

Table of Contents

	Page
Acknowledgements.....	iii
Abstract in English.....	v
Abstract in Thai.....	vii
List of Tables.....	xiii
List of Acronyms	xv
Chapter 1 Introduction.....	1
1.1 Background	1
1.2 Rationale	3
1.3 Objectives.....	6
Chapter 2 Literature Review	7
2.1 Definition of agricultural extension.....	7
2.2 Objectives of agricultural extension	7
2.3 Agricultural extension system in Asian countries	8
2.4 Extension system in Vietnam and in DakLak province.....	9
2.5 Studies on extension impact	11
Chapter 3 Research Methods.....	14
3.1 Scopes and limitations of the study	14
3.2 Selection of research site.....	14
3.3 Data collection instruments.....	15
3.4 Data analysis.....	17
3.4.1 Descriptive analysis	17

3.4.2 The Analytic Hierarchy Process (AHP)	18
3.4.3 Index acceptability analysis.....	19
3.4.4. Regression model -- production function analysis.....	19
Chapter 4 Technology Transfer and Extension Approaches	22
4.1 Definition of technology transfer	22
4.2 Research-extension linkage.....	22
4.3 Diffusion of improved technologies to farmers	24
4.3.1 Fertilization.....	24
4.3.2 Irrigation	26
4.3.3 Pruning	28
4.3.4 Pest and disease management.....	30
4.3.5 Grafting techniques	35
4.4 Extension approaches.....	35
4.4.1 Lecture in class room	36
4.4.2 Demonstration.....	37
4.4.3 Mass Media.....	38
4.4.4 Training and visit system (T & V system)	38
4.4.5 Farmer-led approach	39
4.5 Constraints to efficient performances of extension programs.....	40
Chapter 5 Profile and Production Systems of the Study Area	42
5.1 Physical settings of the study area	42
5.1.1 Climatic condition.....	42
5.1.2 Social-economic setting	43
5.2 Agricultural production at the study area.....	44
5.2.1 Land holding	44
5.2.2 Cropping pattern	45
5.3 Coffee production system	46
5.3.1 Importance and opportunity of coffee production	46
5.3.2 Maintenance activities of coffee production	47

Chapter 6 Impact of Agricultural Extension on Coffee Production	49
6.1 Farmers' profile on accessing to the extension programs.....	49
6.1.1 Features of the respondents at the survey villages.....	50
6.1.2 Contact farmers' setting	54
6.2 Impact of extension on farmers' practices	56
6.2.1 Fertilization.....	56
6.2.2 Irrigation.....	63
6.2.3 Pest and disease control.....	66
6.2.4 Labor	70
6.3 Intercropping in coffee production	76
6.4 Inputs application trends	79
6.5 Information access	81
6.5.1 Information approaching on improved technological aspects.....	81
6.5.2 Credit access on coffee production.....	84
6.5.3 Market access on coffee production.....	86
6.6 Farmers' constraints on coffee production.....	88
6.7 Adoption of recommended technologies	90
6.7.1 Adoption analysis.....	90
6.7.2 Adoption rate and index acceptability.....	91
6.8 Farm performance.....	95
6.8.1 Yield variability	96
6.8.2 Yield distribution	97
6.8.3 Farm performance efficiency analysis	98
Chapter 7 Analysis Hierarchy Process and Regression Analysis	102
7.1 Analytic Hierarchy Process (AHP).....	102
7.1.1 AHP procedures.....	102
7.1.2 Farmers' preferences on the extension approach.....	104
7.2 Production function analysis	115
7.2.1 Descriptive statistics	115

7.2.2 Multiple Regression Analysis for both groups	116
7.2.3 Estimation the contribution of extension on coffee yield	121
7.2.4 Multiple Regression Analysis for the contact farmer group	122
Chapter 8 Discussion, Conclusions and Recommendations	125
8.1 Discussion	125
8.1.1 Change in farmers' practices on coffee production	125
8.1.2 Economic consideration	128
8.1.3 Potential of intercropping coffee-based farming system.....	128
8.1.4 Consequences of coffee production	130
8.1.5 Improving agricultural extension.....	131
8.2 Conclusion.....	134
8.3 Recommendations.....	137
8.3.1 Organic coffee production	137
8.3.2 Components of improved technology	138
8.3.3 Incorporated indigenous' knowledge components	138
8.3.4 Farmers' participation	138
8.3.5 Farmer-to-farmer extension	139
8.3.6 Priority female on the extension programs.....	139
8.3.7 Information sources and extension approach	139
8.4 Suggestions for further research.....	140
References.....	141
Appendices.....	151
Curriculum Vitae.....	159

