	0.733	0.111	0.111	0.778

**Appendix 1: The analytical of priority ranking scores (con't)**

No.	Code of questionnaire	Wet Season			Dry Season		
		Economic	Social	Engineering	Economic	Social	Engineering
46	SI017	0.472	0.084	0.444	0.125	0.125	0.750
47	SI018	0.435	0.078	0.487	0.111	0.111	0.778
48	SI019	0.075	0.229	0.696	0.081	0.196	0.723
49	SI020	0.088	0.195	0.717	0.069	0.241	0.690
50	SI021	0.064	0.237	0.699	0.059	0.225	0.716
51	SI022	0.064	0.699	0.237	0.239	0.068	0.693
52	SI023	0.320	0.558	0.122	0.262	0.084	0.654
53	SI024	0.166	0.073	0.761	0.243	0.062	0.695
54	SI025	0.258	0.105	0.637	0.267	0.078	0.655
55	SI026	0.124	0.517	0.359	0.121	0.271	0.608
56	SI027	0.217	0.066	0.717	0.285	0.094	0.621
57	SI028	0.226	0.101	0.674	0.259	0.084	0.657
58	SI029	0.249	0.157	0.594	0.194	0.072	0.734
59	SI030	0.268	0.117	0.614	0.209	0.059	0.732
60	SI031	0.223	0.070	0.707	0.203	0.066	0.731
61	SI032	0.199	0.068	0.733	0.181	0.064	0.755
62	SI033	0.199	0.068	0.733	0.211	0.086	0.703
63	SI034	0.218	0.691	0.091	0.063	0.172	0.765
64	SI035	0.218	0.691	0.091	0.281	0.333	0.386
65	SI036	0.696	0.229	0.075	0.228	0.681	0.091
66	SI037	0.088	0.717	0.195	0.074	0.702	0.224
67	SI038	0.223	0.070	0.707	0.282	0.088	0.630
68	SI039	0.070	0.223	0.707	0.182	0.073	0.745
69	SI040	0.121	0.115	0.764	0.157	0.073	0.770
70	SI041	0.289	0.394	0.317	0.063	0.206	0.731
71	SI042	0.070	0.223	0.707	0.066	0.155	0.779
72	SI043	0.699	0.237	0.064	0.072	0.223	0.705
73	SI044	0.707	0.070	0.223	0.237	0.061	0.702
74	SI045	0.199	0.733	0.068	0.229	0.115	0.656
75	SI046	0.236	0.682	0.082	0.256	0.081	0.663
76	SI047	0.691	0.218	0.091	0.063	0.214	0.723
77	SI048	0.682	0.236	0.082	0.069	0.215	0.716
78	SI049	0.696	0.229	0.075	0.077	0.669	0.254
79	SI050	0.733	0.199	0.068	0.382	0.283	0.335
80	SI051	0.237	0.699	0.064	0.066	0.156	0.778
81	SI052	0.268	0.614	0.117	0.617	0.098	0.285
82	SI053	0.085	0.271	0.644	0.060	0.212	0.728
83	SI054	0.117	0.614	0.268	0.067	0.159	0.774
84	SI055	0.223	0.707	0.070	0.234	0.119	0.647
85	SI056	0.229	0.075	0.696	0.255	0.087	0.658
86	SI057	0.733	0.199	0.068	0.079	0.205	0.716
87	SI058	0.682	0.236	0.082	0.070	0.221	0.709
88	SI059	0.691	0.218	0.091	0.059	0.716	0.225
89	SU001	0.283	0.387	0.331	0.170	0.063	0.767
90	SU002	0.333	0.097	0.570	0.247	0.076	0.677

**Appendix 1:** The analytical of priority ranking scores (con't)

No.	Code of questionnaire	Wet Season			Dry Season		
		Economic	Social	Engineering	Economic	Social	Engineering
91	SU003	0.188	0.081	0.731	0.190	0.064	0.746
92	SU004	0.707	0.223	0.070	0.063	0.192	0.745
93	SU005	0.070	0.223	0.707	0.111	0.111	0.778
94	SU006	0.472	0.084	0.444	0.125	0.125	0.750
95	SU007	0.435	0.078	0.487	0.111	0.111	0.778
96	SU008	0.068	0.199	0.733	0.077	0.270	0.653
97	SU009	0.088	0.195	0.717	0.066	0.221	0.713
98	SU010	0.075	0.229	0.696	0.060	0.222	0.718
99	SU011	0.101	0.674	0.226	0.261	0.074	0.665
100	SU012	0.696	0.229	0.075	0.202	0.730	0.068
101	SU013	0.082	0.682	0.236	0.068	0.682	0.250
102	SU014	0.237	0.064	0.699	0.266	0.087	0.647
103	SU015	0.117	0.268	0.614	0.198	0.069	0.733
104	SU016	0.121	0.115	0.764	0.140	0.066	0.794
105	SU017	0.277	0.378	0.345	0.064	0.218	0.718
106	SU018	0.068	0.199	0.733	0.064	0.197	0.739
107	SU019	0.707	0.223	0.070	0.072	0.227	0.701
108	SU020	0.649	0.279	0.072	0.205	0.086	0.709
109	SU021	0.218	0.091	0.691	0.198	0.061	0.741
110	SU022	0.237	0.064	0.699	0.195	0.061	0.744
111	SU023	0.258	0.637	0.105	0.279	0.340	0.381
112	SU024	0.226	0.101	0.674	0.266	0.088	0.646
113	SU025	0.249	0.157	0.594	0.213	0.060	0.727
114	SU026	0.236	0.682	0.082	0.281	0.340	0.379
115	SU027	0.696	0.229	0.075	0.191	0.734	0.075
116	SU028	0.211	0.084	0.705	0.271	0.077	0.652
117	SU029	0.733	0.068	0.199	0.233	0.059	0.708
118	SU030	0.696	0.229	0.075	0.384	0.277	0.339
119	SU031	0.101	0.674	0.226	0.066	0.213	0.721
120	SU032	0.199	0.733	0.068	0.253	0.101	0.646
121	SU033	0.229	0.696	0.075	0.073	0.168	0.759
122	SU034	0.696	0.229	0.075	0.073	0.214	0.713
123	SU035	0.237	0.699	0.064	0.061	0.185	0.754
124	SU036	0.237	0.699	0.064	0.672	0.075	0.253
125	SU037	0.229	0.696	0.075	0.234	0.116	0.650
126	SU038	0.226	0.101	0.674	0.265	0.084	0.651
127	SU039	0.268	0.117	0.614	0.624	0.092	0.284
128	SU040	0.121	0.115	0.764	0.167	0.074	0.759
129	SU041	0.333	0.333	0.333	0.323	0.237	0.440
130	SU042	0.268	0.614	0.117	0.066	0.190	0.744
131	SU043	0.064	0.699	0.237	0.151	0.091	0.758
132	SU044	0.183	0.075	0.742	0.237	0.078	0.685
133	SU045	0.088	0.195	0.717	0.333	0.333	0.334
134	SU046	0.075	0.229	0.696	0.255	0.068	0.677
135	SU047	0.223	0.707	0.070	0.066	0.205	0.729

**Appendix 1: The analytical of priority ranking scores (con't)**

No.	Code of questionnaire	Wet Season			Dry Season		
		Economic	Social	Engineering	Economic	Social	Engineering
136	SU048	0.111	0.111	0.778	0.065	0.181	0.754
137	SU049	0.064	0.699	0.237	0.423	0.251	0.326
138	SU050	0.260	0.413	0.327	0.234	0.443	0.323
139	SU051	0.260	0.413	0.327	0.234	0.444	0.322
140	SU052	0.223	0.707	0.070	0.186	0.066	0.748
141	SU053	0.333	0.333	0.333	0.100	0.100	0.800
142	SU054	0.218	0.091	0.691	0.214	0.077	0.709
143	SU055	0.194	0.063	0.743	0.192	0.065	0.743
144	SU056	0.223	0.070	0.707	0.212	0.079	0.709
145	SU057	0.258	0.105	0.637	0.281	0.093	0.626
146	SU058	0.268	0.117	0.614	0.190	0.075	0.735
147	SU059	0.208	0.131	0.661	0.211	0.061	0.728
148	SU060	0.231	0.060	0.709	0.202	0.062	0.736
149	SU061	0.223	0.070	0.707	0.272	0.096	0.632
150	SU062	0.194	0.063	0.743	0.208	0.064	0.728
151	SU063	0.236	0.682	0.082	0.071	0.185	0.744
152	SU064	0.279	0.649	0.072	0.283	0.334	0.383
153	SU065	0.659	0.263	0.079	0.237	0.687	0.076
154	SU066	0.101	0.674	0.226	0.074	0.702	0.224
155	SU067	0.188	0.081	0.731	0.244	0.080	0.676
156	SU068	0.070	0.223	0.707	0.202	0.073	0.725
157	SU069	0.121	0.115	0.764	0.156	0.067	0.777
158	SU070	0.289	0.387	0.324	0.065	0.178	0.757
159	SU071	0.075	0.229	0.696	0.093	0.292	0.615
160	SU072	0.707	0.223	0.070	0.071	0.728	0.201
161	SU073	0.742	0.075	0.183	0.240	0.059	0.701
162	SU074	0.661	0.272	0.067	0.252	0.098	0.650
163	SU075	0.707	0.223	0.070	0.380	0.280	0.340
164	SU076	0.223	0.707	0.070	0.063	0.197	0.740
165	SU077	0.268	0.117	0.614	0.584	0.113	0.303
166	SU078	0.088	0.243	0.669	0.058	0.260	0.682
167	SU079	0.101	0.674	0.226	0.064	0.175	0.761
168	SU080	0.272	0.661	0.067	0.235	0.115	0.650
169	SU081	0.258	0.105	0.637	0.229	0.075	0.696
170	SU082	0.655	0.250	0.095	0.076	0.231	0.693
171	SU083	0.655	0.250	0.095	0.066	0.177	0.757
172	SU084	0.641	0.293	0.067	0.060	0.699	0.241
173	SU085	0.671	0.256	0.073	0.379	0.281	0.340
174	SU086	0.272	0.661	0.067	0.067	0.170	0.763
175	SU087	0.268	0.117	0.614	0.574	0.119	0.307
176	SU088	0.095	0.250	0.655	0.068	0.241	0.691
177	SU089	0.101	0.674	0.226	0.066	0.179	0.755
178	SU090	0.223	0.707	0.070	0.235	0.114	0.651
179	SU091	0.320	0.558	0.122	0.263	0.087	0.650
180	SU092	0.707	0.223	0.070	0.077	0.234	0.689

**Appendix 1:** The analytical of priority ranking scores (con't)

No.	Code of questionnaire	Wet Season			Dry Season		
		Economic	Social	Engineering	Economic	Social	Engineering
181	SU093	0.637	0.258	0.105	0.063	0.170	0.767
182	SU094	0.644	0.271	0.085	0.072	0.640	0.288
183	Y001	0.272	0.661	0.067	0.230	0.069	0.701
184	Y002	0.223	0.707	0.070	0.265	0.089	0.646
185	Y003	0.229	0.696	0.075	0.192	0.073	0.735
186	Y004	0.258	0.637	0.105	0.201	0.068	0.731
187	Y005	0.297	0.540	0.163	0.192	0.062	0.746
188	Y006	0.333	0.570	0.097	0.221	0.069	0.710
189	Y007	0.659	0.263	0.079	0.191	0.063	0.746
190	Y008	0.205	0.078	0.717	0.071	0.188	0.741
191	Y009	0.707	0.070	0.223	0.283	0.334	0.383
192	Y010	0.661	0.272	0.067	0.200	0.725	0.075
193	Y011	0.094	0.627	0.280	0.069	0.674	0.257
194	Y012	0.205	0.717	0.078	0.258	0.076	0.666
195	Y013	0.223	0.707	0.070	0.174	0.066	0.760
196	Y014	0.661	0.272	0.067	0.150	0.074	0.776
197	Y015	0.272	0.661	0.067	0.061	0.263	0.676
198	Y016	0.326	0.604	0.070	0.065	0.187	0.748
199	Y017	0.272	0.661	0.067	0.072	0.225	0.703
200	Y018	0.258	0.105	0.637	0.270	0.058	0.672
201	Y019	0.320	0.122	0.558	0.216	0.063	0.721
202	Y020	0.121	0.115	0.764	0.382	0.279	0.339
203	Y021	0.333	0.333	0.333	0.065	0.190	0.745
204	Y022	0.226	0.674	0.101	0.587	0.307	0.106
205	Y023	0.095	0.655	0.250	0.065	0.280	0.655
206	Y024	0.183	0.075	0.742	0.068	0.198	0.734
207	Y025	0.084	0.147	0.769	0.249	0.126	0.625
208	Y026	0.070	0.223	0.707	0.243	0.091	0.666
209	Y027	0.223	0.707	0.070	0.082	0.236	0.682
210	Y028	0.111	0.111	0.778	0.066	0.190	0.744
211	Y029	0.073	0.671	0.256	0.063	0.702	0.235
212	Y030	0.260	0.413	0.327	0.394	0.285	0.321
213	Y031	0.260	0.413	0.327	0.067	0.192	0.741
214	Y032	0.256	0.671	0.073	0.592	0.120	0.288
215	Y033	0.333	0.333	0.333	0.067	0.270	0.663
216	Y034	0.101	0.674	0.226	0.066	0.215	0.719
217	Y035	0.218	0.091	0.691	0.233	0.116	0.651
218	Y036	0.223	0.070	0.707	0.252	0.074	0.674
219	Y037	0.223	0.707	0.070	0.070	0.223	0.707
220	Y038	0.258	0.637	0.105	0.065	0.184	0.751
221	Y039	0.333	0.528	0.140	0.068	0.682	0.250
222	Y040	0.258	0.637	0.105	0.380	0.275	0.345
223	Y041	0.644	0.271	0.085	0.063	0.189	0.748
224	Y042	0.256	0.671	0.073	0.599	0.100	0.301
225	Y043	0.671	0.073	0.256	0.065	0.258	0.677

**Appendix 1: The analytical of priority ranking scores (con't)**

No.	Code of questionnaire	Wet Season			Dry Season		
		Economic	Social	Engineering	Economic	Social	Engineering
226	Y044	0.659	0.263	0.079	0.070	0.195	0.735
227	Y045	0.101	0.674	0.226	0.240	0.126	0.634
228	Y046	0.205	0.717	0.078	0.271	0.094	0.635
229	Y047	0.205	0.717	0.078	0.076	0.212	0.712
230	Y048	0.671	0.256	0.073	0.066	0.190	0.744
231	Y049	0.256	0.671	0.073	0.068	0.686	0.246
232	RI001	0.205	0.078	0.717	0.207	0.063	0.730
233	RI002	0.333	0.592	0.075	0.191	0.062	0.747
234	RI003	0.268	0.614	0.117	0.280	0.337	0.383
235	RI004	0.268	0.614	0.117	0.246	0.079	0.675
236	RI005	0.121	0.115	0.764	0.209	0.060	0.731
237	RI006	0.333	0.333	0.333	0.275	0.345	0.380
238	RI007	0.320	0.558	0.122	0.206	0.715	0.079
239	RI008	0.078	0.717	0.205	0.252	0.074	0.674
240	RI009	0.256	0.073	0.671	0.224	0.066	0.710
241	RI010	0.117	0.200	0.683	0.381	0.280	0.339
242	RI011	0.075	0.229	0.696	0.069	0.199	0.732
243	RI012	0.256	0.671	0.073	0.249	0.100	0.651
244	RI013	0.111	0.111	0.778	0.072	0.171	0.757
245	RI014	0.070	0.707	0.223	0.073	0.224	0.703
246	RI015	0.260	0.413	0.327	0.065	0.151	0.784
247	RI016	0.260	0.413	0.327	0.695	0.078	0.227
248	RI017	0.223	0.707	0.070	0.236	0.112	0.652
249	RI018	0.333	0.333	0.333	0.270	0.099	0.631
250	RI019	0.211	0.084	0.705	0.619	0.111	0.270
251	RI020	0.223	0.070	0.707	0.166	0.067	0.767
252	RI021	0.258	0.637	0.105	0.324	0.240	0.436
253	RI022	0.230	0.122	0.648	0.060	0.198	0.742
254	RI023	0.249	0.157	0.594	0.121	0.115	0.764
255	RI024	0.300	0.600	0.100	0.258	0.074	0.668
256	RI025	0.655	0.250	0.095	0.333	0.333	0.334
257	RI026	0.205	0.078	0.717	0.255	0.079	0.666
258	RI027	0.682	0.082	0.236	0.066	0.199	0.735
259	RI028	0.671	0.256	0.073	0.066	0.200	0.734
260	RI029	0.101	0.674	0.226	0.234	0.443	0.323
261	RI030	0.183	0.742	0.075	0.238	0.439	0.323
262	RI031	0.256	0.671	0.073	0.237	0.441	0.322
263	RI032	0.707	0.223	0.070	0.178	0.063	0.759
264	RI033	0.236	0.682	0.082	0.100	0.100	0.800
265	RI034	0.205	0.078	0.717	0.062	0.199	0.739
266	RI035	0.243	0.669	0.088	0.205	0.060	0.735
267	RI036	0.250	0.095	0.655	0.188	0.063	0.749
268	RI037	0.268	0.117	0.614	0.279	0.340	0.381
269	RI038	0.121	0.115	0.764	0.254	0.080	0.666
270	RI039	0.333	0.333	0.333	0.209	0.060	0.731

**Appendix 1:** The analytical of priority ranking scores (con't)

No.	Code of questionnaire	Wet Season			Dry Season		
		Economic	Social	Engineering	Economic	Social	Engineering
271	RI040	0.211	0.705	0.084	0.274	0.345	0.381
272	RI041	0.387	0.324	0.289	0.202	0.735	0.063
273	RI042	0.205	0.078	0.717	0.280	0.627	0.093
274	RI043	0.102	0.172	0.726	0.293	0.067	0.640
275	RI044	0.084	0.211	0.705	0.379	0.289	0.332
276	RI045	0.223	0.707	0.070	0.075	0.183	0.742
277	RI046	0.111	0.111	0.778	0.345	0.109	0.546
278	RI047	0.073	0.671	0.256	0.075	0.229	0.696
279	RI048	0.260	0.413	0.327	0.082	0.236	0.682
280	RI049	0.260	0.413	0.327	0.078	0.205	0.717
281	RI050	0.223	0.707	0.070	0.614	0.117	0.269
282	RI051	0.333	0.333	0.333	0.226	0.101	0.673
283	RI052	0.250	0.095	0.655	0.352	0.089	0.559
284	RI053	0.256	0.073	0.671	0.528	0.140	0.332
285	RI054	0.263	0.659	0.079	0.229	0.075	0.696
286	RI055	0.263	0.659	0.079	0.327	0.260	0.413
287	RI056	0.320	0.558	0.122	0.088	0.139	0.773
288	RI057	0.271	0.644	0.085	0.121	0.115	0.764
289	RI058	0.671	0.256	0.073	0.287	0.078	0.635
290	RI059	0.205	0.078	0.717	0.333	0.333	0.334
291	RI060	0.661	0.067	0.272	0.285	0.062	0.653
292	RI061	0.671	0.256	0.073	0.075	0.183	0.742
293	RI062	0.671	0.256	0.073	0.075	0.183	0.742
294	RI063	0.238	0.691	0.072	0.260	0.413	0.327
295	RI064	0.254	0.682	0.064	0.260	0.413	0.327
296	RI065	0.698	0.236	0.066	0.260	0.413	0.327
297	RI066	0.237	0.695	0.068	0.237	0.064	0.699
298	RI067	0.183	0.074	0.742	0.100	0.100	0.800
299	RI068	0.249	0.680	0.071	0.200	0.073	0.727
300	RI069	0.201	0.101	0.697	0.223	0.070	0.707
301	RI070	0.283	0.124	0.594	0.283	0.331	0.386
302	RI071	0.121	0.115	0.764	0.352	0.089	0.559
303	RI072	0.333	0.333	0.333	0.250	0.069	0.681
304	RI073	0.342	0.577	0.081	0.283	0.331	0.386
305	RI074	0.386	0.333	0.281	0.280	0.627	0.093
306	RI075	0.166	0.073	0.761	0.368	0.082	0.550
307	RI076	0.081	0.188	0.731	0.125	0.079	0.796
308	RI077	0.065	0.210	0.726	0.379	0.289	0.332
309	RI078	0.262	0.668	0.071	0.061	0.333	0.606
310	RI079	0.111	0.111	0.778	0.345	0.109	0.546
311	RI080	0.069	0.695	0.236	0.091	0.151	0.758
312	RI081	0.256	0.417	0.327	0.088	0.243	0.669
313	RI082	0.260	0.413	0.327	0.157	0.249	0.594
314	RI083	0.260	0.413	0.327	0.687	0.127	0.186
315	RI084	0.333	0.333	0.333	0.320	0.122	0.558

