Chapter 3

Research Methods

3.1 Scopes and limitations of the study

Limitation of time and inadequate information, references related to coffee production and extension were the main constraints of this study. The data used for analyzing purely based on the information collected, site observation, a set of participatory workshop (PW), and the secondary data. As coffee being a perennial crop, a practical difficulty was encountered during the survey to get the exact information on expenditure made much earlier as the farmers did not have the habit of keeping account. The general purpose of this study was to analyze the impact of agricultural extension on coffee production. Therefore, analysis and description on farmers' practices would be focus on two groups of farmer, who had access to the extension programs and other non-contact group. Both groups had their coffee gardens' age ranging from 11 to 12 years.

3.2 Selection of research site

The domain of study was carried out at the commune, where a certain group of farmers had access to the extension programs for five years. 145 coffee households at three villages were selected, its namely is called Cu Sue belongs to Cu Mgar district, DakLak province. The main criteria for selecting of this commune were that it had a heavy concentration of coffee area, and coffee was the main source of income and source of livelihood of people. Almost all the households were both directly and indirectly engaged in coffee production. It has the concentration of ethnic minority groups included Kinh, Ede, Man, and M'nong and this commune is adjacent to the Buon Yong Dam that was being undertaken the feasibility study and proposed to build the irrigation system that would supply water for many thousands ha of coffee and other crops in adjacent areas. Furthermore, this commune is located in an area

characterized by social, economic, cultural, natural as well as climatic, and topographical, environmental conditions are common most of the province. Besides, the priority advancement of being one of the extensionist of the study site for over four years, combined with the accumulated experiences from practical work on coffee production for seven years helped in getting the first hand knowledge and in depth understanding of coffee production systems of the region that gave insight field work research as well as data analysis.

3.3 Data collection instruments

The study employed three methods of data collection: Primary, secondary and participatory workshop. Information obtained from secondary data, and a series of participatory workshop were used to define the nature of problems, opportunities, and reactions of stakeholders on the extension programs in the study area. Of which, the well-defined questionnaire for field survey was developed for primary data collection and subsequent analysis.

- Primary data was mainly obtained from the field of the study area for the 2001 cropping year. The fieldwork was carried out in two periods of time from March to May, and from October to November 2002 at the three sample villages through structured questionnaires by directly interviewing coffee farm households. The formal survey was consisted of well-defined questionnaire that was build up under consulting from coffee experts and extensionist with pre-tested for 10 households aimed to screen any unnecessary and sensitive information and issues to maintain the consistency and quality of related information for statistical analysis. 145 coffee households were interviewed with the sampling percentage over the study site of 12 percent of population in each village. The types of data which has been gathered included:

i. Socio-economic data: Household members, family labors, farm size, farm experience, education, labor exchange, land use system, household income sources, land ownership, credit, and market.

ii. Coffee production: Varieties, age, inputs, yield, intercropping, irrigation, cover crop, constraints on coffee production and farming practices.

iii. Extension service: Extension programs, extension methods, information sources, and extension contents. Notable, author spent much time on measuring farmers' adoption on each recommendation practices distributed by the extension agents. This information were related to the rate of farmers' adoption, and the proportion of area to be covered or have been applied practices followed the extension agents.

- Secondary data: Data on coffee production and the performance of the extension services were collected by working with DakLak Department of Agriculture and Rural Development, Extension Center, Coffee Research Institute, Statistical Department, Plan Protection Department, and Land Use Department at provincial, district, and commune levels. The documents included various published and unpublished documents, such as yearly reports, literature, proceeding, scientific reports, trial and demonstration results. Aside from that, the individual interviews, group discussions, key informants were also organized at those offices for acquiring the quantitative and qualitative information. These information used to define the nature of problems, holistic view and opportunities in the whole province as well as study site aiming subsequent for further analysis.

- Participatory workshop (PA): Thirty participants at Cu Sue commune were selected to participate in the workshop. The participants included coffee farmers who had been access to the extension programs and representatives from relevant unions of Cu Sue commune who they were women associations, local leaders, credit, irrigation, plant protection, and farmers association. The purposes of the workshop were to obtain the overview of the information regarding demography, land use patterns, crops, livestock, farming system, credit, crop calendar, and other aspects related to the extension activities, extension methods, and farmer' practices on coffee production. Especially,

much time spent to identify the farmers' preferences on the extension approach.

- Direct observation: As Bonor and Harrison (1977) stated, a visit to areas where the extension agents are working provided visible evidence of the impact of the extension. This is the same kind of impact that farmers see and convince them to follow the practices from the recommendations. The visibility of the effects of the extension programs and the speed at which they occur amaze most visitors. Author directly observed the coffee sites of the interviewed farmers. The conditions of the fields showed sound agricultural practices, such as performance of coffee gardens related to leaf color, basal and bund making, fertilization, pruning techniques, and pests were well controlled or not. All of these show clearly a basic transformation in agricultural practices, hence in yields and incomes as well as the impact of agricultural extension.

3.4 Data analysis

The general profile and coffee production systems of the study area were described from the information generated through biophysical and so-economic survey and other relevant documents. These information were useful to understand all aspects of coffee production systems and further defined the current farming practices. The path to the impacts of extension and farmers' perception on the extension approaches could find by following analysis methods.

