CHAPTER II

RESEARCH METHODS

2.1 Scope of the Study

This study deals mainly with milk production function to assess productivity and find optimum level of capital need for different dairy farming groups classified by farm size and loan repayment performance to classify the different groups of dairy farming.

The other purpose of the study is to identify loan and loan repayment practice among dairy farmers who borrowed from the Bank for Agriculture and Agricultural Cooperatives (BAAC).

In addition, the study examines farm management practices such as fertility, genetic composition , success in artificial insemination and incidence of mastitis as they have impact on milk production and the production function. The other inputs such as land, labor, capital, material, fodder feed, concentrate feed, year of farming and farm size are also examined in the production function as well.

Figure 2.1 displays the components and interactions which contribute to the performance of dairy farming system. It shows that dairy farmers need to borrow money from BAAC to invest in their farm and to pay for fixed and variable costs. Dairy farmers feed their cows with fodder feed and concentrate feed which in turn will have impact on fertility, dairy growth rate, milk quality, income and loan repayment. Disease incidence also has effect on milk quality. Bad management will have serious effects on milking cows.

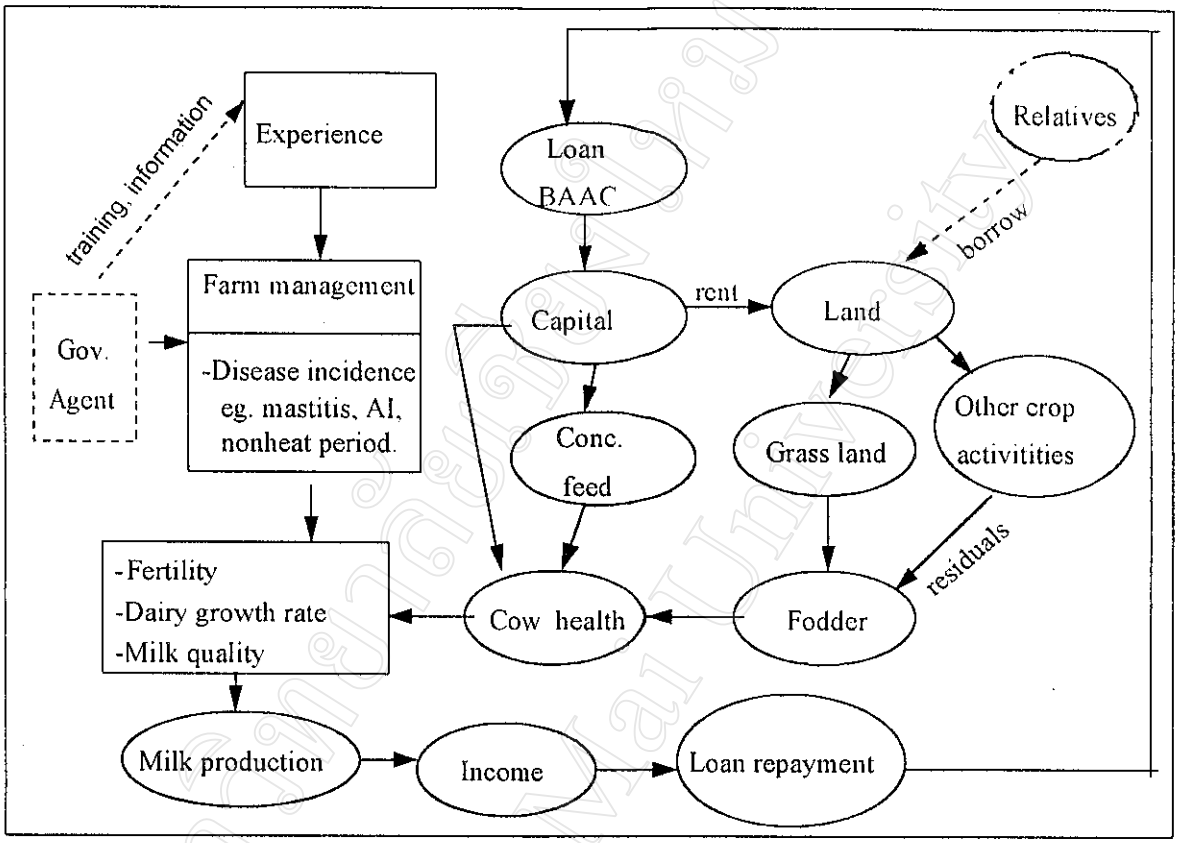

Figure 2.1 Components on performance of dairy farming systems in the scope of the study.

2.2 Theoretical Framework

In production function analysis, output is usually denoted by Y and the amount of the i^{th} input factors by X_i. Y depends on the input quantities X_1, X_2,..., X_n or more briefly in algebraic shorthand, that output and inputs are related by the function (1).

$$Y = f(X_1, X_2,.., X_n) \quad \text{.....(1)}$$

Agricultural input-output relationships follow the law of diminishing returns. The marginal product of the i^{th} input factor (i = 1,2,..,n) is denoted as MP_i was calculated as

the first derivative (dY/dX_i) of this function with respect to the X_i inputs (Dillon and Hardaker, 1980).