**Appendix 1: The analytical of priority ranking scores (con't)**

No.	Code of questionnaire	Wet Season			Dry Season		
		Economic	Social	Engineering	Economic	Social	Engineering
316	RI085	0.211	0.084	0.705	0.352	0.089	0.559
317	RI086	0.254	0.070	0.676	0.540	0.163	0.297
318	RI087	0.311	0.602	0.087	0.263	0.079	0.658
319	RI088	0.284	0.094	0.623	0.327	0.260	0.413
320	RI089	0.245	0.125	0.631	0.098	0.187	0.715
321	RI090	0.266	0.620	0.114	0.121	0.115	0.764
322	RI091	0.678	0.253	0.070	0.368	0.082	0.550
323	RI092	0.213	0.070	0.717	0.333	0.333	0.334
324	RI093	0.643	0.072	0.286	0.348	0.069	0.583
325	RI094	0.711	0.212	0.076	0.088	0.139	0.773
326	RI095	0.101	0.674	0.226	0.070	0.326	0.604
327	RI096	0.203	0.718	0.079	0.260	0.413	0.327
328	RI097	0.217	0.708	0.075	0.260	0.413	0.327
329	RI098	0.704	0.225	0.071	0.260	0.413	0.327
330	RI099	0.221	0.712	0.067	0.595	0.128	0.277
331	RI100	0.208	0.072	0.720	0.240	0.210	0.550
332	RI101	0.252	0.681	0.067	0.205	0.078	0.717
333	RI102	0.238	0.099	0.663	0.205	0.078	0.717
334	RI103	0.266	0.119	0.615	0.283	0.331	0.386
335	RI104	0.121	0.115	0.764	0.352	0.089	0.559
336	RI105	0.333	0.333	0.333	0.300	0.052	0.648
337	RI106	0.256	0.641	0.102	0.283	0.331	0.386
338	RI107	0.071	0.698	0.231	0.342	0.577	0.081
339	RI108	0.172	0.078	0.750	0.368	0.082	0.550
340	RI109	0.088	0.196	0.716	0.374	0.054	0.572
341	RI110	0.065	0.206	0.729	0.387	0.283	0.330
342	RI111	0.212	0.726	0.062	0.085	0.129	0.786
343	RI112	0.111	0.111	0.778	0.333	0.097	0.570
344	RI113	0.066	0.710	0.224	0.068	0.285	0.647
345	RI114	0.238	0.439	0.323	0.108	0.261	0.631
346	RI115	0.260	0.413	0.327	0.077	0.177	0.746
347	RI116	0.273	0.656	0.070	0.558	0.122	0.320
348	RI117	0.333	0.333	0.333	0.320	0.122	0.558
349	RI118	0.260	0.413	0.327	0.352	0.089	0.559
350	RI119	0.237	0.699	0.064	0.540	0.163	0.297
351	RI120	0.333	0.333	0.333	0.263	0.079	0.658
352	RI121	0.231	0.060	0.709	0.327	0.260	0.413
353	RI122	0.195	0.088	0.717	0.088	0.243	0.669
354	RI123	0.268	0.117	0.614	0.121	0.115	0.764
355	RI124	0.226	0.101	0.674	0.400	0.200	0.400
356	RI125	0.194	0.063	0.743	0.333	0.333	0.334
357	RI126	0.199	0.068	0.733	0.368	0.082	0.550
358	RI127	0.162	0.068	0.700	0.088	0.139	0.773
359	RI128	0.361	0.574	0.065	0.078	0.205	0.717
360	RI129	0.280	0.627	0.094	0.260	0.413	0.327

**Appendix 1:** The analytical of priority ranking scores (con't)

No.	Code of questionnaire	Wet Season			Dry Season		
		Economic	Social	Engineering	Economic	Social	Engineering
361	RI130	0.649	0.279	0.072	0.260	0.413	0.327
362	RI131	0.095	0.655	0.250	0.260	0.403	0.337
363	RI132	0.188	0.081	0.731	0.326	0.070	0.604
364	RI133	0.075	0.183	0.742	0.100	0.100	0.800
365	RI134	0.121	0.115	0.764	0.249	0.157	0.594
366	RI135	0.289	0.379	0.331	0.290	0.055	0.655
367	RI136	0.068	0.199	0.733	0.283	0.331	0.386
368	RI137	0.649	0.279	0.072	0.352	0.089	0.559
369	RI138	0.707	0.070	0.223	0.265	0.063	0.672
370	RI139	0.661	0.272	0.067	0.283	0.331	0.386
371	RI140	0.707	0.223	0.070	0.342	0.577	0.081
372	RI141	0.285	0.653	0.062	0.368	0.082	0.550
373	RI142	0.258	0.105	0.637	0.236	0.082	0.682
374	RI143	0.075	0.183	0.742	0.387	0.283	0.330
375	RI144	0.101	0.674	0.226	0.085	0.129	0.786
376	RI145	0.205	0.717	0.078	0.333	0.097	0.570
377	RI146	0.166	0.073	0.761	0.073	0.256	0.671
378	RI147	0.644	0.271	0.085	0.109	0.163	0.728
379	RI148	0.637	0.258	0.105	0.077	0.117	0.806
380	RI149	0.644	0.271	0.085	0.687	0.127	0.186
381	RI150	0.661	0.272	0.067	0.320	0.122	0.558
382	RI151	0.272	0.661	0.067	0.352	0.089	0.559
383	RI152	0.258	0.105	0.637	0.630	0.151	0.219
384	RI153	0.095	0.250	0.655	0.315	0.082	0.603
385	RI154	0.091	0.691	0.218	0.327	0.260	0.413
386	RI155	0.272	0.661	0.067	0.088	0.139	0.773
387	RI156	0.211	0.084	0.705	0.121	0.115	0.764
388	RI157	0.691	0.218	0.091	0.358	0.105	0.537
389	RI158	0.570	0.333	0.097	0.333	0.333	0.334
390	RI159	0.592	0.333	0.075	0.368	0.082	0.550
391	RI160	0.691	0.218	0.091	0.088	0.243	0.669
392	RI161	0.285	0.653	0.062	0.088	0.139	0.773
393	RI162	0.258	0.105	0.637	0.260	0.413	0.327
394	RI163	0.088	0.243	0.669	0.260	0.413	0.327
395	RI164	0.085	0.644	0.271	0.260	0.413	0.327
396	RI165	0.271	0.644	0.085	0.272	0.067	0.661
397	RI166	0.195	0.088	0.717	0.100	0.100	0.800
398	RI167	0.637	0.258	0.105	0.260	0.413	0.327
399	RI168	0.644	0.271	0.085	0.326	0.070	0.604
400	RI169	0.649	0.279	0.072	0.100	0.100	0.800

**Appendix 2:** The analytical of priority ranking scores of economic Criteria

No.	Code of questionnaire	Economic Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
1	M001	0.213	0.211	0.196	0.380	0.153	0.062	0.246	0.539
2	M002	0.658	0.140	0.091	0.111	0.064	0.516	0.121	0.299
3	M003	0.234	0.064	0.116	0.586	0.114	0.049	0.519	0.318
4	M004	0.628	0.084	0.044	0.244	0.632	0.044	0.092	0.232
5	M005	0.580	0.099	0.047	0.274	0.264	0.207	0.140	0.389
6	M006	0.594	0.088	0.045	0.273	0.637	0.223	0.042	0.098
7	M007	0.660	0.148	0.044	0.148	0.102	0.218	0.075	0.605
8	M008	0.629	0.065	0.187	0.119	0.195	0.185	0.416	0.204
9	M009	0.627	0.086	0.241	0.046	0.513	0.134	0.284	0.068
10	M010	0.627	0.046	0.086	0.241	0.061	0.233	0.118	0.588
11	M011	0.711	0.089	0.065	0.135	0.076	0.236	0.104	0.584
12	M012	0.299	0.209	0.253	0.239	0.243	0.182	0.379	0.197
13	M013	0.718	0.119	0.043	0.120	0.495	0.204	0.094	0.207
14	M014	0.725	0.135	0.083	0.057	0.083	0.367	0.131	0.418
15	M015	0.620	0.094	0.076	0.210	0.500	0.123	0.049	0.327
16	M016	0.255	0.108	0.042	0.595	0.244	0.115	0.046	0.595
17	M017	0.615	0.105	0.045	0.235	0.590	0.116	0.069	0.225
18	M018	0.220	0.107	0.053	0.620	0.269	0.104	0.057	0.570
19	M019	0.182	0.161	0.165	0.492	0.195	0.172	0.144	0.489
20	M020	0.078	0.189	0.119	0.614	0.099	0.215	0.129	0.557
21	M021	0.277	0.230	0.210	0.283	0.278	0.221	0.212	0.288
22	M022	0.286	0.269	0.219	0.226	0.283	0.271	0.218	0.228
23	M023	0.061	0.261	0.102	0.576	0.048	0.248	0.106	0.599
24	M024	0.277	0.107	0.051	0.565	0.241	0.149	0.070	0.540
25	M025	0.710	0.047	0.111	0.132	0.122	0.113	0.451	0.314
26	M026	0.635	0.047	0.093	0.225	0.306	0.290	0.096	0.307
27	M027	0.699	0.100	0.097	0.104	0.048	0.270	0.131	0.551
28	M028	0.683	0.049	0.069	0.199	0.065	0.129	0.466	0.340
29	M029	0.735	0.089	0.087	0.089	0.056	0.178	0.158	0.608
30	SI001	0.301	0.242	0.054	0.403	0.171	0.151	0.048	0.630
31	SI002	0.577	0.275	0.103	0.045	0.039	0.086	0.617	0.257
32	SI003	0.598	0.266	0.089	0.047	0.038	0.089	0.587	0.285
33	SI004	0.598	0.124	0.104	0.174	0.061	0.222	0.418	0.300
34	SI005	0.606	0.121	0.089	0.184	0.057	0.136	0.601	0.206
35	SI006	0.041	0.290	0.103	0.566	0.555	0.270	0.056	0.119

**Appendix 2:** The analytical of priority ranking scores of economic Criteria (con't)

No.	Code of questionnaire	Economic Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
36	SI007	0.666	0.090	0.045	0.199	0.122	0.207	0.074	0.598
37	SI008	0.284	0.266	0.222	0.228	0.045	0.090	0.233	0.633
38	SI009	0.306	0.301	0.315	0.078	0.041	0.114	0.585	0.261
39	SI010	0.357	0.235	0.172	0.236	0.115	0.157	0.402	0.325
40	SI011	0.069	0.372	0.171	0.388	0.118	0.171	0.410	0.301
41	SI012	0.700	0.100	0.100	0.100	0.421	0.065	0.287	0.227
42	SI013	0.709	0.098	0.095	0.098	0.410	0.048	0.318	0.224
43	SI014	0.606	0.054	0.226	0.114	0.049	0.248	0.113	0.589
44	SI015	0.646	0.059	0.242	0.053	0.045	0.176	0.104	0.675
45	SI016	0.395	0.108	0.041	0.456	0.063	0.248	0.062	0.627
46	SI017	0.250	0.079	0.065	0.606	0.058	0.220	0.053	0.669
47	SI018	0.372	0.109	0.047	0.472	0.156	0.181	0.052	0.611
48	SI019	0.281	0.059	0.057	0.603	0.082	0.389	0.080	0.449
49	SI020	0.243	0.290	0.080	0.387	0.236	0.162	0.067	0.535
50	SI021	0.608	0.099	0.044	0.249	0.529	0.123	0.043	0.305
51	SI022	0.230	0.121	0.309	0.340	0.042	0.323	0.323	0.312
52	SI023	0.350	0.039	0.312	0.299	0.104	0.299	0.273	0.324
53	SI024	0.255	0.125	0.043	0.577	0.075	0.511	0.110	0.304
54	SI025	0.127	0.240	0.062	0.571	0.088	0.269	0.048	0.595
55	SI026	0.221	0.078	0.273	0.428	0.144	0.371	0.061	0.424
56	SI027	0.743	0.085	0.085	0.087	0.042	0.323	0.323	0.312
57	SI028	0.709	0.098	0.095	0.098	0.104	0.299	0.273	0.324
58	SI029	0.735	0.089	0.087	0.089	0.075	0.511	0.110	0.304
59	SI030	0.596	0.105	0.125	0.174	0.154	0.369	0.064	0.413
60	SI031	0.662	0.103	0.163	0.072	0.689	0.197	0.054	0.060
61	SI032	0.529	0.165	0.102	0.204	0.724	0.099	0.089	0.089
62	SI033	0.604	0.126	0.173	0.097	0.695	0.100	0.095	0.110
63	SI034	0.639	0.147	0.050	0.164	0.075	0.265	0.050	0.611
64	SI035	0.518	0.213	0.055	0.214	0.323	0.222	0.230	0.225
65	SI036	0.540	0.133	0.268	0.059	0.233	0.279	0.244	0.244
66	SI037	0.711	0.059	0.172	0.058	0.557	0.209	0.073	0.161
67	SI038	0.629	0.074	0.224	0.073	0.575	0.105	0.212	0.109
68	SI039	0.551	0.150	0.147	0.152	0.071	0.243	0.049	0.637
69	SI040	0.507	0.127	0.311	0.055	0.268	0.217	0.278	0.237
70	SI041	0.235	0.235	0.172	0.358	0.272	0.058	0.342	0.328

**Appendix 2:** The analytical of priority ranking scores of economic Criteria (con't)

No.	Code of questionnaire	Economic Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
71	SI042	0.688	0.139	0.045	0.128	0.489	0.214	0.063	0.234
72	SI043	0.566	0.290	0.041	0.103	0.626	0.252	0.039	0.083
73	SI044	0.609	0.097	0.245	0.049	0.098	0.263	0.046	0.593
74	SI045	0.385	0.204	0.221	0.190	0.275	0.236	0.090	0.398
75	SI046	0.718	0.093	0.093	0.096	0.079	0.307	0.288	0.327
76	SI047	0.629	0.099	0.050	0.222	0.127	0.519	0.073	0.281
77	SI048	0.519	0.120	0.045	0.316	0.138	0.547	0.050	0.265
78	SI049	0.546	0.099	0.050	0.305	0.135	0.394	0.077	0.394
79	SI050	0.550	0.118	0.056	0.276	0.555	0.259	0.044	0.142
80	SI051	0.250	0.562	0.077	0.111	0.070	0.234	0.055	0.641
81	SI052	0.539	0.222	0.096	0.143	0.162	0.524	0.151	0.162
82	SI053	0.459	0.119	0.285	0.137	0.075	0.149	0.410	0.366
83	SI054	0.660	0.078	0.179	0.083	0.110	0.282	0.457	0.151
84	SI055	0.391	0.195	0.138	0.276	0.275	0.240	0.088	0.397
85	SI056	0.718	0.093	0.093	0.096	0.079	0.307	0.288	0.327
86	SI057	0.633	0.093	0.048	0.226	0.138	0.512	0.073	0.276
87	SI058	0.537	0.131	0.047	0.285	0.134	0.551	0.056	0.259
88	SI059	0.546	0.099	0.050	0.305	0.135	0.394	0.077	0.394
89	SU001	0.639	0.049	0.095	0.217	0.045	0.119	0.568	0.267
90	SU002	0.399	0.222	0.051	0.328	0.385	0.227	0.081	0.307
91	SU003	0.661	0.128	0.216	-0.005	0.603	0.233	0.122	0.042
92	SU004	0.424	0.119	0.043	0.414	0.102	0.224	0.050	0.624
93	SU005	0.424	0.119	0.043	0.414	0.063	0.248	0.062	0.627
94	SU006	0.277	0.056	0.057	0.610	0.057	0.223	0.050	0.669
95	SU007	0.434	0.123	0.045	0.398	0.156	0.181	0.052	0.611
96	SU008	0.277	0.059	0.054	0.610	0.082	0.389	0.080	0.449
97	SU009	0.249	0.278	0.064	0.409	0.211	0.176	0.059	0.554
98	SU010	0.551	0.116	0.038	0.295	0.508	0.120	0.044	0.328
99	SU011	0.228	0.056	0.311	0.405	0.042	0.323	0.323	0.312
100	SU012	0.540	0.133	0.268	0.059	0.224	0.280	0.256	0.240
101	SU013	0.725	0.062	0.154	0.059	0.557	0.209	0.073	0.161
102	SU014	0.629	0.074	0.224	0.073	0.573	0.101	0.218	0.107
103	SU015	0.382	0.212	0.216	0.190	0.078	0.234	0.052	0.637
104	SU016	0.456	0.173	0.240	0.131	0.265	0.221	0.286	0.227
105	SU017	0.235	0.235	0.172	0.358	0.272	0.058	0.342	0.328

**Appendix 2:** The analytical of priority ranking scores of economic Criteria (con't)

No.	Code of questionnaire	Economic Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
106	SU018	0.658	0.153	0.044	0.145	0.489	0.214	0.063	0.234
107	SU019	0.557	0.284	0.045	0.114	0.627	0.240	0.040	0.093
108	SU020	0.559	0.236	0.074	0.131	0.197	0.134	0.101	0.568
109	SU021	0.472	0.135	0.170	0.223	0.150	0.357	0.060	0.433
110	SU022	0.674	0.141	0.045	0.140	0.727	0.091	0.091	0.091
111	SU023	0.586	0.172	0.069	0.173	0.664	0.128	0.113	0.096
112	SU024	0.709	0.098	0.095	0.098	0.092	0.295	0.295	0.318
113	SU025	0.670	0.133	0.052	0.145	0.727	0.091	0.091	0.091
114	SU026	0.514	0.209	0.067	0.210	0.589	0.132	0.139	0.140
115	SU027	0.540	0.133	0.268	0.059	0.228	0.277	0.257	0.239
116	SU028	0.629	0.074	0.224	0.073	0.549	0.116	0.228	0.107
117	SU029	0.607	0.119	0.222	0.052	0.109	0.262	0.052	0.577
118	SU030	0.626	0.093	0.049	0.232	0.624	0.201	0.045	0.130
119	SU031	0.660	0.078	0.179	0.083	0.082	0.538	0.124	0.256
120	SU032	0.391	0.195	0.138	0.276	0.289	0.227	0.095	0.389
121	SU033	0.274	0.329	0.177	0.220	0.074	0.272	0.044	0.610
122	SU034	0.540	0.307	0.045	0.108	0.597	0.261	0.100	0.042
123	SU035	0.339	0.479	0.064	0.118	0.075	0.251	0.047	0.626
124	SU036	0.552	0.209	0.101	0.138	0.176	0.552	0.136	0.136
125	SU037	0.391	0.195	0.138	0.276	0.327	0.216	0.066	0.390
126	SU038	0.608	0.128	0.128	0.136	0.079	0.307	0.288	0.327
127	SU039	0.539	0.222	0.096	0.143	0.162	0.524	0.151	0.162
128	SU040	0.676	0.144	0.048	0.132	0.337	0.272	0.183	0.208
129	SU041	0.357	0.235	0.172	0.236	0.118	0.171	0.410	0.301
130	SU042	0.332	0.051	0.292	0.325	0.083	0.395	0.085	0.437
131	SU043	0.256	0.054	0.291	0.399	0.156	0.181	0.052	0.611
132	SU044	0.273	0.132	0.047	0.548	0.102	0.254	0.049	0.595
133	SU045	0.235	0.281	0.120	0.364	0.110	0.136	0.408	0.345
134	SU046	0.573	0.085	0.043	0.299	0.084	0.267	0.046	0.603
135	SU047	0.277	0.269	0.232	0.222	0.053	0.291	0.160	0.496
136	SU048	0.642	0.155	0.043	0.160	0.120	0.196	0.077	0.606
137	SU049	0.049	0.550	0.135	0.266	0.549	0.264	0.057	0.130
138	SU050	0.539	0.142	0.096	0.223	0.216	0.279	0.231	0.275
139	SU051	0.615	0.120	0.102	0.163	0.058	0.207	0.390	0.345
140	SU052	0.618	0.246	0.090	0.046	0.042	0.125	0.560	0.273