3.4.1 Descriptive analysis

To achieve the objectives number one and parts of three, the descriptive analysis method was used to describe, analyze and to see how differences between the contact farmers and the non-contact farmers from farming practices, of which, mean, percentage, frequencies, standard deviation (SD) values were calculated. 145 farm households in three villages were selected randomly interviewed, and directly

observed. Due to some incomplete information on the data for this study, 15 questionnaires were dropped and 130 households finally remained and classified into two different groups as follow.

- Contact farmers, a coffee farmer at Cu Sue commune, who was a head of household, has been selected by the extension workers and village leaders to participate into the extension programs and voluntarily serve as liaison between the farmers and the extension agents, those contact farmers also serve as a model farmer or crop demonstrators.

- Non-contact farmers, a coffee farmer who cultivates coffee at Cu Sue commune. She or he may be an owner operator, tenant or part owner of the farm, they has not been selected as a contact farmer or participate directly on the extension programs.

3.4.2 The Analytic Hierarchy Process (AHP)

To achieve the objective number two, the Analytic Hierarchy Process (AHP) was applied, which is a multi-criteria decision making tool for selecting the suitable alternative through provide a framework of logic and problem solving (Saaty, 1980).

The method was implemented through a series of participatory workshop for the contact farmers and the relevant representatives. The participants ranked their preferred to extension approaches through pair-wise comparison matrix, which was based upon criteria such as, adaptable, realistic, interactive, broad-based impact, responsible, understandable, and accessible, which were proposed by the participants themselves in advanced. Through processing steps, the weight for each alternative was measured, and the results showed the higher weight of alternatives, the more preference of farmers to the extension approaches, which included demonstration, lecture in classroom, T & V system, farmer-led approach, and mass media.

3.4.3 Index acceptability analysis

To achieve a part of objective three, index acceptability analysis was adopted for this study. Based on the followed formula that was proposed by Hildebrand and Poey (1985).

$$I_a = \left(\frac{C \quad X \quad A}{100} \right) \qquad (1)$$

Where:

I_a, index acceptability

C, percentage of the farmers interviewed who participated in the large scale testing and who were using the technology on at least part of the crop at the time of interview.

A, from among those farmers who used the practice that year, the percentage of the area they planted with the new technology compared to the total area planted to the particular crop.

3.4.4. Regression model -- production function analysis

To achieve a part of objective number three, the Multiple Regression Model through production function was adopted to estimate the contribution of inputs and how the extension's impact to coffee yield. The basic of production functions are linear form, semi-log form, polynomial form, inverse form and Cobb-Douglas or double-log function (Gujarati, 1995).

The general form of production function can be written as follow:

$$Y = f(\beta_i Xi, \varepsilon_i) \qquad (2)$$

Then, the Cobb-Douglas function was adopted for this study; Gujarati (1995) expressed its stochastic as followed formula:

$$Y_j = \beta_0 X_i^{\beta i} e^{Di} + \varepsilon_j \quad (3)$$

Y_j = output of farm j

X_i= input i used

β_i = coefficients to be estimated are constant, β_0 = constant term, β_i = partial elasticity of input X_i, if we add the elasticity coefficients, we obtain an economically important parameter, called the returns to scale parameter, which gives the response of output to a proportional change in inputs. If $\sum\beta_i = 1$" constant return to scale", $\sum\beta_i > 1$ "increasing return to scale", $\sum\beta_i < 1$ "decreasing return to scale".

Based on the function (3), we can apply the variables for this study as detailed followed form under ln formula:

$$LnYj = \beta_0 + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4 + \beta_5 lnX_5 + \beta_6 lnX_6 + D_z + \varepsilon_j \quad (4)$$

(z = 1 to 3)

Where:

- Y_j yield of farm j (in ton dry coffee bean ha^{-1})
- X_1 quantity of nitrogen fertilizer (kg ha^{-1})
- X_2 quantity of phosphorous fertilizer (kg ha^{-1})
- X_3 quantity of potassium fertilizer (kg ha^{-1})
- X_4 irrigation (m^3 of water ha^{-1})
- X_5 pest and disease control (VND ha^{-1})
- X_6 labor (mayday ha^{-1})
- D_1 Dummy for extension, 1 for contact farmers and 0 for non-contact
- D_2 Dummy for pruning, 1 for who pruned, others 0
- D_3 Dummy for manure, 1 for who applied, others 0
- ε_j disturbance error

Result of the model will show the coefficient number for each variable within the model and test whether these variables are statistical significant impact or none

significant. The greater estimated coefficients the higher contribution of variables will effect on coffee yield.

To grasp the economic picture of farmers' practices on coffee production, all variable cost, including labor, irrigation, fertilizers, pesticides, which have invested on one year production were summed for the estimation of gross margins, and some economic indicators for measuring the farm performances were calculated throughout the following equations:

Total revenue	=	Total production in kg multiplied by per unit price
Total variable cost	=	All variable costs
Fixed cost	=	Land tax and depreciation cost for all equipment
Gross margin	=	Total revenue – total variable costs
Farm return	=	Total revenue – total costs

In which, the fix cost was calculated as followed formula to obtain the annual straight-line depreciation proposed by McConnell and Dillon (1997), who suggested for Asian farms where most capital items like pump, tractor, cultivators etc. suffer no loss in value due to obsolescence, are entirely used up in the production process, and do not have a residual value.

$$D = \frac{(PV - SV)}{L} \qquad (5)$$

Where: D, denoted the annual straight-line depreciation amount.

PV, the item's present value

SV, its expected salvage or residual value at the end of its useful life

L, expected total year of life

Finally, a t-student test for independent samples (two-tailed) was applied to test for different means of two populations.