List of Tables

	Page
Table.	
1 Evolving of Vietnam coffee area and productivity through years	2
2 Coffee areas and productivity in DakLak province throughout the years	4
3 Fertilizer application for bearing coffee at different sites in DakLak	25
4 Demography of Cu Sue commune	43
5 Economic status of households at Cu Sue commune	44
6 Land holding for agriculture of Cu Sue commune.....	45
7 Farm households access to the extension at Cu Sue commune	50
8 Educational status and farm experiences of the sampled farmers.....	51
9 Composition of labour force and family size.....	52
10 Farm size and coffee age of sampled households	53
11 Soil features and landscape of coffee farm of sample households.....	54
12 Establishing the contact farmers through years.....	55
13 Chemical fertilizer use ($\text{kg ha}^{-1} \text{ year}^{-1}$) by contact and non-contact farmers	57
14 Manure and bio-fertilizer usages by contact and non-contact farmers.....	62
15 Quantity and number of times of irrigation ($\text{m}^3 \text{ ha}^{-1} \text{ year}^{-1}$)	63
16 Time of irrigation for coffee in dry season	65
17 Frequency of pesticide and insecticide application.....	67
18 Common pests and diseases reported by farmers.....	69
19 Labor usage on maintenance activities (man-day $\text{ha}^{-1} \text{ year}^{-1}$).....	71
20 Farmers' practice on pruning for improving coffee gardens.	73
21 Frequency of hand weeding as practised by coffee farmers	75
22 Common component crops in the coffee intercropping systems	77
23 Changes in input use in coffee production during 1998 - 2002	80
24 Source of information on coffee production	83
25 Frequency contact information from different sources by coffee farmers	84
26 Access to credit from different sources by coffee farmers	85

27 Marketing channels for coffee production.....	87
28 Common constraints of respondents on coffee production.....	89
29 Index acceptability on recommended technological components.....	92
30 Coffee yields of contact and non-contact farmers (dry bean ton ha ⁻¹)	96
31 Yield gap distribution among contact and non-contact farmers	97
32 Costs and economic return for contact, non-contact farmers, \$ ha ⁻¹ year ⁻¹	99
33 Scoring to select criteria for the efficiency extension approaches	105
34 Pair-wise comparison matrix for interactive criteria	106
35 The average consistencies of random index – RI values	107
36 Pair-wise comparison matrix for realistic criteria	108
37 Pair-wise comparison matrix for broad-based impact criteria	109
38 Pair-wise comparison matrix for responsible criteria.....	110
39 Pair-wise comparison matrix for adoptable criteria	111
40 Pair-wise comparison matrix for 5 criteria	111
41 Priority matrix for selecting the extension approaches.....	112
42 Annual inputs used by contact and non-contact farmers and coffee yield	116
43 Result of regression analysis on factors affecting coffee yield.....	117
44 The estimation of extension variables of the general model.....	122
45 Result of regression analysis for the contact farmer group.....	123

List of Acronyms

λ_{\max}	Eigenvalue
AHP	Analytic Hierarchy Process
CBD	Coffee Berry Disease
CI	Consistency Index
CLR	Coffee Leaf Rust
CR	Consistency Ratio
CV	Coefficient of variation
DANIDA	Danish international development agency
DARD	Department of agriculture and rural development
DEC	DakLak Extension Center
GDP	Gross domestic product
GM	Gross Margin
GTZ	German technical cooperation agency
IA	Index of acceptability
IPM	Integrated Pest Management
MARD	Ministry of agriculture and Rural Development
NGOs	Non-government organizations
RI	Random Index
SD	Standard deviation
SWRM	Support to water resource management
T & V	Training and visiting system
TR	Total return
TV	Television
VBA	Vietnamese bank for agricultural and rural development
VC	Variable cost
VND	Vietnam dong
WASI	The western highlands agro-forestry science and technical institute