**Appendix 2: The analytical of priority ranking scores of economic Criteria (con't)**

No.	Code of questionnaire	Economic Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
141	SU053	0.237	0.260	0.139	0.364	0.188	0.241	0.331	0.241
142	SU054	0.604	0.097	0.126	0.173	0.155	0.376	0.053	0.416
143	SU055	0.674	0.141	0.045	0.140	0.727	0.091	0.091	0.091
144	SU056	0.743	0.085	0.085	0.087	0.042	0.323	0.323	0.312
145	SU057	0.709	0.098	0.095	0.098	0.104	0.299	0.273	0.324
146	SU058	0.735	0.089	0.087	0.089	0.075	0.511	0.110	0.304
147	SU059	0.610	0.096	0.133	0.161	0.153	0.373	0.059	0.415
148	SU060	0.635	0.110	0.183	0.072	0.710	0.182	0.055	0.054
149	SU061	0.618	0.095	0.118	0.169	0.750	0.083	0.083	0.083
150	SU062	0.641	0.107	0.161	0.091	0.686	0.102	0.099	0.112
151	SU063	0.621	0.152	0.051	0.176	0.082	0.267	0.052	0.598
152	SU064	0.514	0.209	0.067	0.210	0.694	0.100	0.101	0.106
153	SU065	0.540	0.133	0.268	0.059	0.234	0.279	0.248	0.239
154	SU066	0.728	0.064	0.145	0.063	0.557	0.209	0.073	0.161
155	SU067	0.629	0.074	0.224	0.073	0.565	0.118	0.197	0.121
156	SU068	0.382	0.209	0.213	0.196	0.065	0.211	0.054	0.670
157	SU069	0.494	0.154	0.270	0.082	0.263	0.209	0.296	0.231
158	SU070	0.235	0.235	0.172	0.358	0.272	0.058	0.342	0.328
159	SU071	0.659	0.142	0.044	0.155	0.351	0.262	0.213	0.174
160	SU072	0.563	0.272	0.044	0.121	0.642	0.225	0.044	0.088
161	SU073	0.639	0.095	0.218	0.048	0.094	0.222	0.050	0.634
162	SU074	0.626	0.107	0.061	0.206	0.092	0.235	0.048	0.626
163	SU075	0.606	0.114	0.054	0.226	0.586	0.255	0.042	0.117
164	SU076	0.244	0.561	0.066	0.129	0.085	0.283	0.051	0.581
165	SU077	0.539	0.222	0.096	0.143	0.162	0.524	0.151	0.162
166	SU078	0.465	0.139	0.239	0.157	0.053	0.126	0.561	0.260
167	SU079	0.660	0.078	0.179	0.083	0.082	0.538	0.124	0.256
168	SU080	0.391	0.195	0.138	0.276	0.283	0.240	0.095	0.381
169	SU081	0.727	0.091	0.091	0.091	0.079	0.307	0.288	0.327
170	SU082	0.617	0.114	0.073	0.196	0.131	0.501	0.077	0.291
171	SU083	0.577	0.118	0.056	0.249	0.129	0.567	0.047	0.257
172	SU084	0.595	0.113	0.054	0.238	0.145	0.381	0.093	0.381
173	SU085	0.607	0.134	0.048	0.211	0.602	0.243	0.046	0.109
174	SU086	0.245	0.567	0.073	0.115	0.069	0.270	0.053	0.607
175	SU087	0.539	0.222	0.096	0.143	0.162	0.524	0.151	0.162

**Appendix 2: The analytical of priority ranking scores of economic Criteria (con't)**

**Appendix 2:** The analytical of priority ranking scores of economic Criteria (con't)

No.	Code of questionnaire	Economic Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
176	SU088	0.465	0.139	0.239	0.157	0.060	0.129	0.558	0.253
177	SU089	0.574	0.100	0.232	0.094	0.077	0.550	0.121	0.252
178	SU090	0.423	0.174	0.137	0.266	0.286	0.227	0.098	0.390
179	SU091	0.718	0.093	0.093	0.096	0.079	0.307	0.288	0.327
180	SU092	0.591	0.223	0.060	0.126	0.142	0.483	0.079	0.296
181	SU093	0.601	0.109	0.048	0.242	0.123	0.586	0.042	0.248
182	SU094	0.598	0.116	0.057	0.229	0.135	0.394	0.077	0.394
183	Y001	0.554	0.105	0.138	0.203	0.042	0.323	0.323	0.312
184	Y002	0.628	0.152	0.046	0.174	0.104	0.299	0.273	0.324
185	Y003	0.586	0.172	0.069	0.173	0.075	0.511	0.110	0.304
186	Y004	0.709	0.098	0.095	0.098	0.154	0.373	0.057	0.416
187	Y005	0.664	0.113	0.057	0.166	0.695	0.201	0.053	0.051
188	Y006	0.514	0.209	0.067	0.210	0.750	0.083	0.083	0.083
189	Y007	0.540	0.133	0.268	0.059	0.686	0.102	0.099	0.112
190	Y008	0.629	0.074	0.224	0.073	0.079	0.250	0.050	0.621
191	Y009	0.612	0.114	0.227	0.047	0.629	0.119	0.125	0.126
192	Y010	0.635	0.099	0.058	0.208	0.229	0.280	0.248	0.243
193	Y011	0.660	0.078	0.179	0.083	0.557	0.209	0.073	0.161
194	Y012	0.448	0.161	0.136	0.255	0.579	0.109	0.206	0.107
195	Y013	0.245	0.567	0.073	0.115	0.068	0.241	0.045	0.646
196	Y014	0.592	0.270	0.042	0.096	0.267	0.216	0.283	0.234
197	Y015	0.319	0.346	0.065	0.270	0.272	0.058	0.342	0.328
198	Y016	0.557	0.174	0.147	0.122	0.489	0.214	0.063	0.234
199	Y017	0.423	0.174	0.137	0.266	0.707	0.147	0.044	0.102
200	Y018	0.608	0.128	0.128	0.136	0.123	0.229	0.047	0.601
201	Y019	0.539	0.222	0.096	0.143	0.095	0.272	0.045	0.589
202	Y020	0.600	0.200	0.046	0.154	0.637	0.205	0.047	0.111
203	Y021	0.331	0.241	0.188	0.240	0.095	0.256	0.051	0.598
204	Y022	0.274	0.155	0.294	0.277	0.162	0.524	0.151	0.162
205	Y023	0.246	0.058	0.291	0.405	0.060	0.135	0.548	0.258
206	Y024	0.276	0.170	0.044	0.510	0.082	0.538	0.124	0.256
207	Y025	0.236	0.318	0.049	0.397	0.257	0.243	0.109	0.391
208	Y026	0.545	0.113	0.049	0.293	0.079	0.307	0.288	0.327
209	Y027	0.286	0.268	0.226	0.220	0.143	0.478	0.084	0.295
210	Y028	0.676	0.144	0.048	0.132	0.135	0.583	0.045	0.236

**Appendix 2: The analytical of priority ranking scores of economic Criteria (con't)**

No.	Code of questionnaire	Economic Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
211	Y029	0.050	0.517	0.109	0.324	0.135	0.394	0.077	0.394
212	Y030	0.613	0.123	0.096	0.168	0.615	0.236	0.041	0.108
213	Y031	0.615	0.120	0.102	0.163	0.099	0.595	0.047	0.259
214	Y032	0.549	0.282	0.120	0.049	0.162	0.524	0.151	0.162
215	Y033	0.243	0.243	0.172	0.342	0.059	0.128	0.558	0.254
216	Y034	0.660	0.078	0.179	0.083	0.082	0.538	0.124	0.256
217	Y035	0.641	0.091	0.115	0.153	0.281	0.229	0.105	0.385
218	Y036	0.645	0.158	0.045	0.152	0.079	0.307	0.288	0.327
219	Y037	0.586	0.172	0.069	0.173	0.148	0.460	0.082	0.309
220	Y038	0.709	0.098	0.095	0.098	0.133	0.586	0.044	0.237
221	Y039	0.675	0.139	0.059	0.127	0.135	0.394	0.077	0.394
222	Y040	0.514	0.209	0.067	0.210	0.562	0.288	0.040	0.109
223	Y041	0.533	0.162	0.240	0.065	0.086	0.279	0.050	0.585
224	Y042	0.629	0.074	0.224	0.073	0.162	0.524	0.151	0.162
225	Y043	0.626	0.128	0.176	0.070	0.062	0.136	0.495	0.307
226	Y044	0.614	0.102	0.048	0.236	0.082	0.538	0.124	0.256
227	Y045	0.660	0.078	0.179	0.083	0.283	0.229	0.108	0.381
228	Y046	0.391	0.195	0.138	0.276	0.079	0.307	0.288	0.327
229	Y047	0.245	0.567	0.073	0.115	0.161	0.477	0.082	0.280
230	Y048	0.529	0.300	0.052	0.119	0.138	0.558	0.060	0.245
231	Y049	0.315	0.469	0.079	0.137	0.135	0.394	0.077	0.394
232	RI001	0.557	0.174	0.147	0.122	0.155	0.372	0.059	0.414
233	RI002	0.391	0.195	0.138	0.276	0.727	0.091	0.091	0.091
234	RI003	0.608	0.128	0.128	0.136	0.612	0.123	0.127	0.138
235	RI004	0.539	0.222	0.096	0.143	0.092	0.295	0.295	0.318
236	RI005	0.632	0.154	0.048	0.166	0.727	0.091	0.091	0.091
237	RI006	0.331	0.241	0.188	0.240	0.525	0.149	0.157	0.169
238	RI007	0.292	0.160	0.283	0.265	0.225	0.278	0.253	0.244
239	RI008	0.234	0.063	0.290	0.413	0.549	0.107	0.227	0.118
240	RI009	0.280	0.130	0.045	0.545	0.119	0.291	0.050	0.541
241	RI010	0.221	0.273	0.078	0.428	0.613	0.215	0.048	0.124
242	RI011	0.537	0.129	0.044	0.290	0.082	0.538	0.124	0.256
243	RI012	0.286	0.264	0.232	0.218	0.274	0.233	0.072	0.421
244	RI013	0.678	0.148	0.052	0.122	0.094	0.275	0.051	0.579
245	RI014	0.056	0.544	0.140	0.260	0.643	0.205	0.051	0.101

**Appendix 2:** The analytical of priority ranking scores of economic Criteria (con't)

No.	Code of questionnaire	Economic Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
246	RI015	0.517	0.156	0.099	0.228	0.080	0.257	0.048	0.615
247	RI016	0.559	0.140	0.109	0.192	0.128	0.608	0.128	0.136
248	RI017	0.565	0.286	0.099	0.050	0.273	0.228	0.113	0.385
249	RI018	0.237	0.270	0.154	0.339	0.079	0.307	0.288	0.327
250	RI019	0.472	0.135	0.170	0.223	0.162	0.524	0.151	0.162
251	RI020	0.676	0.144	0.048	0.132	0.325	0.286	0.184	0.205
252	RI021	0.586	0.172	0.069	0.173	0.118	0.171	0.410	0.301
253	RI022	0.709	0.098	0.095	0.098	0.083	0.395	0.085	0.437
254	RI023	0.675	0.139	0.059	0.127	0.156	0.181	0.052	0.611
255	RI024	0.514	0.209	0.067	0.210	0.111	0.268	0.061	0.560
256	RI025	0.540	0.133	0.268	0.059	0.112	0.151	0.409	0.328
257	RI026	0.629	0.074	0.224	0.073	0.085	0.273	0.049	0.593
258	RI027	0.580	0.111	0.255	0.054	0.051	0.304	0.163	0.482
259	RI028	0.588	0.109	0.052	0.251	0.124	0.193	0.088	0.594
260	RI029	0.660	0.078	0.179	0.083	0.521	0.280	0.061	0.139
261	RI030	0.391	0.195	0.138	0.276	0.215	0.246	0.254	0.285
262	RI031	0.245	0.567	0.073	0.115	0.111	0.229	0.372	0.288
263	RI032	0.538	0.294	0.049	0.119	0.047	0.138	0.553	0.263
264	RI033	0.275	0.520	0.082	0.123	0.188	0.241	0.331	0.241
265	RI034	0.552	0.209	0.101	0.138	0.082	0.538	0.124	0.256
266	RI035	0.423	0.174	0.137	0.266	0.145	0.377	0.050	0.427
267	RI036	0.608	0.128	0.128	0.136	0.727	0.091	0.091	0.091
268	RI037	0.539	0.222	0.096	0.143	0.599	0.137	0.121	0.143
269	RI038	0.648	0.149	0.047	0.156	0.092	0.295	0.295	0.318
270	RI039	0.298	0.246	0.210	0.246	0.727	0.091	0.091	0.091
271	RI040	0.239	0.140	0.340	0.281	0.497	0.279	0.098	0.125
272	RI041	0.228	0.056	0.311	0.405	0.221	0.285	0.254	0.240
273	RI042	0.242	0.111	0.055	0.592	0.568	0.125	0.183	0.125
274	RI043	0.218	0.288	0.072	0.422	0.109	0.314	0.059	0.519
275	RI044	0.539	0.135	0.041	0.285	0.680	0.157	0.055	0.108
276	RI045	0.282	0.265	0.232	0.221	0.082	0.538	0.124	0.256
277	RI046	0.617	0.170	0.052	0.161	0.298	0.221	0.079	0.402
278	RI047	0.053	0.553	0.138	0.256	0.091	0.300	0.045	0.565
279	RI048	0.613	0.123	0.096	0.168	0.642	0.226	0.042	0.090
280	RI049	0.599	0.130	0.104	0.167	0.106	0.274	0.060	0.560

**Appendix 2:** The analytical of priority ranking scores of economic Criteria (con't)

No.	Code of questionnaire	Economic Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
281	RI050	0.557	0.284	0.114	0.045	0.176	0.552	0.136	0.136
282	RI051	0.237	0.260	0.139	0.364	0.275	0.232	0.110	0.383
283	RI052	0.663	0.089	0.117	0.131	0.567	0.143	0.155	0.136
284	RI053	0.676	0.144	0.048	0.132	0.162	0.524	0.151	0.162
285	RI054	0.586	0.172	0.069	0.173	0.345	0.282	0.185	0.187
286	RI055	0.709	0.098	0.095	0.098	0.118	0.171	0.410	0.301
287	RI056	0.673	0.136	0.055	0.136	0.083	0.395	0.085	0.437
288	RI057	0.514	0.209	0.067	0.210	0.156	0.181	0.052	0.611
289	RI058	0.540	0.133	0.268	0.059	0.093	0.283	0.048	0.576
290	RI059	0.629	0.074	0.224	0.073	0.102	0.183	0.455	0.260
291	RI060	0.621	0.091	0.225	0.063	0.093	0.242	0.052	0.613
292	RI061	0.629	0.098	0.064	0.209	0.049	0.298	0.192	0.461
293	RI062	0.629	0.098	0.064	0.209	0.122	0.191	0.091	0.596
294	RI063	0.444	0.154	0.131	0.271	0.576	0.237	0.068	0.119
295	RI064	0.245	0.567	0.073	0.115	0.214	0.238	0.250	0.298
296	RI065	0.619	0.228	0.048	0.105	0.072	0.239	0.408	0.281
297	RI066	0.257	0.563	0.064	0.116	0.055	0.111	0.653	0.181
298	RI067	0.552	0.209	0.101	0.138	0.188	0.241	0.331	0.240
299	RI068	0.408	0.203	0.123	0.266	0.148	0.328	0.071	0.453
300	RI069	0.608	0.128	0.128	0.136	0.727	0.091	0.091	0.091
301	RI070	0.539	0.222	0.096	0.143	0.382	0.219	0.205	0.194
302	RI071	0.652	0.163	0.048	0.137	0.092	0.295	0.295	0.318
303	RI072	0.331	0.241	0.188	0.240	0.727	0.091	0.091	0.091
304	RI073	0.324	0.059	0.340	0.277	0.417	0.196	0.196	0.191
305	RI074	0.215	0.077	0.307	0.401	0.225	0.278	0.254	0.243
306	RI075	0.293	0.072	0.043	0.592	0.444	0.122	0.312	0.122
307	RI076	0.235	0.294	0.066	0.405	0.112	0.305	0.067	0.516
308	RI077	0.569	0.116	0.044	0.271	0.673	0.208	0.047	0.072
309	RI078	0.274	0.257	0.232	0.237	0.153	0.267	0.096	0.484
310	RI079	0.670	0.147	0.049	0.134	0.309	0.230	0.121	0.340
311	RI080	0.046	0.542	0.117	0.295	0.137	0.269	0.060	0.534
312	RI081	0.609	0.122	0.092	0.177	0.599	0.269	0.048	0.084
313	RI082	0.614	0.120	0.100	0.166	0.102	0.165	0.061	0.672
314	RI083	0.611	0.256	0.090	0.043	0.305	0.294	0.201	0.200
315	RI084	0.237	0.251	0.136	0.376	0.281	0.235	0.120	0.364

**Appendix 2:** The analytical of priority ranking scores of economic Criteria (con't)

No.	Code of questionnaire	Economic Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
316	RI085	0.601	0.092	0.137	0.170	0.079	0.307	0.288	0.326
317	RI086	0.713	0.122	0.048	0.117	0.162	0.524	0.151	0.163
318	RI087	0.586	0.172	0.069	0.173	0.324	0.296	0.176	0.204
319	RI088	0.709	0.098	0.095	0.098	0.118	0.171	0.410	0.301
320	RI089	0.674	0.130	0.051	0.145	0.085	0.402	0.090	0.423
321	RI090	0.514	0.209	0.067	0.210	0.156	0.181	0.052	0.611
322	RI091	0.540	0.133	0.268	0.059	0.136	0.162	0.064	0.638
323	RI092	0.629	0.074	0.224	0.073	0.100	0.164	0.446	0.290
324	RI093	0.611	0.100	0.244	0.045	0.102	0.247	0.048	0.603
325	RI094	0.598	0.105	0.048	0.249	0.080	0.281	0.210	0.429
326	RI095	0.660	0.078	0.179	0.083	0.310	0.264	0.052	0.374
327	RI096	0.475	0.151	0.126	0.248	0.647	0.165	0.072	0.116
328	RI097	0.245	0.567	0.073	0.115	0.233	0.222	0.277	0.268
329	RI098	0.569	0.260	0.051	0.120	0.051	0.246	0.366	0.337
330	RI099	0.288	0.521	0.067	0.124	0.042	0.086	0.651	0.221
331	RI100	0.552	0.209	0.101	0.138	0.188	0.241	0.331	0.240
332	RI101	0.437	0.171	0.118	0.274	0.150	0.361	0.046	0.443
333	RI102	0.608	0.128	0.128	0.136	0.727	0.091	0.091	0.091
334	RI103	0.539	0.222	0.096	0.143	0.736	0.094	0.088	0.082
335	RI104	0.670	0.144	0.049	0.137	0.092	0.295	0.295	0.318
336	RI105	0.331	0.241	0.188	0.240	0.727	0.091	0.091	0.091
337	RI106	0.306	0.093	0.320	0.281	0.720	0.100	0.094	0.086
338	RI107	0.227	0.049	0.303	0.421	0.225	0.278	0.254	0.243
339	RI108	0.278	0.101	0.041	0.580	0.449	0.138	0.288	0.125
340	RI109	0.221	0.333	0.042	0.404	0.107	0.194	0.061	0.638
341	RI110	0.577	0.074	0.041	0.308	0.066	0.212	0.048	0.674
342	RI111	0.281	0.262	0.234	0.223	0.082	0.538	0.124	0.256
343	RI112	0.661	0.164	0.043	0.132	0.386	0.242	0.204	0.168
344	RI113	0.049	0.628	0.102	0.221	0.114	0.222	0.044	0.620
345	RI114	0.610	0.122	0.092	0.176	0.719	0.127	0.064	0.090
346	RI115	0.613	0.119	0.098	0.170	0.147	0.274	0.035	0.544
347	RI116	0.595	0.271	0.095	0.039	0.176	0.552	0.136	0.136
348	RI117	0.235	0.211	0.135	0.419	0.275	0.232	0.110	0.383
349	RI118	0.615	0.120	0.102	0.163	0.079	0.307	0.288	0.326
350	RI119	0.569	0.318	0.071	0.042	0.162	0.524	0.151	0.163

**Appendix 2: The analytical of priority ranking scores of economic Criteria (con't)**

No.	Code of questionnaire	Economic Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
351	RI120	0.236	0.219	0.132	0.413	0.345	0.282	0.185	0.188
352	RI121	0.743	0.085	0.085	0.087	0.118	0.171	0.410	0.301
353	RI122	0.709	0.098	0.095	0.098	0.083	0.395	0.085	0.437
354	RI123	0.735	0.089	0.087	0.089	0.185	0.192	0.054	0.569
355	RI124	0.696	0.081	0.105	0.118	0.110	0.211	0.048	0.631
356	RI125	0.735	0.082	0.124	0.059	0.138	0.195	0.391	0.276
357	RI126	0.663	0.088	0.104	0.145	0.094	0.262	0.047	0.597
358	RI127	0.732	0.089	0.104	0.075	0.051	0.328	0.198	0.423
359	RI128	0.621	0.152	0.051	0.176	0.107	0.157	0.085	0.651
360	RI129	0.514	0.209	0.067	0.210	0.643	0.180	0.083	0.094
361	RI130	0.540	0.133	0.268	0.059	0.218	0.267	0.233	0.282
362	RI131	0.725	0.062	0.154	0.059	0.136	0.237	0.340	0.287
363	RI132	0.629	0.074	0.224	0.073	0.044	0.106	0.636	0.214
364	RI133	0.587	0.110	0.242	0.061	0.188	0.241	0.331	0.240
365	RI134	0.523	0.146	0.267	0.064	0.134	0.335	0.078	0.453
366	RI135	0.235	0.235	0.172	0.358	0.727	0.091	0.091	0.091
367	RI136	0.688	0.139	0.045	0.128	0.382	0.219	0.205	0.194
368	RI137	0.586	0.277	0.048	0.089	0.092	0.295	0.295	0.318
369	RI138	0.596	0.124	0.231	0.049	0.727	0.091	0.091	0.091
370	RI139	0.701	0.095	0.103	0.101	0.382	0.219	0.205	0.194
371	RI140	0.682	0.116	0.102	0.100	0.225	0.278	0.254	0.243
372	RI141	0.245	0.567	0.073	0.115	0.449	0.138	0.288	0.125
373	RI142	0.539	0.222	0.096	0.143	0.113	0.230	0.067	0.590
374	RI143	0.493	0.120	0.239	0.148	0.666	0.212	0.048	0.074
375	RI144	0.660	0.078	0.179	0.083	0.082	0.538	0.124	0.256
376	RI145	0.528	0.158	0.165	0.149	0.287	0.237	0.136	0.340
377	RI146	0.727	0.091	0.091	0.091	0.124	0.209	0.043	0.624
378	RI147	0.656	0.117	0.103	0.124	0.706	0.139	0.055	0.100
379	RI148	0.646	0.123	0.114	0.117	0.095	0.258	0.078	0.569
380	RI149	0.632	0.126	0.116	0.126	0.176	0.552	0.136	0.136
381	RI150	0.638	0.130	0.044	0.188	0.287	0.237	0.136	0.340
382	RI151	0.245	0.567	0.073	0.115	0.079	0.307	0.288	0.326
383	RI152	0.539	0.222	0.096	0.143	0.162	0.524	0.151	0.163
384	RI153	0.495	0.134	0.218	0.153	0.324	0.296	0.176	0.204
385	RI154	0.660	0.078	0.179	0.083	0.118	0.171	0.410	0.301

**Appendix 2:** The analytical of priority ranking scores of economic Criteria (con't)

No.	Code of questionnaire	Economic Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
386	RI155	0.468	0.150	0.134	0.248	0.083	0.395	0.085	0.437
387	RI156	0.718	0.093	0.093	0.096	0.156	0.181	0.052	0.611
388	RI157	0.659	0.115	0.109	0.117	0.113	0.184	0.068	0.635
389	RI158	0.617	0.131	0.119	0.133	0.100	0.164	0.446	0.290
390	RI159	0.620	0.106	0.118	0.156	0.102	0.247	0.048	0.603
391	RI160	0.677	0.151	0.049	0.123	0.074	0.275	0.182	0.469
392	RI161	0.245	0.567	0.073	0.115	0.114	0.143	0.096	0.647
393	RI162	0.539	0.222	0.096	0.143	0.498	0.301	0.094	0.107
394	RI163	0.493	0.120	0.239	0.148	0.229	0.220	0.278	0.273
395	RI164	0.660	0.078	0.179	0.083	0.136	0.237	0.340	0.287
396	RI165	0.515	0.176	0.133	0.176	0.050	0.087	0.655	0.208
397	RI166	0.718	0.093	0.093	0.096	0.210	0.246	0.298	0.246
398	RI167	0.663	0.140	0.046	0.151	0.068	0.216	0.417	0.299
399	RI168	0.593	0.184	0.043	0.180	0.040	0.079	0.573	0.308
400	RI169	0.601	0.150	0.053	0.196	0.188	0.241	0.331	0.240

**Appendix 3: The analytical of priority ranking scores of social Criteria**

No.	Code of questionnaire	Social Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
1	M001	0.104	0.107	0.107	0.682	0.105	0.054	0.230	0.611
2	M002	0.357	0.235	0.172	0.236	0.250	0.250	0.250	0.250
3	M003	0.261	0.048	0.118	0.573	0.111	0.083	0.149	0.657
4	M004	0.598	0.047	0.089	0.266	0.561	0.039	0.138	0.262
5	M005	0.618	0.090	0.046	0.246	0.508	0.137	0.072	0.283
6	M006	0.629	0.099	0.042	0.230	0.104	0.228	0.048	0.620
7	M007	0.688	0.128	0.045	0.139	0.116	0.231	0.056	0.597
8	M008	0.688	0.050	0.144	0.118	0.259	0.213	0.313	0.215
9	M009	0.607	0.048	0.249	0.096	0.323	0.203	0.248	0.226
10	M010	0.645	0.100	0.057	0.198	0.113	0.228	0.070	0.589
11	M011	0.671	0.056	0.054	0.219	0.092	0.371	0.116	0.421
12	M012	0.711	0.059	0.172	0.058	0.080	0.207	0.485	0.228
13	M013	0.715	0.117	0.041	0.127	0.091	0.386	0.091	0.432
14	M014	0.737	0.055	0.149	0.059	0.083	0.388	0.112	0.417
15	M015	0.680	0.104	0.104	0.112	0.500	0.138	0.168	0.194
16	M016	0.635	0.093	0.047	0.225	0.589	0.108	0.043	0.260
17	M017	0.622	0.250	0.042	0.086	0.516	0.244	0.092	0.148
18	M018	0.644	0.107	0.056	0.193	0.597	0.114	0.044	0.245
19	M019	0.668	0.054	0.074	0.204	0.556	0.066	0.115	0.263
20	M020	0.277	0.107	0.051	0.565	0.245	0.125	0.064	0.566
21	M021	0.593	0.053	0.093	0.261	0.572	0.058	0.100	0.270
22	M022	0.300	0.304	0.288	0.108	0.284	0.302	0.267	0.147
23	M023	0.097	0.184	0.464	0.255	0.079	0.122	0.506	0.293
24	M024	0.465	0.048	0.085	0.402	0.379	0.048	0.127	0.446
25	M025	0.063	0.218	0.049	0.670	0.106	0.242	0.384	0.268
26	M026	0.635	0.047	0.093	0.225	0.275	0.155	0.281	0.289
27	M027	0.735	0.089	0.087	0.089	0.155	0.238	0.068	0.539
28	M028	0.663	0.094	0.051	0.192	0.068	0.142	0.186	0.604
29	M029	0.290	0.257	0.278	0.175	0.071	0.232	0.378	0.319
30	SI001	0.243	0.105	0.053	0.599	0.057	0.258	0.058	0.627
31	SI002	0.591	0.280	0.043	0.086	0.243	0.117	0.047	0.593
32	SI003	0.598	0.259	0.041	0.102	0.270	0.128	0.040	0.562
33	SI004	0.126	0.523	0.111	0.240	0.208	0.312	0.222	0.258
34	SI005	0.578	0.266	0.047	0.109	0.144	0.564	0.068	0.224
35	SI006	0.621	0.224	0.056	0.099	0.306	0.517	0.059	0.118

**Appendix 3:** The analytical of priority ranking scores of social Criteria (con't)

No.	Code of questionnaire	Social Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
36	SI007	0.455	0.206	0.042	0.297	0.053	0.415	0.118	0.414
37	SI008	0.272	0.173	0.216	0.339	0.046	0.624	0.096	0.234
38	SI009	0.317	0.330	0.311	0.042	0.042	0.280	0.562	0.116
39	SI010	0.682	0.137	0.050	0.131	0.101	0.560	0.077	0.262
40	SI011	0.050	0.590	0.123	0.237	0.058	0.526	0.149	0.267
41	SI012	0.582	0.049	0.130	0.239	0.040	0.320	0.320	0.320
42	SI013	0.709	0.098	0.095	0.098	0.090	0.311	0.267	0.332
43	SI014	0.606	0.054	0.226	0.114	0.042	0.242	0.108	0.608
44	SI015	0.646	0.059	0.242	0.053	0.047	0.240	0.089	0.624
45	SI016	0.395	0.108	0.041	0.456	0.066	0.250	0.060	0.624
46	SI017	0.250	0.079	0.065	0.606	0.063	0.415	0.073	0.449
47	SI018	0.372	0.109	0.047	0.472	0.433	0.224	0.045	0.298
48	SI019	0.281	0.059	0.057	0.603	0.074	0.167	0.136	0.623
49	SI020	0.243	0.290	0.080	0.387	0.288	0.263	0.219	0.230
50	SI021	0.608	0.099	0.044	0.249	0.515	0.128	0.049	0.308
51	SI022	0.230	0.121	0.309	0.340	0.040	0.320	0.320	0.320
52	SI023	0.350	0.039	0.312	0.299	0.090	0.311	0.267	0.332
53	SI024	0.255	0.125	0.043	0.577	0.120	0.309	0.234	0.337
54	SI025	0.127	0.240	0.062	0.571	0.138	0.408	0.047	0.407
55	SI026	0.221	0.078	0.273	0.428	0.527	0.122	0.144	0.207
56	SI027	0.743	0.085	0.085	0.087	0.040	0.320	0.320	0.320
57	SI028	0.709	0.098	0.095	0.098	0.090	0.311	0.267	0.332
58	SI029	0.735	0.089	0.087	0.089	0.119	0.313	0.234	0.334
59	SI030	0.596	0.105	0.125	0.174	0.533	0.121	0.140	0.206
60	SI031	0.662	0.103	0.163	0.072	0.442	0.167	0.137	0.254
61	SI032	0.529	0.165	0.102	0.204	0.743	0.085	0.085	0.087
62	SI033	0.604	0.126	0.173	0.097	0.735	0.089	0.089	0.087
63	SI034	0.639	0.147	0.050	0.164	0.096	0.235	0.043	0.626
64	SI035	0.518	0.213	0.055	0.214	0.621	0.221	0.051	0.107
65	SI036	0.540	0.133	0.268	0.059	0.513	0.304	0.035	0.148
66	SI037	0.711	0.059	0.172	0.058	0.240	0.583	0.114	0.063
67	SI038	0.629	0.074	0.224	0.073	0.548	0.086	0.280	0.086
68	SI039	0.551	0.150	0.147	0.152	0.231	0.213	0.279	0.277
69	SI040	0.507	0.127	0.311	0.055	0.231	0.555	0.069	0.145
70	SI041	0.235	0.235	0.172	0.358	0.272	0.058	0.342	0.328

**Appendix 3:** The analytical of priority ranking scores of social Criteria (con't)

No.	Code of questionnaire	Social Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
71	SI042	0.688	0.139	0.045	0.128	0.477	0.218	0.068	0.237
72	SI043	0.566	0.290	0.041	0.103	0.598	0.263	0.039	0.100
73	SI044	0.609	0.097	0.245	0.049	0.689	0.106	0.102	0.103
74	SI045	0.385	0.204	0.221	0.190	0.077	0.193	0.555	0.175
75	SI046	0.718	0.093	0.093	0.096	0.084	0.326	0.264	0.326
76	SI047	0.629	0.099	0.050	0.222	0.154	0.508	0.072	0.266
77	SI048	0.519	0.120	0.045	0.316	0.095	0.640	0.056	0.209
78	SI049	0.546	0.099	0.050	0.305	0.147	0.334	0.078	0.441
79	SI050	0.550	0.118	0.056	0.276	0.616	0.087	0.049	0.248
80	SI051	0.250	0.562	0.077	0.111	0.118	0.256	0.048	0.578
81	SI052	0.539	0.222	0.096	0.143	0.136	0.567	0.143	0.154
82	SI053	0.459	0.119	0.285	0.137	0.071	0.195	0.545	0.189
83	SI054	0.669	0.069	0.191	0.071	0.080	0.570	0.127	0.223
84	SI055	0.239	0.070	0.614	0.077	0.082	0.255	0.429	0.234
85	SI056	0.060	0.323	0.293	0.324	0.084	0.326	0.264	0.326
86	SI057	0.620	0.107	0.053	0.220	0.163	0.503	0.067	0.267
87	SI058	0.557	0.114	0.045	0.284	0.091	0.668	0.050	0.191
88	SI059	0.574	0.192	0.060	0.174	0.160	0.238	0.063	0.539
89	SU001	0.570	0.072	0.092	0.266	0.509	0.047	0.104	0.340
90	SU002	0.316	0.037	0.326	0.321	0.196	0.466	0.164	0.174
91	SU003	0.703	0.137	0.094	0.066	0.627	0.232	0.094	0.047
92	SU004	0.438	0.111	0.040	0.411	0.104	0.308	0.059	0.529
93	SU005	0.442	0.101	0.039	0.418	0.069	0.255	0.059	0.617
94	SU006	0.282	0.289	0.135	0.294	0.063	0.415	0.073	0.449
95	SU007	0.435	0.195	0.050	0.320	0.433	0.224	0.045	0.298
96	SU008	0.441	0.055	0.089	0.415	0.074	0.167	0.136	0.623
97	SU009	0.303	0.215	0.036	0.446	0.280	0.288	0.210	0.222
98	SU010	0.579	0.262	0.045	0.114	0.288	0.263	0.235	0.214
99	SU011	0.213	0.123	0.150	0.514	0.248	0.201	0.277	0.274
100	SU012	0.389	0.188	0.299	0.124	0.523	0.327	0.037	0.113
101	SU013	0.487	0.118	0.276	0.119	0.262	0.577	0.108	0.053
102	SU014	0.548	0.128	0.195	0.129	0.572	0.189	0.135	0.104
103	SU015	0.394	0.199	0.260	0.147	0.229	0.223	0.280	0.268
104	SU016	0.620	0.100	0.212	0.068	0.194	0.578	0.100	0.128
105	SU017	0.305	0.099	0.158	0.438	0.272	0.058	0.342	0.328

**Appendix 3:** The analytical of priority ranking scores of social Criteria (con't)

No.	Code of questionnaire	Social Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
106	SU018	0.635	0.145	0.048	0.172	0.477	0.218	0.068	0.237
107	SU019	0.559	0.270	0.045	0.126	0.611	0.257	0.039	0.093
108	SU020	0.251	0.164	0.071	0.514	0.613	0.089	0.089	0.209
109	SU021	0.496	0.131	0.155	0.218	0.452	0.130	0.184	0.234
110	SU022	0.735	0.089	0.087	0.089	0.735	0.087	0.089	0.089
111	SU023	0.473	0.376	0.049	0.102	0.649	0.177	0.051	0.123
112	SU024	0.063	0.312	0.296	0.329	0.072	0.303	0.303	0.322
113	SU025	0.735	0.089	0.087	0.089	0.743	0.085	0.085	0.087
114	SU026	0.473	0.376	0.049	0.102	0.577	0.250	0.055	0.118
115	SU027	0.386	0.182	0.318	0.114	0.525	0.333	0.038	0.104
116	SU028	0.529	0.121	0.212	0.138	0.548	0.086	0.280	0.086
117	SU029	0.291	0.249	0.288	0.172	0.689	0.106	0.102	0.103
118	SU030	0.635	0.099	0.058	0.208	0.600	0.099	0.043	0.258
119	SU031	0.604	0.076	0.243	0.077	0.080	0.572	0.141	0.207
120	SU032	0.232	0.094	0.574	0.100	0.069	0.177	0.561	0.193
121	SU033	0.196	0.518	0.072	0.214	0.100	0.253	0.043	0.604
122	SU034	0.563	0.282	0.046	0.109	0.599	0.249	0.047	0.105
123	SU035	0.203	0.556	0.066	0.175	0.106	0.237	0.050	0.607
124	SU036	0.611	0.168	0.052	0.169	0.132	0.590	0.139	0.139
125	SU037	0.222	0.087	0.609	0.082	0.077	0.193	0.555	0.175
126	SU038	0.063	0.328	0.296	0.313	0.084	0.326	0.264	0.326
127	SU039	0.473	0.214	0.064	0.249	0.136	0.567	0.143	0.154
128	SU040	0.638	0.177	0.045	0.140	0.203	0.621	0.056	0.120
129	SU041	0.441	0.113	0.404	0.042	0.042	0.226	0.103	0.629
130	SU042	0.665	0.062	0.101	0.172	0.074	0.167	0.136	0.623
131	SU043	0.216	0.118	0.160	0.506	0.439	0.220	0.045	0.296
132	SU044	0.623	0.109	0.038	0.230	0.146	0.399	0.056	0.399
133	SU045	0.281	0.210	0.046	0.463	0.102	0.577	0.063	0.258
134	SU046	0.598	0.249	0.046	0.107	0.142	0.387	0.047	0.424
135	SU047	0.643	0.143	0.045	0.169	0.042	0.633	0.094	0.231
136	SU048	0.486	0.173	0.061	0.280	0.053	0.415	0.118	0.414
137	SU049	0.611	0.237	0.053	0.099	0.306	0.517	0.059	0.118
138	SU050	0.605	0.218	0.056	0.121	0.137	0.571	0.070	0.222
139	SU051	0.102	0.578	0.077	0.243	0.136	0.411	0.079	0.374
140	SU052	0.580	0.268	0.047	0.105	0.275	0.112	0.043	0.570

**Appendix 3:** The analytical of priority ranking scores of social Criteria (con't)

No.	Code of questionnaire	Social Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
141	SU053	0.667	0.060	0.057	0.216	0.129	0.581	0.052	0.238
142	SU054	0.621	0.098	0.115	0.166	0.530	0.115	0.133	0.222
143	SU055	0.735	0.089	0.087	0.089	0.735	0.087	0.089	0.089
144	SU056	0.635	0.047	0.093	0.225	0.040	0.320	0.320	0.320
145	SU057	0.070	0.316	0.281	0.333	0.090	0.311	0.267	0.332
146	SU058	0.219	0.252	0.258	0.271	0.120	0.310	0.234	0.336
147	SU059	0.684	0.084	0.104	0.128	0.502	0.127	0.156	0.215
148	SU060	0.641	0.091	0.115	0.153	0.473	0.152	0.136	0.239
149	SU061	0.735	0.089	0.087	0.089	0.743	0.085	0.085	0.087
150	SU062	0.718	0.096	0.093	0.093	0.735	0.089	0.089	0.087
151	SU063	0.602	0.178	0.049	0.171	0.101	0.227	0.049	0.623
152	SU064	0.473	0.376	0.049	0.102	0.591	0.247	0.047	0.115
153	SU065	0.386	0.182	0.318	0.114	0.475	0.339	0.041	0.145
154	SU066	0.539	0.103	0.244	0.114	0.253	0.578	0.117	0.052
155	SU067	0.543	0.104	0.295	0.058	0.548	0.086	0.280	0.086
156	SU068	0.463	0.152	0.313	0.072	0.230	0.211	0.294	0.265
157	SU069	0.662	0.087	0.187	0.064	0.204	0.570	0.075	0.151
158	SU070	0.298	0.245	0.176	0.281	0.272	0.058	0.342	0.328
159	SU071	0.637	0.135	0.051	0.177	0.280	0.254	0.215	0.251
160	SU072	0.615	0.253	0.044	0.088	0.625	0.226	0.041	0.108
161	SU073	0.292	0.239	0.293	0.176	0.689	0.106	0.102	0.103
162	SU074	0.642	0.097	0.052	0.209	0.585	0.268	0.038	0.109
163	SU075	0.563	0.131	0.055	0.251	0.628	0.089	0.045	0.238
164	SU076	0.208	0.487	0.096	0.209	0.114	0.264	0.045	0.577
165	SU077	0.473	0.214	0.064	0.249	0.128	0.608	0.128	0.136
166	SU078	0.704	0.059	0.175	0.062	0.080	0.226	0.468	0.226
167	SU079	0.604	0.076	0.243	0.077	0.100	0.574	0.094	0.232
168	SU080	0.253	0.088	0.580	0.079	0.077	0.193	0.555	0.175
169	SU081	0.060	0.323	0.293	0.324	0.084	0.326	0.264	0.326
170	SU082	0.582	0.116	0.046	0.256	0.212	0.360	0.224	0.204
171	SU083	0.549	0.120	0.048	0.283	0.099	0.614	0.054	0.233
172	SU084	0.574	0.192	0.060	0.174	0.144	0.330	0.081	0.445
173	SU085	0.580	0.111	0.055	0.254	0.617	0.101	0.048	0.234
174	SU086	0.226	0.391	0.126	0.257	0.110	0.235	0.040	0.615
175	SU087	0.477	0.218	0.068	0.237	0.136	0.567	0.143	0.154

**Appendix 3:** The analytical of priority ranking scores of social Criteria (con't)

No.	Code of questionnaire	Social Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
176	SU088	0.710	0.066	0.155	0.069	0.078	0.200	0.531	0.191
177	SU089	0.604	0.076	0.243	0.077	0.079	0.566	0.130	0.225
178	SU090	0.217	0.081	0.621	0.081	0.077	0.193	0.555	0.175
179	SU091	0.060	0.323	0.293	0.324	0.084	0.326	0.264	0.326
180	SU092	0.579	0.101	0.051	0.269	0.171	0.494	0.072	0.263
181	SU093	0.569	0.116	0.046	0.269	0.107	0.610	0.054	0.229
182	SU094	0.574	0.192	0.060	0.174	0.143	0.338	0.068	0.451
183	Y001	0.641	0.091	0.115	0.153	0.040	0.320	0.320	0.320
184	Y002	0.735	0.089	0.087	0.089	0.090	0.311	0.267	0.332
185	Y003	0.473	0.376	0.049	0.102	0.119	0.305	0.234	0.342
186	Y004	0.063	0.312	0.296	0.329	0.466	0.134	0.160	0.240
187	Y005	0.735	0.089	0.087	0.089	0.453	0.159	0.131	0.257
188	Y006	0.473	0.376	0.049	0.102	0.743	0.085	0.088	0.084
189	Y007	0.391	0.195	0.276	0.138	0.735	0.089	0.089	0.087
190	Y008	0.513	0.104	0.295	0.088	0.097	0.240	0.050	0.613
191	Y009	0.291	0.243	0.289	0.177	0.605	0.233	0.047	0.115
192	Y010	0.513	0.138	0.057	0.292	0.468	0.339	0.040	0.153
193	Y011	0.604	0.076	0.243	0.077	0.260	0.557	0.126	0.057
194	Y012	0.243	0.118	0.528	0.111	0.548	0.086	0.280	0.086
195	Y013	0.213	0.514	0.123	0.150	0.225	0.215	0.285	0.275
196	Y014	0.597	0.248	0.047	0.108	0.190	0.620	0.061	0.129
197	Y015	0.203	0.556	0.066	0.175	0.272	0.058	0.342	0.328
198	Y016	0.592	0.181	0.053	0.174	0.477	0.218	0.068	0.237
199	Y017	0.213	0.076	0.630	0.081	0.580	0.265	0.041	0.114
200	Y018	0.063	0.328	0.296	0.313	0.689	0.106	0.102	0.103
201	Y019	0.473	0.214	0.064	0.249	0.628	0.222	0.043	0.107
202	Y020	0.604	0.181	0.042	0.173	0.590	0.106	0.047	0.257
203	Y021	0.419	0.138	0.397	0.046	0.102	0.281	0.045	0.572
204	Y022	0.636	0.056	0.108	0.200	0.128	0.608	0.128	0.136
205	Y023	0.184	0.110	0.143	0.563	0.071	0.195	0.545	0.189
206	Y024	0.610	0.115	0.038	0.237	0.080	0.559	0.131	0.230
207	Y025	0.304	0.183	0.053	0.460	0.113	0.223	0.276	0.388
208	Y026	0.595	0.256	0.044	0.105	0.084	0.326	0.264	0.326
209	Y027	0.660	0.156	0.049	0.135	0.157	0.496	0.074	0.273
210	Y028	0.453	0.203	0.048	0.296	0.106	0.593	0.056	0.245

**Appendix 3:** The analytical of priority ranking scores of social Criteria (con't)

No.	Code of questionnaire	Social Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
211	Y029	0.598	0.234	0.047	0.121	0.149	0.331	0.073	0.447
212	Y030	0.552	0.266	0.071	0.111	0.547	0.118	0.058	0.277
213	Y031	0.142	0.542	0.076	0.240	0.084	0.226	0.052	0.638
214	Y032	0.629	0.223	0.050	0.098	0.136	0.567	0.143	0.154
215	Y033	0.623	0.064	0.062	0.251	0.071	0.195	0.545	0.189
216	Y034	0.081	0.554	0.152	0.213	0.081	0.557	0.132	0.230
217	Y035	0.531	0.126	0.152	0.191	0.077	0.193	0.555	0.175
218	Y036	0.735	0.089	0.087	0.089	0.084	0.326	0.264	0.326
219	Y037	0.473	0.376	0.049	0.102	0.147	0.502	0.060	0.291
220	Y038	0.063	0.312	0.296	0.329	0.112	0.602	0.055	0.231
221	Y039	0.735	0.089	0.087	0.089	0.140	0.333	0.073	0.454
222	Y040	0.473	0.376	0.049	0.102	0.584	0.112	0.049	0.255
223	Y041	0.389	0.188	0.299	0.124	0.132	0.247	0.054	0.567
224	Y042	0.513	0.104	0.295	0.088	0.136	0.567	0.143	0.154
225	Y043	0.290	0.245	0.292	0.173	0.071	0.195	0.545	0.189
226	Y044	0.584	0.128	0.063	0.225	0.079	0.559	0.130	0.232
227	Y045	0.604	0.076	0.243	0.077	0.077	0.193	0.555	0.175
228	Y046	0.222	0.083	0.597	0.098	0.084	0.326	0.264	0.326
229	Y047	0.196	0.518	0.072	0.214	0.158	0.504	0.062	0.276
230	Y048	0.624	0.232	0.049	0.095	0.131	0.599	0.060	0.210
231	Y049	0.203	0.556	0.066	0.175	0.142	0.261	0.046	0.551
232	RI001	0.588	0.190	0.050	0.172	0.511	0.114	0.156	0.219
233	RI002	0.199	0.082	0.637	0.082	0.735	0.087	0.089	0.089
234	RI003	0.063	0.328	0.296	0.313	0.651	0.205	0.043	0.101
235	RI004	0.473	0.214	0.064	0.249	0.072	0.303	0.303	0.322
236	RI005	0.638	0.177	0.045	0.140	0.743	0.085	0.085	0.087
237	RI006	0.391	0.143	0.414	0.052	0.638	0.192	0.054	0.116
238	RI007	0.653	0.051	0.098	0.198	0.541	0.280	0.041	0.138
239	RI008	0.224	0.135	0.170	0.471	0.548	0.086	0.280	0.086
240	RI009	0.571	0.128	0.052	0.249	0.689	0.106	0.102	0.103
241	RI010	0.276	0.207	0.055	0.462	0.629	0.117	0.052	0.202
242	RI011	0.481	0.333	0.050	0.136	0.080	0.572	0.141	0.207
243	RI012	0.617	0.170	0.052	0.161	0.066	0.179	0.566	0.189
244	RI013	0.458	0.196	0.054	0.292	0.115	0.253	0.049	0.583
245	RI014	0.568	0.252	0.059	0.121	0.623	0.239	0.039	0.099

**Appendix 3:** The analytical of priority ranking scores of social Criteria (con't)

No.	Code of questionnaire	Social Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
246	RI015	0.564	0.253	0.060	0.123	0.137	0.280	0.050	0.533
247	RI016	0.138	0.502	0.090	0.270	0.128	0.608	0.128	0.136
248	RI017	0.601	0.258	0.050	0.091	0.077	0.193	0.555	0.175
249	RI018	0.660	0.063	0.060	0.217	0.084	0.326	0.264	0.326
250	RI019	0.613	0.101	0.101	0.185	0.136	0.567	0.143	0.154
251	RI020	0.735	0.089	0.087	0.089	0.200	0.618	0.055	0.127
252	RI021	0.473	0.376	0.049	0.102	0.043	0.245	0.121	0.591
253	RI022	0.063	0.312	0.296	0.329	0.074	0.167	0.136	0.623
254	RI023	0.735	0.089	0.087	0.089	0.437	0.221	0.045	0.297
255	RI024	0.473	0.376	0.049	0.102	0.141	0.394	0.057	0.408
256	RI025	0.383	0.219	0.273	0.125	0.101	0.590	0.061	0.248
257	RI026	0.513	0.104	0.295	0.088	0.147	0.381	0.049	0.423
258	RI027	0.295	0.248	0.284	0.173	0.047	0.596	0.237	0.120
259	RI028	0.606	0.129	0.058	0.207	0.053	0.415	0.118	0.414
260	RI029	0.604	0.076	0.243	0.077	0.306	0.517	0.059	0.118
261	RI030	0.275	0.082	0.555	0.088	0.150	0.519	0.058	0.273
262	RI031	0.193	0.513	0.068	0.226	0.128	0.400	0.078	0.394
263	RI032	0.572	0.285	0.046	0.097	0.123	0.272	0.052	0.553
264	RI033	0.203	0.556	0.066	0.175	0.131	0.565	0.057	0.247
265	RI034	0.596	0.171	0.056	0.177	0.080	0.572	0.141	0.207
266	RI035	0.226	0.092	0.590	0.092	0.519	0.116	0.148	0.217
267	RI036	0.063	0.328	0.296	0.313	0.735	0.087	0.089	0.089
268	RI037	0.473	0.214	0.064	0.249	0.492	0.305	0.055	0.148
269	RI038	0.647	0.160	0.050	0.143	0.072	0.303	0.303	0.322
270	RI039	0.453	0.169	0.288	0.090	0.743	0.085	0.085	0.087
271	RI040	0.645	0.057	0.100	0.198	0.653	0.197	0.047	0.103
272	RI041	0.238	0.125	0.135	0.502	0.530	0.287	0.041	0.142
273	RI042	0.647	0.086	0.042	0.225	0.548	0.086	0.280	0.086
274	RI043	0.287	0.216	0.060	0.437	0.689	0.106	0.102	0.103
275	RI044	0.554	0.246	0.058	0.142	0.614	0.117	0.070	0.199
276	RI045	0.597	0.175	0.053	0.175	0.067	0.564	0.124	0.245
277	RI046	0.456	0.190	0.067	0.287	0.065	0.136	0.617	0.182
278	RI047	0.620	0.220	0.053	0.107	0.090	0.225	0.051	0.634
279	RI048	0.588	0.236	0.064	0.112	0.680	0.180	0.049	0.091
280	RI049	0.137	0.527	0.084	0.252	0.107	0.239	0.058	0.596

**Appendix 3:** The analytical of priority ranking scores of social Criteria (con't)

No.	Code of questionnaire	Social Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
281	RI050	0.657	0.208	0.045	0.090	0.128	0.608	0.128	0.136
282	RI051	0.710	0.066	0.069	0.155	0.077	0.193	0.555	0.175
283	RI052	0.472	0.135	0.170	0.223	0.074	0.321	0.284	0.321
284	RI053	0.735	0.089	0.087	0.089	0.136	0.567	0.143	0.154
285	RI054	0.473	0.376	0.049	0.102	0.221	0.596	0.060	0.123
286	RI055	0.063	0.312	0.296	0.329	0.049	0.303	0.085	0.563
287	RI056	0.735	0.089	0.087	0.089	0.074	0.167	0.136	0.623
288	RI057	0.473	0.376	0.049	0.102	0.440	0.212	0.047	0.301
289	RI058	0.381	0.163	0.345	0.111	0.131	0.370	0.066	0.433
290	RI059	0.499	0.105	0.301	0.095	0.102	0.509	0.058	0.331
291	RI060	0.290	0.245	0.292	0.173	0.153	0.363	0.049	0.435
292	RI061	0.574	0.131	0.056	0.239	0.042	0.546	0.111	0.301
293	RI062	0.574	0.131	0.056	0.239	0.053	0.415	0.118	0.414
294	RI063	0.221	0.075	0.625	0.079	0.306	0.517	0.059	0.118
295	RI064	0.196	0.518	0.072	0.214	0.132	0.548	0.080	0.240
296	RI065	0.653	0.212	0.046	0.089	0.128	0.400	0.078	0.394
297	RI066	0.203	0.556	0.066	0.175	0.316	0.110	0.050	0.524
298	RI067	0.595	0.179	0.052	0.174	0.130	0.469	0.054	0.347
299	RI068	0.245	0.076	0.606	0.073	0.621	0.098	0.115	0.166
300	RI069	0.063	0.328	0.296	0.313	0.735	0.087	0.089	0.089
301	RI070	0.473	0.214	0.064	0.249	0.605	0.271	0.050	0.074
302	RI071	0.658	0.153	0.047	0.142	0.072	0.303	0.303	0.322
303	RI072	0.383	0.136	0.443	0.038	0.743	0.085	0.085	0.087
304	RI073	0.605	0.048	0.070	0.277	0.581	0.222	0.059	0.138
305	RI074	0.181	0.098	0.125	0.596	0.560	0.318	0.046	0.076
306	RI075	0.581	0.133	0.041	0.245	0.548	0.086	0.280	0.086
307	RI076	0.294	0.191	0.047	0.468	0.689	0.106	0.102	0.103
308	RI077	0.588	0.263	0.050	0.099	0.572	0.085	0.048	0.295
309	RI078	0.656	0.160	0.048	0.136	0.080	0.572	0.141	0.207
310	RI079	0.467	0.194	0.047	0.292	0.091	0.197	0.556	0.156
311	RI080	0.600	0.270	0.044	0.086	0.169	0.298	0.068	0.465
312	RI081	0.558	0.280	0.051	0.111	0.690	0.167	0.055	0.088
313	RI082	0.150	0.543	0.079	0.228	0.175	0.307	0.135	0.383
314	RI083	0.546	0.251	0.039	0.164	0.128	0.608	0.128	0.136
315	RI084	0.683	0.065	0.063	0.189	0.077	0.193	0.555	0.175

**Appendix 3:** The analytical of priority ranking scores of social Criteria (con't)

No.	Code of questionnaire	Social Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
316	RI085	0.613	0.095	0.113	0.179	0.084	0.326	0.264	0.326
317	RI086	0.735	0.089	0.087	0.089	0.136	0.567	0.143	0.154
318	RI087	0.444	0.376	0.064	0.116	0.310	0.495	0.061	0.134
319	RI088	0.063	0.312	0.296	0.329	0.055	0.268	0.110	0.567
320	RI089	0.735	0.089	0.087	0.089	0.074	0.167	0.136	0.623
321	RI090	0.537	0.210	0.047	0.206	0.450	0.189	0.062	0.299
322	RI091	0.383	0.104	0.293	0.220	0.228	0.357	0.058	0.357
323	RI092	0.513	0.239	0.295	-0.047	0.096	0.537	0.061	0.306
324	RI093	0.305	0.239	0.275	0.181	0.169	0.332	0.049	0.450
325	RI094	0.583	0.106	0.050	0.261	0.043	0.647	0.101	0.209
326	RI095	0.604	0.076	0.243	0.077	0.053	0.415	0.118	0.414
327	RI096	0.248	0.087	0.579	0.086	0.306	0.517	0.059	0.118
328	RI097	0.196	0.518	0.072	0.214	0.176	0.539	0.069	0.216
329	RI098	0.570	0.263	0.057	0.110	0.128	0.400	0.078	0.394
330	RI099	0.203	0.556	0.066	0.175	0.239	0.108	0.049	0.604
331	RI100	0.601	0.175	0.052	0.172	0.099	0.633	0.053	0.215
332	RI101	0.271	0.086	0.563	0.080	0.634	0.110	0.114	0.142
333	RI102	0.067	0.317	0.300	0.316	0.735	0.087	0.089	0.089
334	RI103	0.473	0.214	0.064	0.249	0.511	0.222	0.061	0.206
335	RI104	0.647	0.151	0.045	0.157	0.072	0.303	0.303	0.322
336	RI105	0.400	0.148	0.411	0.041	0.743	0.085	0.085	0.087
337	RI106	0.734	0.054	0.077	0.135	0.611	0.242	0.051	0.096
338	RI107	0.230	0.121	0.174	0.475	0.555	0.316	0.051	0.078
339	RI108	0.649	0.096	0.041	0.214	0.548	0.086	0.280	0.086
340	RI109	0.291	0.183	0.049	0.477	0.689	0.106	0.102	0.103
341	RI110	0.554	0.297	0.043	0.106	0.679	0.093	0.050	0.178
342	RI111	0.661	0.165	0.044	0.130	0.080	0.572	0.141	0.207
343	RI112	0.460	0.197	0.047	0.296	0.062	0.166	0.621	0.151
344	RI113	0.595	0.269	0.045	0.091	0.094	0.890	0.047	-0.031
345	RI114	0.545	0.286	0.048	0.121	0.581	0.304	0.043	0.072
346	RI115	0.127	0.611	0.067	0.195	0.095	0.166	0.053	0.686
347	RI116	0.562	0.313	0.045	0.080	0.128	0.608	0.128	0.136
348	RI117	0.685	0.065	0.068	0.182	0.077	0.193	0.555	0.175
349	RI118	0.135	0.569	0.074	0.222	0.084	0.326	0.264	0.326
350	RI119	0.539	0.340	0.039	0.082	0.136	0.567	0.143	0.154

**Appendix 3:** The analytical of priority ranking scores of social Criteria (con't)

No.	Code of questionnaire	Social Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
351	RI120	0.683	0.064	0.077	0.176	0.266	0.555	0.059	0.120
352	RI121	0.640	0.044	0.087	0.229	0.070	0.261	0.148	0.521
353	RI122	0.070	0.316	0.281	0.333	0.074	0.167	0.136	0.623
354	RI123	0.212	0.254	0.250	0.284	0.440	0.196	0.052	0.312
355	RI124	0.641	0.091	0.115	0.153	0.131	0.370	0.066	0.433
356	RI125	0.705	0.080	0.097	0.118	0.109	0.612	0.057	0.222
357	RI126	0.735	0.089	0.087	0.089	0.116	0.399	0.057	0.428
358	RI127	0.718	0.096	0.093	0.093	0.059	0.594	0.103	0.244
359	RI128	0.605	0.169	0.052	0.174	0.053	0.415	0.118	0.414
360	RI129	0.473	0.376	0.049	0.102	0.306	0.517	0.059	0.118
361	RI130	0.381	0.203	0.312	0.104	0.169	0.561	0.061	0.209
362	RI131	0.522	0.128	0.232	0.118	0.139	0.486	0.071	0.304
363	RI132	0.513	0.104	0.295	0.088	0.335	0.164	0.063	0.438
364	RI133	0.638	0.106	0.188	0.068	0.195	0.391	0.138	0.276
365	RI134	0.671	0.092	0.166	0.071	0.610	0.114	0.126	0.150
366	RI135	0.262	0.114	0.145	0.479	0.735	0.087	0.089	0.089
367	RI136	0.635	0.145	0.048	0.172	0.607	0.235	0.076	0.082
368	RI137	0.560	0.322	0.041	0.077	0.072	0.303	0.303	0.322
369	RI138	0.299	0.247	0.175	0.279	0.743	0.085	0.085	0.087
370	RI139	0.711	0.098	0.091	0.100	0.684	0.139	0.074	0.103
371	RI140	0.660	0.115	0.106	0.119	0.550	0.316	0.047	0.087
372	RI141	0.200	0.522	0.078	0.200	0.480	0.172	0.275	0.073
373	RI142	0.473	0.214	0.064	0.249	0.689	0.106	0.102	0.103
374	RI143	0.704	0.059	0.175	0.062	0.535	0.116	0.063	0.286
375	RI144	0.604	0.076	0.243	0.077	0.080	0.572	0.141	0.207
376	RI145	0.271	75.000	0.584	-74.855	0.065	0.136	0.617	0.182
377	RI146	0.636	0.117	0.130	0.117	0.132	0.302	0.049	0.517
378	RI147	0.650	0.113	0.105	0.132	0.383	0.273	0.125	0.219
379	RI148	0.643	0.121	0.110	0.126	0.108	0.246	0.053	0.593
380	RI149	0.574	0.192	0.060	0.174	0.128	0.608	0.128	0.136
381	RI150	0.659	0.116	0.111	0.114	0.077	0.193	0.555	0.175
382	RI151	0.200	0.522	0.078	0.200	0.084	0.326	0.264	0.326
383	RI152	0.473	0.214	0.064	0.249	0.136	0.567	0.143	0.154
384	RI153	0.706	0.064	0.166	0.064	0.274	0.538	0.060	0.128
385	RI154	0.604	0.076	0.243	0.077	0.059	0.219	0.103	0.619

**Appendix 3:** The analytical of priority ranking scores of social Criteria (con't)

No.	Code of questionnaire	Social Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
386	RI155	0.276	0.075	0.573	0.076	0.074	0.167	0.136	0.623
387	RI156	0.636	0.117	0.130	0.117	0.450	0.199	0.057	0.294
388	RI157	0.682	0.107	0.105	0.106	0.224	0.367	0.055	0.354
389	RI158	0.644	0.097	0.109	0.150	0.114	0.633	0.057	0.196
390	RI159	0.604	0.076	0.243	0.077	0.169	0.332	0.049	0.450
391	RI160	0.664	0.147	0.059	0.130	0.045	0.559	0.081	0.315
392	RI161	0.200	0.522	0.078	0.200	0.053	0.415	0.118	0.414
393	RI162	0.473	0.214	0.064	0.249	0.306	0.517	0.059	0.118
394	RI163	0.704	0.059	0.175	0.062	0.132	0.548	0.080	0.240
395	RI164	0.661	0.081	0.165	0.093	0.128	0.400	0.078	0.394
396	RI165	0.265	0.070	0.595	0.070	0.243	0.128	0.046	0.583
397	RI166	0.636	0.117	0.130	0.117	0.135	0.573	0.043	0.249
398	RI167	0.675	0.132	0.046	0.147	0.128	0.400	0.078	0.394
399	RI168	0.619	0.169	0.040	0.172	0.362	0.143	0.055	0.440
400	RI169	0.574	0.192	0.060	0.174	0.103	0.608	0.065	0.224

**Appendix 4:** The analytical of priority ranking scores of engineering Criteria

No.	Code of questionnaire	Engineering Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
1	M001	0.659	0.074	0.105	0.162	0.160	0.072	0.239	0.529
2	M002	0.670	0.178	0.088	0.064	0.071	0.341	0.102	0.486
3	M003	0.258	0.051	0.103	0.588	0.104	0.059	0.589	0.248
4	M004	0.605	0.045	0.105	0.245	0.629	0.040	0.081	0.250
5	M005	0.587	0.106	0.042	0.265	0.545	0.146	0.082	0.227
6	M006	0.654	0.215	0.044	0.087	0.591	0.251	0.045	0.113
7	M007	0.632	0.101	0.044	0.223	0.112	0.222	0.046	0.620
8	M008	0.695	0.063	0.136	0.106	0.184	0.208	0.448	0.160
9	M009	0.664	0.049	0.179	0.108	0.544	0.066	0.127	0.263
10	M010	0.663	0.094	0.051	0.192	0.487	0.153	0.044	0.316
11	M011	0.735	0.089	0.087	0.089	0.066	0.279	0.116	0.539
12	M012	0.718	0.132	0.062	0.088	0.563	0.124	0.057	0.256
13	M013	0.737	0.103	0.045	0.115	0.520	0.193	0.077	0.210
14	M014	0.709	0.097	0.097	0.097	0.541	0.126	0.065	0.268
15	M015	0.660	0.048	0.091	0.201	0.598	0.043	0.096	0.263
16	M016	0.670	0.081	0.049	0.200	0.612	0.097	0.044	0.247
17	M017	0.279	0.119	0.043	0.559	0.261	0.111	0.065	0.563
18	M018	0.103	0.203	0.052	0.642	0.103	0.257	0.050	0.590
19	M019	0.690	0.098	0.073	0.139	0.520	0.106	0.076	0.298
20	M020	0.458	0.113	0.052	0.377	0.366	0.125	0.075	0.434
21	M021	0.725	0.056	0.083	0.136	0.507	0.081	0.128	0.284
22	M022	0.255	0.106	0.322	0.317	0.295	0.123	0.280	0.302
23	M023	0.318	0.098	0.265	0.319	0.231	0.049	0.126	0.594
24	M024	0.331	0.209	0.218	0.242	0.361	0.234	0.234	0.171
25	M025	0.621	0.045	0.185	0.149	0.427	0.078	0.311	0.184
26	M026	0.639	0.049	0.095	0.217	0.335	0.046	0.302	0.317
27	M027	0.710	0.077	0.124	0.089	0.165	0.273	0.066	0.496
28	M028	0.353	0.188	0.182	0.277	0.161	0.170	0.171	0.498
29	M029	0.687	0.060	0.059	0.194	0.622	0.105	0.042	0.231
30	SI001	0.149	0.166	0.048	0.637	0.063	0.438	0.063	0.436
31	SI002	0.618	0.081	0.041	0.260	0.501	0.123	0.035	0.341
32	SI003	0.635	0.103	0.046	0.216	0.502	0.089	0.038	0.371
33	SI004	0.166	0.519	0.072	0.243	0.185	0.246	0.090	0.479
34	SI005	0.585	0.283	0.039	0.093	0.124	0.617	0.062	0.197
35	SI006	0.575	0.236	0.054	0.135	0.482	0.341	0.057	0.120

**Appendix 4:** The analytical of priority ranking scores of engineering Criteria (con't)

No.	Code of questionnaire	Engineering Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
36	SI007	0.411	0.106	0.040	0.443	0.042	0.401	0.105	0.452
37	SI008	0.286	0.336	0.334	0.044	0.041	0.236	0.628	0.095
38	SI009	0.269	0.222	0.273	0.236	0.043	0.240	0.614	0.103
39	SI010	0.552	0.188	0.071	0.189	0.119	0.521	0.074	0.286
40	SI011	0.059	0.535	0.143	0.263	0.057	0.556	0.145	0.242
41	SI012	0.619	0.059	0.219	0.103	0.042	0.323	0.312	0.323
42	SI013	0.123	0.292	0.235	0.350	0.302	0.196	0.304	0.198
43	SI014	0.627	0.156	0.123	0.094	0.108	0.113	0.098	0.681
44	SI015	0.373	0.205	0.146	0.276	0.438	0.063	0.063	0.436
45	SI016	0.629	0.099	0.042	0.230	0.091	0.228	0.051	0.630
46	SI017	0.102	0.214	0.052	0.632	0.070	0.433	0.064	0.433
47	SI018	0.213	0.454	0.040	0.293	0.079	0.427	0.067	0.427
48	SI019	0.316	0.302	0.053	0.329	0.100	0.556	0.104	0.240
49	SI020	0.235	0.290	0.151	0.324	0.620	0.092	0.045	0.243
50	SI021	0.428	0.108	0.350	0.114	0.520	0.312	0.044	0.124
51	SI022	0.735	0.087	0.044	0.134	0.039	0.317	0.327	0.317
52	SI023	0.579	0.044	0.078	0.299	0.315	0.192	0.297	0.196
53	SI024	0.250	0.133	0.052	0.565	0.297	0.231	0.172	0.300
54	SI025	0.577	0.255	0.043	0.125	0.393	0.336	0.067	0.204
55	SI026	0.052	0.221	0.147	0.580	0.458	0.132	0.174	0.236
56	SI027	0.638	0.049	0.106	0.207	0.042	0.323	0.312	0.323
57	SI028	0.131	0.300	0.238	0.331	0.306	0.197	0.301	0.196
58	SI029	0.433	0.169	0.238	0.160	0.292	0.234	0.177	0.297
59	SI030	0.645	0.090	0.120	0.145	0.529	0.121	0.141	0.209
60	SI031	0.667	0.111	0.111	0.111	0.489	0.161	0.137	0.213
61	SI032	0.542	0.142	0.110	0.206	0.718	0.093	0.096	0.093
62	SI033	0.676	0.105	0.114	0.105	0.726	0.094	0.091	0.089
63	SI034	0.661	0.083	0.054	0.202	0.307	0.294	0.088	0.311
64	SI035	0.575	0.278	0.048	0.099	0.618	0.261	0.042	0.079
65	SI036	0.431	0.189	0.246	0.134	0.520	0.303	0.128	0.049
66	SI037	0.573	0.075	0.276	0.076	0.505	0.238	0.150	0.107
67	SI038	0.573	0.075	0.276	0.076	0.573	0.075	0.276	0.076
68	SI039	0.271	0.215	0.343	0.171	0.070	0.205	0.053	0.672
69	SI040	0.571	0.124	0.241	0.064	0.105	0.544	0.295	0.056
70	SI041	0.338	0.154	0.237	0.271	0.491	0.186	0.156	0.167

**Appendix 4:** The analytical of priority ranking scores of engineering Criteria (con't)

No.	Code of questionnaire	Engineering Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
71	SI042	0.588	0.171	0.050	0.191	0.468	0.226	0.080	0.226
72	SI043	0.540	0.307	0.045	0.108	0.632	0.234	0.040	0.094
73	SI044	0.375	0.247	0.314	0.064	0.545	0.201	0.147	0.107
74	SI045	0.330	0.081	0.505	0.084	0.105	0.383	0.295	0.217
75	SI046	0.131	0.300	0.238	0.331	0.321	0.187	0.294	0.198
76	SI047	0.592	0.099	0.045	0.264	0.553	0.279	0.057	0.111
77	SI048	0.637	0.086	0.046	0.231	0.504	0.136	0.055	0.305
78	SI049	0.534	0.245	0.087	0.134	0.527	0.131	0.064	0.278
79	SI050	0.601	0.091	0.050	0.258	0.086	0.246	0.098	0.570
80	SI051	0.293	0.291	0.126	0.290	0.344	0.283	0.066	0.307
81	SI052	0.548	0.199	0.071	0.182	0.151	0.582	0.127	0.140
82	SI053	0.613	0.072	0.240	0.075	0.069	0.104	0.619	0.208
83	SI054	0.590	0.092	0.226	0.092	0.092	0.590	0.092	0.226
84	SI055	0.330	0.081	0.505	0.084	0.060	0.221	0.306	0.413
85	SI056	0.131	0.300	0.238	0.331	0.312	0.189	0.299	0.200
86	SI057	0.594	0.101	0.047	0.258	0.574	0.258	0.057	0.111
87	SI058	0.586	0.104	0.047	0.263	0.494	0.153	0.056	0.297
88	SI059	0.499	0.284	0.083	0.134	0.527	0.131	0.064	0.278
89	SU001	0.620	0.053	0.107	0.220	0.521	0.047	0.302	0.130
90	SU002	0.047	0.205	0.086	0.662	0.044	0.096	0.191	0.669
91	SU003	0.694	0.190	0.057	0.059	0.627	0.232	0.094	0.047
92	SU004	0.104	0.255	0.052	0.589	0.200	0.117	0.054	0.629
93	SU005	0.642	0.097	0.052	0.209	0.095	0.243	0.053	0.609
94	SU006	0.152	0.199	0.057	0.592	0.070	0.433	0.064	0.433
95	SU007	0.213	0.454	0.040	0.293	0.079	0.427	0.067	0.427
96	SU008	0.316	0.302	0.053	0.329	0.089	0.236	0.068	0.607
97	SU009	0.222	0.327	0.051	0.400	0.571	0.103	0.048	0.278
98	SU010	0.345	0.212	0.182	0.261	0.086	0.246	0.098	0.570
99	SU011	0.735	0.087	0.044	0.134	0.121	0.404	0.185	0.290
100	SU012	0.391	0.193	0.276	0.140	0.462	0.281	0.193	0.064
101	SU013	0.573	0.075	0.276	0.076	0.498	0.227	0.161	0.114
102	SU014	0.573	0.075	0.276	0.076	0.573	0.075	0.276	0.076
103	SU015	0.290	0.216	0.278	0.216	0.209	0.657	0.050	0.084
104	SU016	0.569	0.113	0.257	0.061	0.103	0.527	0.313	0.057
105	SU017	0.448	0.137	0.235	0.180	0.491	0.186	0.156	0.167

**Appendix 4:** The analytical of priority ranking scores of engineering Criteria (con't)

No.	Code of questionnaire	Engineering Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
106	SU018	0.588	0.171	0.050	0.191	0.468	0.226	0.080	0.226
107	SU019	0.587	0.241	0.051	0.121	0.602	0.285	0.038	0.075
108	SU020	0.224	0.129	0.075	0.572	0.610	0.077	0.099	0.214
109	SU021	0.627	0.185	0.042	0.146	0.520	0.127	0.127	0.226
110	SU022	0.638	0.106	0.049	0.207	0.709	0.098	0.095	0.098
111	SU023	0.575	0.278	0.048	0.099	0.630	0.225	0.045	0.100
112	SU024	0.123	0.292	0.235	0.350	0.279	0.198	0.312	0.211
113	SU025	0.553	0.154	0.107	0.186	0.718	0.093	0.096	0.093
114	SU026	0.575	0.278	0.048	0.099	0.595	0.258	0.049	0.098
115	SU027	0.391	0.195	0.276	0.138	0.455	0.326	0.165	0.054
116	SU028	0.595	0.070	0.265	0.070	0.576	0.081	0.266	0.077
117	SU029	0.417	0.237	0.276	0.070	0.604	0.164	0.141	0.091
118	SU030	0.533	0.095	0.053	0.319	0.086	0.246	0.098	0.570
119	SU031	0.614	0.085	0.216	0.085	0.083	0.581	0.083	0.253
120	SU032	0.330	0.081	0.505	0.084	0.100	0.219	0.297	0.384
121	SU033	0.289	0.279	0.134	0.298	0.295	0.316	0.077	0.312
122	SU034	0.577	0.255	0.043	0.125	0.608	0.263	0.037	0.092
123	SU035	0.287	0.307	0.134	0.272	0.283	0.304	0.088	0.325
124	SU036	0.542	0.223	0.101	0.134	0.151	0.582	0.127	0.140
125	SU037	0.330	0.081	0.505	0.084	0.052	0.118	0.248	0.582
126	SU038	0.122	0.321	0.235	0.322	0.322	0.186	0.291	0.201
127	SU039	0.550	0.205	0.076	0.169	0.162	0.524	0.162	0.152
128	SU040	0.658	0.153	0.044	0.145	0.193	0.558	0.114	0.135
129	SU041	0.610	0.161	0.133	0.096	0.171	0.171	0.183	0.475
130	SU042	0.621	0.050	0.068	0.261	0.089	0.242	0.070	0.599
131	SU043	0.710	0.101	0.046	0.143	0.079	0.427	0.067	0.427
132	SU044	0.106	0.223	0.055	0.616	0.399	0.339	0.060	0.202
133	SU045	0.233	0.325	0.047	0.395	0.121	0.535	0.072	0.272
134	SU046	0.408	0.118	0.038	0.436	0.167	0.333	0.167	0.333
135	SU047	0.623	0.168	0.041	0.168	0.126	0.299	0.291	0.284
136	SU048	0.413	0.110	0.049	0.428	0.052	0.405	0.112	0.431
137	SU049	0.551	0.260	0.060	0.129	0.460	0.351	0.057	0.132
138	SU050	0.580	0.273	0.047	0.100	0.133	0.589	0.059	0.219
139	SU051	0.167	0.557	0.060	0.216	0.194	0.244	0.089	0.473
140	SU052	0.589	0.123	0.055	0.233	0.553	0.094	0.041	0.312

**Appendix 4:** The analytical of priority ranking scores of engineering Criteria (con't)

No.	Code of questionnaire	Engineering Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
141	SU053	0.727	0.091	0.091	0.091	0.456	0.333	0.049	0.162
142	SU054	0.674	0.141	0.045	0.140	0.462	0.138	0.158	0.242
143	SU055	0.626	0.107	0.061	0.206	0.700	0.100	0.100	0.100
144	SU056	0.611	0.050	0.098	0.241	0.040	0.320	0.320	0.320
145	SU057	0.123	0.292	0.235	0.350	0.310	0.191	0.299	0.200
146	SU058	0.433	0.169	0.238	0.160	0.295	0.229	0.180	0.296
147	SU059	0.547	0.113	0.136	0.204	0.486	0.138	0.154	0.222
148	SU060	0.667	0.111	0.111	0.111	0.471	0.167	0.118	0.244
149	SU061	0.663	0.104	0.088	0.145	0.718	0.093	0.096	0.093
150	SU062	0.676	0.105	0.114	0.105	0.185	0.316	0.218	0.281
151	SU063	0.683	0.090	0.058	0.169	0.338	0.266	0.100	0.296
152	SU064	0.575	0.278	0.048	0.099	0.596	0.257	0.042	0.105
153	SU065	0.391	0.195	0.276	0.138	0.542	0.227	0.140	0.091
154	SU066	0.573	0.075	0.276	0.076	0.498	0.227	0.170	0.105
155	SU067	0.595	0.070	0.265	0.070	0.573	0.075	0.276	0.076
156	SU068	0.283	0.219	0.273	0.225	0.072	0.337	0.048	0.543
157	SU069	0.653	0.089	0.190	0.068	0.091	0.578	0.281	0.050
158	SU070	0.413	0.132	0.236	0.219	0.491	0.186	0.156	0.167
159	SU071	0.588	0.171	0.050	0.191	0.449	0.229	0.090	0.232
160	SU072	0.549	0.282	0.048	0.121	0.605	0.245	0.037	0.113
161	SU073	0.383	0.223	0.337	0.057	0.519	0.203	0.162	0.116
162	SU074	0.653	0.197	0.051	0.099	0.585	0.268	0.038	0.109
163	SU075	0.599	0.111	0.063	0.227	0.086	0.246	0.098	0.570
164	SU076	0.281	0.284	0.149	0.286	0.114	0.265	0.042	0.579
165	SU077	0.548	0.199	0.071	0.182	0.151	0.582	0.127	0.140
166	SU078	0.613	0.072	0.240	0.075	0.066	0.107	0.600	0.227
167	SU079	0.590	0.092	0.226	0.092	0.090	0.585	0.085	0.240
168	SU080	0.285	0.098	0.503	0.114	0.071	0.246	0.309	0.374
169	SU081	0.131	0.300	0.238	0.331	0.293	0.201	0.303	0.203
170	SU082	0.622	0.095	0.045	0.238	0.580	0.261	0.054	0.105
171	SU083	0.598	0.089	0.047	0.266	0.468	0.175	0.073	0.284
172	SU084	0.459	0.305	0.093	0.143	0.529	0.134	0.068	0.269
173	SU085	0.545	0.113	0.049	0.293	0.086	0.246	0.098	0.570
174	SU086	0.292	0.298	0.134	0.276	0.307	0.315	0.085	0.293
175	SU087	0.550	0.205	0.076	0.169	0.151	0.582	0.127	0.140

**Appendix 4:** The analytical of priority ranking scores of engineering Criteria (con't)

No.	Code of questionnaire	Engineering Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
176	SU088	0.613	0.072	0.240	0.075	0.060	0.104	0.606	0.230
177	SU089	0.590	0.092	0.226	0.092	0.092	0.590	0.092	0.226
178	SU090	0.330	0.081	0.505	0.084	0.119	0.228	0.284	0.369
179	SU091	0.131	0.300	0.238	0.331	0.289	0.203	0.303	0.205
180	SU092	0.627	0.116	0.045	0.212	0.579	0.251	0.105	0.065
181	SU093	0.615	0.101	0.054	0.230	0.487	0.155	0.067	0.291
182	SU094	0.504	0.260	0.085	0.151	0.527	0.131	0.064	0.278
183	Y001	0.653	0.162	0.056	0.129	0.042	0.323	0.312	0.323
184	Y002	0.676	0.110	0.062	0.152	0.293	0.203	0.301	0.203
185	Y003	0.575	0.278	0.048	0.099	0.283	0.235	0.184	0.298
186	Y004	0.131	0.331	0.238	0.300	0.409	0.156	0.165	0.270
187	Y005	0.654	0.107	0.092	0.147	0.472	0.171	0.141	0.216
188	Y006	0.575	0.278	0.048	0.099	0.718	0.093	0.096	0.093
189	Y007	0.391	0.195	0.276	0.138	0.197	0.293	0.216	0.294
190	Y008	0.595	0.070	0.265	0.070	0.281	0.312	0.098	0.309
191	Y009	0.409	0.231	0.301	0.059	0.614	0.252	0.046	0.088
192	Y010	0.625	0.097	0.047	0.231	0.482	0.282	0.153	0.083
193	Y011	0.614	0.085	0.216	0.085	0.496	0.228	0.166	0.110
194	Y012	0.330	0.081	0.505	0.084	0.573	0.075	0.276	0.076
195	Y013	0.293	0.284	0.134	0.289	0.071	0.247	0.056	0.626
196	Y014	0.663	0.193	0.051	0.093	0.139	0.493	0.308	0.060
197	Y015	0.293	0.407	0.075	0.225	0.491	0.186	0.156	0.167
198	Y016	0.515	0.233	0.111	0.141	0.468	0.226	0.080	0.226
199	Y017	0.330	0.081	0.505	0.084	0.596	0.241	0.054	0.109
200	Y018	0.123	0.292	0.235	0.350	0.610	0.172	0.125	0.093
201	Y019	0.550	0.205	0.076	0.169	0.625	0.225	0.039	0.111
202	Y020	0.601	0.178	0.041	0.180	0.086	0.246	0.098	0.570
203	Y021	0.587	0.178	0.136	0.099	0.326	0.265	0.082	0.327
204	Y022	0.599	0.063	0.111	0.227	0.151	0.582	0.127	0.140
205	Y023	0.737	0.090	0.048	0.125	0.070	0.120	0.567	0.243
206	Y024	0.099	0.212	0.055	0.634	0.092	0.590	0.092	0.226
207	Y025	0.248	0.295	0.061	0.396	0.066	0.233	0.275	0.426
208	Y026	0.330	0.196	0.181	0.293	0.309	0.191	0.301	0.199
209	Y027	0.660	0.156	0.049	0.135	0.563	0.271	0.056	0.110
210	Y028	0.395	0.117	0.050	0.438	0.474	0.160	0.057	0.309

**Appendix 4: The analytical of priority ranking scores of engineering Criteria (con't)**

No.	Code of questionnaire	Engineering Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
211	Y029	0.551	0.260	0.060	0.129	0.527	0.131	0.064	0.278
212	Y030	0.576	0.258	0.049	0.117	0.086	0.246	0.098	0.570
213	Y031	0.156	0.512	0.060	0.272	0.304	0.283	0.145	0.268
214	Y032	0.632	0.102	0.053	0.213	0.151	0.582	0.127	0.140
215	Y033	0.727	0.091	0.091	0.091	0.065	0.108	0.597	0.230
216	Y034	0.085	0.585	0.090	0.240	0.092	0.590	0.092	0.226
217	Y035	0.629	0.174	0.048	0.149	0.225	0.243	0.278	0.254
218	Y036	0.719	0.090	0.064	0.127	0.301	0.199	0.292	0.208
219	Y037	0.575	0.278	0.048	0.099	0.576	0.256	0.058	0.110
220	Y038	0.123	0.292	0.235	0.350	0.456	0.166	0.055	0.323
221	Y039	0.472	0.170	0.135	0.223	0.602	0.122	0.063	0.213
222	Y040	0.575	0.278	0.048	0.099	0.086	0.246	0.098	0.570
223	Y041	0.391	0.195	0.276	0.138	0.292	0.281	0.125	0.302
224	Y042	0.595	0.070	0.265	0.070	0.151	0.582	0.127	0.140
225	Y043	0.405	0.228	0.311	0.056	0.064	0.109	0.591	0.236
226	Y044	0.546	0.095	0.062	0.297	0.092	0.590	0.092	0.226
227	Y045	0.614	0.085	0.216	0.085	0.101	0.232	0.274	0.393
228	Y046	0.330	0.081	0.505	0.084	0.302	0.196	0.299	0.203
229	Y047	0.286	0.294	0.138	0.282	0.577	0.261	0.056	0.106
230	Y048	0.541	0.286	0.051	0.122	0.465	0.151	0.056	0.328
231	Y049	0.316	0.312	0.093	0.279	0.527	0.131	0.064	0.278
232	RI001	0.542	0.223	0.101	0.134	0.504	0.127	0.154	0.215
233	RI002	0.307	0.092	0.513	0.088	0.709	0.098	0.095	0.098
234	RI003	0.142	0.309	0.241	0.308	0.666	0.204	0.042	0.088
235	RI004	0.529	0.211	0.078	0.182	0.291	0.202	0.303	0.204
236	RI005	0.614	0.200	0.049	0.137	0.718	0.093	0.096	0.093
237	RI006	0.449	0.228	0.176	0.147	0.678	0.183	0.048	0.091
238	RI007	0.605	0.055	0.081	0.259	0.532	0.279	0.138	0.051
239	RI008	0.652	0.118	0.057	0.173	0.576	0.081	0.266	0.077
240	RI009	0.125	0.266	0.053	0.556	0.416	0.249	0.199	0.136
241	RI010	0.233	0.311	0.065	0.391	0.086	0.246	0.098	0.570
242	RI011	0.432	0.125	0.041	0.402	0.085	0.585	0.090	0.240
243	RI012	0.680	0.134	0.052	0.134	0.089	0.242	0.259	0.410
244	RI013	0.410	0.108	0.047	0.435	0.264	0.307	0.112	0.317
245	RI014	0.528	0.260	0.078	0.134	0.585	0.274	0.039	0.102

**Appendix 4:** The analytical of priority ranking scores of engineering Criteria (con't)

No.	Code of questionnaire	Engineering Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
246	RI015	0.532	0.311	0.047	0.110	0.280	0.285	0.148	0.287
247	RI016	0.158	0.545	0.069	0.228	0.290	0.324	0.193	0.193
248	RI017	0.647	0.116	0.072	0.165	0.099	0.235	0.264	0.402
249	RI018	0.727	0.091	0.091	0.091	0.309	0.193	0.295	0.203
250	RI019	0.613	0.167	0.049	0.171	0.162	0.524	0.162	0.152
251	RI020	0.587	0.135	0.104	0.174	0.186	0.544	0.111	0.159
252	RI021	0.575	0.278	0.048	0.099	0.216	0.220	0.225	0.339
253	RI022	0.123	0.292	0.235	0.350	0.094	0.229	0.079	0.598
254	RI023	0.564	0.150	0.102	0.184	0.079	0.427	0.067	0.427
255	RI024	0.575	0.278	0.048	0.099	0.394	0.341	0.058	0.207
256	RI025	0.423	0.174	0.266	0.137	0.127	0.550	0.064	0.259
257	RI026	0.595	0.070	0.265	0.070	0.161	0.354	0.131	0.354
258	RI027	0.413	0.234	0.290	0.063	0.046	0.570	0.125	0.259
259	RI028	0.603	0.120	0.047	0.230	0.052	0.405	0.112	0.431
260	RI029	0.614	0.085	0.216	0.085	0.460	0.351	0.057	0.132
261	RI030	0.330	0.081	0.505	0.084	0.130	0.603	0.063	0.204
262	RI031	0.293	0.284	0.134	0.289	0.190	0.243	0.089	0.478
263	RI032	0.571	0.241	0.065	0.123	0.577	0.097	0.039	0.287
264	RI033	0.307	0.288	0.093	0.312	0.456	0.333	0.049	0.162
265	RI034	0.550	0.206	0.109	0.135	0.085	0.585	0.090	0.240
266	RI035	0.276	0.142	0.522	0.060	0.458	0.127	0.185	0.230
267	RI036	0.123	0.292	0.235	0.350	0.709	0.098	0.095	0.098
268	RI037	0.550	0.205	0.076	0.169	0.682	0.181	0.045	0.092
269	RI038	0.639	0.162	0.053	0.146	0.273	0.204	0.313	0.210
270	RI039	0.472	0.224	0.170	0.134	0.718	0.093	0.096	0.093
271	RI040	0.568	0.059	0.120	0.253	0.645	0.203	0.048	0.104
272	RI041	0.739	0.077	0.049	0.135	0.495	0.291	0.152	0.062
273	RI042	0.091	0.215	0.058	0.636	0.576	0.081	0.266	0.077
274	RI043	0.237	0.276	0.069	0.418	0.663	0.145	0.104	0.088
275	RI044	0.415	0.126	0.044	0.415	0.086	0.246	0.098	0.570
276	RI045	0.611	0.176	0.059	0.154	0.085	0.585	0.090	0.240
277	RI046	0.415	0.132	0.051	0.402	0.110	0.232	0.275	0.383
278	RI047	0.518	0.273	0.064	0.145	0.275	0.302	0.153	0.270
279	RI048	0.549	0.282	0.048	0.121	0.599	0.269	0.048	0.084
280	RI049	0.162	0.533	0.065	0.240	0.323	0.294	0.036	0.347

**Appendix 4:** The analytical of priority ranking scores of engineering Criteria (con't)

No.	Code of questionnaire	Engineering Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
281	RI050	0.652	0.107	0.053	0.188	0.151	0.582	0.127	0.140
282	RI051	0.727	0.091	0.091	0.091	0.145	0.276	0.288	0.291
283	RI052	0.678	0.148	0.052	0.122	0.294	0.201	0.305	0.200
284	RI053	0.642	0.103	0.052	0.203	0.162	0.524	0.162	0.152
285	RI054	0.575	0.278	0.048	0.099	0.194	0.520	0.109	0.177
286	RI055	0.123	0.292	0.235	0.350	0.091	0.102	0.095	0.712
287	RI056	0.563	0.143	0.110	0.184	0.092	0.228	0.069	0.611
288	RI057	0.575	0.278	0.048	0.099	0.079	0.427	0.067	0.427
289	RI058	0.423	0.174	0.266	0.137	0.415	0.342	0.072	0.171
290	RI059	0.595	0.070	0.265	0.070	0.089	0.596	0.069	0.246
291	RI060	0.386	0.227	0.329	0.058	0.161	0.354	0.131	0.354
292	RI061	0.583	0.113	0.058	0.246	0.046	0.604	0.116	0.234
293	RI062	0.583	0.113	0.058	0.246	0.052	0.405	0.112	0.431
294	RI063	0.330	0.081	0.505	0.084	0.460	0.351	0.057	0.132
295	RI064	0.298	0.309	0.122	0.271	0.131	0.573	0.067	0.229
296	RI065	0.623	0.233	0.050	0.094	0.157	0.251	0.103	0.489
297	RI066	0.300	0.315	0.109	0.276	0.555	0.127	0.047	0.271
298	RI067	0.544	0.218	0.103	0.135	0.456	0.333	0.049	0.162
299	RI068	0.330	0.081	0.505	0.084	0.443	0.137	0.202	0.218
300	RI069	0.142	0.309	0.241	0.308	0.709	0.098	0.095	0.098
301	RI070	0.549	0.201	0.073	0.177	0.522	0.250	0.051	0.177
302	RI071	0.659	0.150	0.049	0.142	0.294	0.201	0.305	0.200
303	RI072	0.608	0.163	0.129	0.100	0.718	0.093	0.096	0.093
304	RI073	0.655	0.051	0.076	0.218	0.624	0.241	0.049	0.086
305	RI074	0.737	0.089	0.047	0.127	0.583	0.219	0.134	0.064
306	RI075	0.099	0.263	0.047	0.591	0.576	0.081	0.266	0.077
307	RI076	0.224	0.290	0.063	0.423	0.680	0.134	0.101	0.085
308	RI077	0.406	0.112	0.041	0.441	0.086	0.246	0.098	0.570
309	RI078	0.677	0.146	0.047	0.130	0.085	0.585	0.090	0.240
310	RI079	0.391	0.118	0.050	0.441	0.083	0.222	0.304	0.391
311	RI080	0.522	0.309	0.060	0.109	0.307	0.287	0.134	0.272
312	RI081	0.553	0.296	0.050	0.101	0.608	0.254	0.041	0.097
313	RI082	0.129	0.571	0.075	0.225	0.279	0.276	0.171	0.274
314	RI083	0.570	0.112	0.053	0.265	0.305	0.294	0.201	0.200
315	RI084	0.727	0.091	0.091	0.091	0.134	0.287	0.272	0.307

**Appendix 4:** The analytical of priority ranking scores of engineering Criteria (con't)

No.	Code of questionnaire	Engineering Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
316	RI085	0.718	0.119	0.054	0.109	0.294	0.201	0.305	0.200
317	RI086	0.634	0.105	0.050	0.211	0.162	0.524	0.162	0.152
318	RI087	0.575	0.278	0.048	0.099	0.242	0.386	0.168	0.204
319	RI088	0.124	0.324	0.236	0.316	0.205	0.194	0.219	0.382
320	RI089	0.474	0.158	0.133	0.235	0.110	0.175	0.098	0.617
321	RI090	0.575	0.278	0.048	0.099	0.079	0.427	0.067	0.427
322	RI091	0.421	0.170	0.276	0.133	0.404	0.338	0.064	0.194
323	RI092	0.595	0.070	0.265	0.070	0.119	0.634	0.047	0.200
324	RI093	0.439	0.230	0.268	0.063	0.161	0.354	0.131	0.354
325	RI094	0.610	0.095	0.048	0.247	0.040	0.547	0.127	0.286
326	RI095	0.614	0.085	0.216	0.085	0.052	0.405	0.112	0.431
327	RI096	0.330	0.081	0.505	0.084	0.460	0.351	0.057	0.132
328	RI097	0.280	0.287	0.129	0.304	0.187	0.432	0.078	0.303
329	RI098	0.594	0.273	0.041	0.092	0.213	0.255	0.087	0.445
330	RI099	0.294	0.301	0.122	0.283	0.663	0.104	0.074	0.159
331	RI100	0.544	0.219	0.103	0.134	0.456	0.333	0.049	0.162
332	RI101	0.330	0.081	0.505	0.084	0.501	0.125	0.183	0.191
333	RI102	0.129	0.329	0.237	0.305	0.709	0.098	0.095	0.098
334	RI103	0.549	0.201	0.073	0.177	0.714	0.158	0.048	0.080
335	RI104	0.663	0.159	0.044	0.134	0.294	0.201	0.305	0.200
336	RI105	0.522	0.203	0.146	0.129	0.718	0.093	0.096	0.093
337	RI106	0.660	0.043	0.078	0.219	0.612	0.259	0.043	0.086
338	RI107	0.735	0.087	0.045	0.133	0.587	0.213	0.145	0.055
339	RI108	0.134	0.324	0.046	0.496	0.540	0.211	0.160	0.089
340	RI109	0.224	0.306	0.056	0.414	0.702	0.110	0.115	0.073
341	RI110	0.428	0.123	0.039	0.410	0.086	0.246	0.098	0.570
342	RI111	0.713	0.112	0.048	0.127	0.085	0.585	0.090	0.240
343	RI112	0.384	0.125	0.040	0.451	0.043	0.242	0.324	0.391
344	RI113	0.579	0.236	0.057	0.128	0.307	0.287	0.134	0.272
345	RI114	0.611	0.232	0.053	0.104	0.709	0.132	0.056	0.103
346	RI115	0.153	0.563	0.065	0.219	0.634	0.245	0.093	0.028
347	RI116	0.642	0.090	0.055	0.213	0.305	0.294	0.201	0.200
348	RI117	0.727	0.091	0.091	0.091	0.134	0.287	0.272	0.307
349	RI118	0.163	0.568	0.056	0.213	0.294	0.201	0.305	0.200
350	RI119	0.610	0.112	0.049	0.229	0.162	0.524	0.162	0.152

**Appendix 4:** The analytical of priority ranking scores of engineering Criteria (con't)

No.	Code of questionnaire	Engineering Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
351	RI120	0.727	0.091	0.091	0.091	0.194	0.520	0.109	0.177
352	RI121	0.619	0.059	0.103	0.219	0.097	0.115	0.106	0.682
353	RI122	0.123	0.292	0.235	0.350	0.110	0.175	0.098	0.617
354	RI123	0.404	0.191	0.239	0.166	0.079	0.427	0.067	0.427
355	RI124	0.675	0.088	0.106	0.131	0.415	0.342	0.072	0.171
356	RI125	0.667	0.111	0.111	0.111	0.131	0.623	0.061	0.185
357	RI126	0.651	0.102	0.090	0.157	0.161	0.354	0.131	0.354
358	RI127	0.676	0.105	0.114	0.105	0.057	0.597	0.104	0.242
359	RI128	0.661	0.083	0.054	0.202	0.052	0.405	0.112	0.431
360	RI129	0.575	0.278	0.048	0.099	0.460	0.351	0.057	0.132
361	RI130	0.416	0.189	0.283	0.112	0.163	0.481	0.065	0.291
362	RI131	0.573	0.075	0.276	0.076	0.199	0.274	0.089	0.438
363	RI132	0.595	0.070	0.265	0.070	0.647	0.091	0.047	0.215
364	RI133	0.272	0.208	0.278	0.242	0.456	0.333	0.049	0.162
365	RI134	0.667	0.092	0.175	0.066	0.439	0.137	0.192	0.232
366	RI135	0.413	0.132	0.236	0.219	0.709	0.098	0.095	0.098
367	RI136	0.588	0.171	0.050	0.191	0.577	0.278	0.049	0.096
368	RI137	0.615	0.253	0.044	0.088	0.294	0.201	0.305	0.200
369	RI138	0.376	0.262	0.318	0.044	0.718	0.093	0.096	0.093
370	RI139	0.720	0.150	0.053	0.077	0.693	0.154	0.065	0.088
371	RI140	0.659	0.120	0.113	0.108	0.424	0.351	0.146	0.079
372	RI141	0.340	0.287	0.136	0.237	0.576	0.081	0.266	0.077
373	RI142	0.548	0.199	0.071	0.182	0.715	0.112	0.095	0.078
374	RI143	0.616	0.079	0.229	0.076	0.086	0.246	0.098	0.570
375	RI144	0.590	0.092	0.226	0.092	0.085	0.585	0.090	0.240
376	RI145	0.330	0.081	0.505	0.084	0.097	0.228	0.295	0.380
377	RI146	0.131	0.300	0.238	0.331	0.329	0.287	0.119	0.265
378	RI147	0.691	0.102	0.100	0.107	0.697	0.161	0.047	0.095
379	RI148	0.701	0.098	0.099	0.102	0.307	0.287	0.134	0.272
380	RI149	0.532	0.258	0.080	0.130	0.305	0.294	0.201	0.200
381	RI150	0.659	0.117	0.113	0.111	0.143	0.272	0.309	0.276
382	RI151	0.296	0.304	0.089	0.311	0.524	0.151	0.162	0.163
383	RI152	0.548	0.199	0.071	0.182	0.162	0.524	0.162	0.152
384	RI153	0.616	0.079	0.229	0.076	0.173	0.604	0.097	0.126
385	RI154	0.590	0.092	0.226	0.092	0.194	0.219	0.205	0.382

**Appendix 4:** The analytical of priority ranking scores of engineering Criteria (con't)

No.	Code of questionnaire	Engineering Criteria							
		Wet Season				Dry Season			
		Rice	Upland	Fruit	Vegetable	Rice	Upland	Fruit	Vegetable
386	RI155	0.330	0.081	0.505	0.084	0.110	0.175	0.098	0.617
387	RI156	0.433	0.169	0.238	0.160	0.079	0.427	0.067	0.427
388	RI157	0.692	0.103	0.098	0.107	0.421	0.344	0.080	0.155
389	RI158	0.702	0.081	0.095	0.122	0.082	0.616	0.065	0.237
390	RI159	0.667	0.092	0.175	0.066	0.161	0.354	0.131	0.354
391	RI160	0.664	0.147	0.059	0.130	0.077	0.593	0.112	0.218
392	RI161	0.303	0.276	0.133	0.288	0.052	0.405	0.112	0.431
393	RI162	0.550	0.205	0.076	0.169	0.460	0.351	0.057	0.132
394	RI163	0.626	0.074	0.225	0.075	0.151	0.489	0.070	0.290
395	RI164	0.590	0.092	0.226	0.092	0.157	0.251	0.103	0.489
396	RI165	0.330	0.081	0.505	0.084	0.581	0.089	0.052	0.278
397	RI166	0.43	0.169	0.238	0.160	0.456	0.333	0.049	0.162
398	RI167	0.68	0.145	0.039	0.139	0.157	0.251	0.103	0.489
399	RI168	0.68	0.143	0.046	0.135	0.580	0.099	0.047	0.274
400	RI169	0.53	0.245	0.087	0.134	0.460	0.336	0.052	0.152

**Appendix 5:** The analytical of priority ranking scores of all criteria (wet season)

Alternative	Criteria			Total Priority Scores of all Criteria	Order
	Economic (0.314)	Social (.0.344)	Engineering(0.342)		
<b>Wet Season</b>					
1	0.529	0.494	0.506	0.508	<b>1</b>
2	0.168	0.189	0.180	0.180	3
3	0.187	0.192	0.195	0.192	2
4	0.116	0.125	0.119	0.120	4
<b>Dry Season</b>					
1	0.220	0.240	0.307	0.279	3
2	0.284	0.324	0.287	0.293	<b>1</b>
3	0.341	0.298	0.265	0.285	2
4	0.154	0.137	0.140	0.142	4

## แบบสอบถามเพื่อการวิจัย

เรื่อง การศึกษาการวางแผนการเพาะปลูกแบบหลายเกณฑ์โดยใช้เทคนิค

กระบวนการวิเคราะห์ตามลำดับชั้น : กรณีศึกษา พื้นที่ทุ่งกุลาร้องไห้

A STUDY ON MULTI-CRITERIA CROPPING PATTERN PLANNING USING ANALYTICAL HIERACHY PROCESS (AHP) : A CASE STUDY OF THUNG KU LA RONG HAI

### แบบสอบถามส่วนที่ 1 ข้อมูลส่วนบุคคล

1. ชื่อ..... นามสกุล.....
2. อาชีพ.....อายุ.....ปี
3. ที่อยู่.....
4. ข้อมูลด้านการเพาะปลูก พื้นที่ทำการเกษตรทั้งหมด.....ไร่

#### ครั้งที่ 1

ชนิดพืชที่ปลูก..... พื้นที่เพาะปลูก.....ไร่ ผลผลิต.....กก./ไร่ - กระสอบ/ไร่

ม.ค.	ก.พ.	มี.ค.	เม.ย.	พ.ค.	มิ.ย.	ก.ค.	ส.ค.	ก.ย.	ต.ค.	พ.ย.	ธ.ค.

#### ครั้งที่ 2

ชนิดพืชที่ปลูก..... พื้นที่เพาะปลูก.....ไร่ ผลผลิต.....กก./ไร่ - กระสอบ/ไร่

ม.ค.	ก.พ.	มี.ค.	เม.ย.	พ.ค.	มิ.ย.	ก.ค.	ส.ค.	ก.ย.	ต.ค.	พ.ย.	ธ.ค.

#### ครั้งที่ 3

ชนิดพืชที่ปลูก..... พื้นที่เพาะปลูก.....ไร่ ผลผลิต.....กก./ไร่ - กระสอบ/ไร่

ม.ค.	ก.พ.	มี.ค.	เม.ย.	พ.ค.	มิ.ย.	ก.ค.	ส.ค.	ก.ย.	ต.ค.	พ.ย.	ธ.ค.

#### 4. ปัญหา/ข้อเสนอแนะ

.....  
 .....

## แบบสอบถามส่วนที่ 2 : การเปรียบเทียบความสำคัญของการตัดสินใจในการวางแผนการเพาะปลูกในพื้นที่ทุ่งกุลาร้องไห้

### คำแนะนำในการตอบแบบสอบถาม

ให้พิจารณาเปรียบเทียบอันดับความสำคัญของการวางแผนการเพาะปลูกพืช มีความสำคัญกว่ากันมากน้อยเพียงใด แล้วระบุระดับคะแนนความสำคัญตามความรู้สึกของท่าน โดยมีระดับคะแนน 9 ระดับ ตั้งแต่ 1คะแนน คือ มีค่าเท่ากันจนถึงระดับ 9 คะแนนคือมีค่ามากที่สุด ดังนี้

คะแนน	คำอธิบาย	เปรียบเทียบความสำคัญ																	
		เกณฑ์ A									เกณฑ์ B								
		ความสำคัญของ A มากกว่า B									ความสำคัญของ B มากกว่า A								
1	มีความสำคัญเท่ากัน	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
2	มีความสำคัญกว่าอย่างน้อยที่สุด																		
3	มีความสำคัญกว่าพอประมาณ																		
4	มีความสำคัญกว่าพอประมาณถึงปานกลาง																		
5	มีความสำคัญกว่าปานกลาง																		
6	มีความสำคัญกว่าปานกลางถึงค่อนข้างมาก																		
7	มีความสำคัญกว่าค่อนข้างมาก																		
8	มีความสำคัญกว่าค่อนข้างมากถึงมากที่สุด																		
9	มีความสำคัญกว่าอย่างมากที่สุด																		

**ตัวอย่าง** โปรดเปรียบเทียบความสำคัญของการวางแผนการเพาะปลูกพืชแต่ละคู่ต่อไปนี้ว่าเกณฑ์แรกมีความสำคัญกว่าเกณฑ์หลังหรือเกณฑ์หลังมีความสำคัญกว่าเกณฑ์แรก แล้วทำเครื่องหมายในช่อง “ระดับความสำคัญ” และช่อง “ระดับคะแนนความสำคัญ”

คู่ที่	เกณฑ์แรก	ระดับความสำคัญ			เกณฑ์หลัง	ระดับคะแนนความสำคัญ								
		>	=	<		เท่ากัน ←-----→ มากที่สุด								
					1	2	3	4	5	6	7	8	9	
1	ปัจจัย ก				ปัจจัย ข									
2	ปัจจัย ก				ปัจจัย ค									
3	ปัจจัย ก				ปัจจัย ง									

จากตัวอย่างนั้น เป็นการเปรียบเทียบ ปัจจัย ก กับ ปัจจัย ข (คู่ที่ 1), ปัจจัย ก กับ ปัจจัย ค (คู่ที่ 2) และ ปัจจัย ก กับปัจจัย ง (คู่ที่3) ผลการเปรียบเทียบแสดงว่า

คู่ที่ 1 ปัจจัย ก มีความสำคัญกว่า ปัจจัย ข ในระดับปานกลาง ระดับคะแนน 5

คู่ที่ 2 ปัจจัย ค มีความสำคัญกว่า ปัจจัย ก ในระดับค่อนข้างมาก ระดับคะแนน 7

คู่ที่ 3 ปัจจัย ก มีความสำคัญกว่า ปัจจัย ง ในกรณีที่มีความสำคัญเท่ากันให้ทำเครื่องหมาย  
ในระดับคะแนน 1 เท่านั้น

**คำอธิบายประกอบแบบสอบถามในการให้น้ำหนักความสำคัญของการตัดสินใจแบบหลายเกณฑ์ในการวางแผนการปลูกพืช**

เกณฑ์ที่ใช้ในการตัดสินใจสำหรับการวางแผนการปลูกพืชได้กำหนดเกณฑ์ไว้ 3 เกณฑ์ ดังนี้

1. **ด้านเศรษฐกิจ** ใช้ผลประโยชน์เป็นดัชนีชี้วัด เช่น ผลผลิตและผลตอบแทนที่ได้รับ
2. **ด้านสังคม** ใช้ ความหนาแน่นของการปลูกพืชเป็นดัชนีชี้วัด เช่น ความถี่ของการใช้พื้นที่เพื่อการเพาะปลูกในรอบปี
3. **ด้านวิศวกรรม** ใช้ความมีประสิทธิภาพเป็นดัชนีชี้วัด เช่น ประสิทธิภาพโครงการ

โดยทางเลือกในการวางแผนการปลูกพืชได้สร้างไว้จำนวน 4 ทางเลือก ดังนี้

ฤดูแล้ง

ทางเลือก	กิจกรรม
1	ข้าว
2	พืชไร่
3	พืชผัก
4	ไม่ผล/ไม่ยืนต้น

ฤดูฝน

ทางเลือก	กิจกรรม
1	ข้าว
2	พืชไร่
3	พืชผัก
4	ไม่ผล/ไม่ยืนต้น

โปรดเปรียบเทียบความสำคัญของการเกณฑ์แต่ละคู่ต่อไปนี้ว่าเกณฑ์ใดมีความสำคัญกว่ากัน แล้ว  
ทำเครื่องหมาย ในช่อง “ระดับความสำคัญ” และช่อง “ระดับคะแนนความสำคัญ”

แบบสอบถามเพื่อให้น้ำหนักความสำคัญของเกณฑ์การวางแผนการปลูกพืชฤดูแล้ง

คู่ที่	เกณฑ์แรก	ระดับความสำคัญ			เกณฑ์หลัง	ระดับคะแนนความสำคัญ												
						เท่ากัน ←-----→ มากที่สุด												
		>	=	<		1	2	3	4	5	6	7	8	9				
1	เศรษฐกิจ				สังคม													
2	เศรษฐกิจ				วิศวกรรม													
3	สังคม				วิศวกรรม													

แบบสอบถามเพื่อเลือกทางเลือกของการวางแผนการเพาะปลูกพืชฤดูแล้งในเกณฑ์เศรษฐกิจ

คู่ที่	ทางเลือกแรก	ระดับความสำคัญ			ทางเลือกหลัง	ระดับคะแนนความสำคัญ												
						เท่ากัน ←-----→ มากที่สุด												
		>	=	<		1	2	3	4	5	6	7	8	9				
1	ข้าว				พืชไร่													
2	ข้าว				พืชผัก													
3	ข้าว				ไม้ผล/ไม้ยืนต้น													
4	พืชไร่				พืชผัก													
5	พืชไร่				ไม้ผล/ไม้ยืนต้น													
6	ไม้ผล/ไม้ยืนต้น				พืชผัก													

## แบบสอบถามเพื่อเลือกทางเลือกของการวางแผนการเพาะปลูกพืชฤดูแล้งในเกณฑ์สังคม

คู่ที่	ทางเลือกแรก	ระดับ ความสำคัญ			ทางเลือกหลัง	ระดับคะแนนความสำคัญ เท่ากัน ←-----→ มากที่สุด												
		>	=	<		1	2	3	4	5	6	7	8	9				
1	ข้าว				พืชไร่													
2	ข้าว				พืชผัก													
3	ข้าว				ไม้ผล/ไม้ยืนต้น													
4	พืชไร่				พืชผัก													
5	พืชไร่				ไม้ผล/ไม้ยืนต้น													
6	ไม้ผล/ไม้ยืนต้น				พืชผัก													

## แบบสอบถามเพื่อเลือกทางเลือกของการวางแผนการเพาะปลูกพืชฤดูแล้งในเกณฑ์วิศวกรรม

คู่ที่	ทางเลือกแรก	ระดับ ความสำคัญ			ทางเลือกหลัง	ระดับคะแนนความสำคัญ เท่ากัน ←-----→ มากที่สุด												
		>	=	<		1	2	3	4	5	6	7	8	9				
1	ข้าว				พืชไร่													
2	ข้าว				พืชผัก													
3	ข้าว				ไม้ผล/ไม้ยืนต้น													
4	พืชไร่				พืชผัก													
5	พืชไร่				ไม้ผล/ไม้ยืนต้น													
6	ไม้ผล/ไม้ยืนต้น				พืชผัก													

แบบสอบถามเพื่อนำหน้าหน้าสำคัญของเกณฑ์การวางแผนการปลูกพืชฤดูฝน

คู่ที่	เกณฑ์แรก	ระดับ ความสำคัญ			เกณฑ์หลัง	ระดับคะแนนความสำคัญ เท่ากัน ←-----→ มากที่สุด									
		>	=	<		1	2	3	4	5	6	7	8	9	
1	เศรษฐกิจ				สังคม										
2	เศรษฐกิจ				วิศวกรรม										
3	สังคม				วิศวกรรม										

แบบสอบถามเพื่อเลือกทางเลือกของการวางแผนการเพาะปลูกพืชฤดูฝนในเกณฑ์เศรษฐกิจ

คู่ที่	ทางเลือกแรก	ระดับ ความสำคัญ			ทางเลือกหลัง	ระดับคะแนนความสำคัญ เท่ากัน ←-----→ มากที่สุด									
		>	=	<		1	2	3	4	5	6	7	8	9	
1	ข้าว				พืชไร่										
2	ข้าว				พืชผัก										
3	ข้าว				ไม้ผล/ไม้ยืนต้น										
4	พืชไร่				พืชผัก										
5	พืชไร่				ไม้ผล/ไม้ยืนต้น										
6	ไม้ผล/ไม้ยืนต้น				พืชผัก										


## แบบสอบถามเพื่อเลือกทางเลือกของการวางแผนการเพาะปลูกพืชฤดูฝนในเกณฑ์สังคม

คู่ที่	ทางเลือกแรก	ระดับ ความสำคัญ			ทางเลือกหลัง	ระดับคะแนนความสำคัญ เท่ากัน ←-----→ มากที่สุด												
		>	=	<		1	2	3	4	5	6	7	8	9				
1	ข้าว				พืชไร่													
2	ข้าว				พืชผัก													
3	ข้าว				ไม้ผล/ไม้ยืนต้น													
4	พืชไร่				พืชผัก													
5	พืชไร่				ไม้ผล/ไม้ยืนต้น													
6	ไม้ผล/ไม้ยืนต้น				พืชผัก													

## แบบสอบถามเพื่อเลือกทางเลือกของการวางแผนการเพาะปลูกพืชฤดูฝนในเกณฑ์วิศวกรรม

คู่ที่	ทางเลือกแรก	ระดับ ความสำคัญ			ทางเลือกหลัง	ระดับคะแนนความสำคัญ เท่ากัน ←-----→ มากที่สุด												
		>	=	<		1	2	3	4	5	6	7	8	9				
1	ข้าว				พืชไร่													
2	ข้าว				พืชผัก													
3	ข้าว				ไม้ผล/ไม้ยืนต้น													
4	พืชไร่				พืชผัก													
5	พืชไร่				ไม้ผล/ไม้ยืนต้น													
6	ไม้ผล/ไม้ยืนต้น				พืชผัก													

## BIOGRAPHY



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