The profit maximization principle states that a decision maker should keep using additional units of a productive input as long as the use of the added input earns or saves more money than it costs. Profit is maximized when marginal revenue equals marginal factor cost. This is expressed mathematically as

$$Py(\Delta Y / \Delta X) = P_x \qquad (2)$$

where;

$Py(\Delta Y / \Delta X)$ = value of the marginal product (MVP)

P_x = price of input

P_y = price of output

$\Delta Y / \Delta X$ = marginal product

With respect to the optimum capital need, farmers' capital need is determined by profit-maximizing level of capital use. The profit is maximized when MVPx = Px. From Figure 2.2, price of input is Px and the optimum level of input (X) used is X_2. Assuming farmer's input utilization is financed by his/her own resource. Therefore, the farmer's maximized profit equals to AEPx (cost is $OPxEX_2$) (Onchan, 1986).

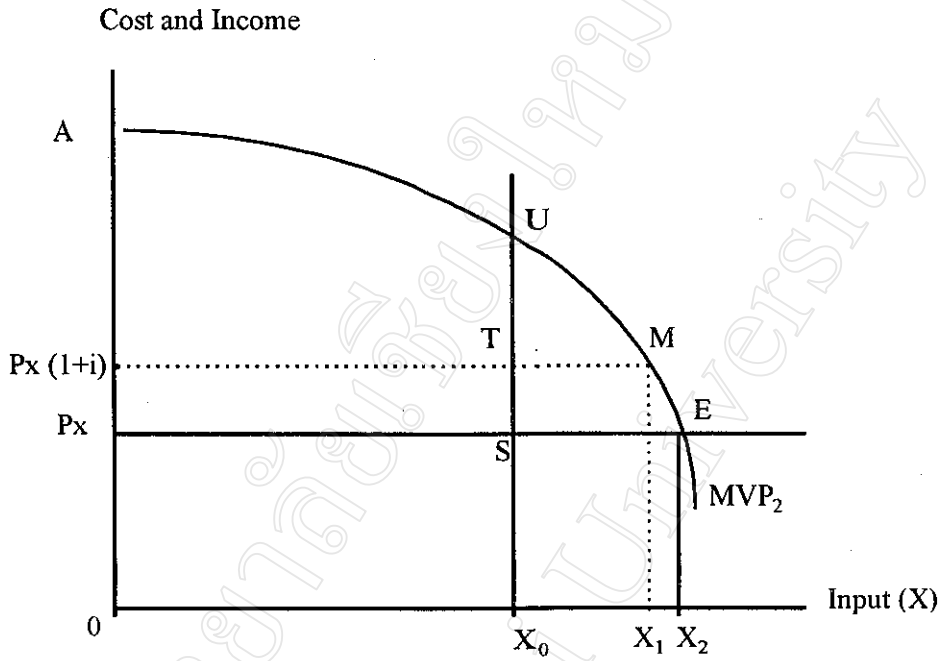

Figure 2.2 Capital need in the use of a variable input

where;

MVP_1	=	marginal value product
Px	=	price of X (input)
E	=	optimum level of input used
$OPxSX_o$	=	own capital constraint

Actually, most of farmers have own capital constrained to buy input for use at the optimum level. Thus, the farmer uses input lower than the maximized profit level. Farmer will loss the opportunity to earn more profit. Assume that the farmer has his/her own input (X) at X_o level, he/she looses income equal to USE area. If a farmer can borrow money to buy input (X), he/she can used input more than X_0. However, borrowing money affects the input cost according to interest rate that credit institution charges farmer.

Assuming farmer borrow money at interest rate level of i. Therefore, the unit cost of input is OPx(1+i). Thus, the new optimum level of input used is X_1. Farmer will earn additional profit of UTM. Although, farmer who obtained credit would use input (X) lower than X_2 but credit helps farmer to improve his/her profit and household income. However, if credit institution charged high interest rate, farmers will be able to obtain less additional profit and income.

This study used the above theoretical principle as the research framework and the details of the functional form and variables used were elaborated in the following section.

2.3 Data Collection

2.3.1 Primary Data

Primary data gathered in this study includes biophysical and socioeconomic information of the dairy farmers in the study area. Semi-structured interviews and formal survey were employed to gather the data in this study.

Formal survey data was collected by questionnaires in May 1997. Dairy farmers who borrowed money from BAAC in San Kamphaeng and King Mae On district, Chiang Mai province, were selected and interviewed by using questionaires to collect primary data for this study in May 1997. These farmers were stratified according to farm size. In total, one hundred dairy farmers were interviewed. The distribution of dairy farmers among the 4 subdistricts of San Kamphaeng and King Mae On is shown in Table 2.1

Table 2.1 The number of interviewed farmers in the study area.

District	Subdistrict	Number of interviewed farmers (households)
San Kamphaeng	Chae-Chang	33
	On-Tai	25
King Mae On	On-Klang	18
	On-Neor	24
Total number of interviewed farmers		100

The following are variables collected in the formal survey and semi-structur interviewing.

2.3.1.1 Bio-physical Variables

- Cropping pattern
- Water source for dairy farming
- Number of dairy cows
- Breed
- Farm management e.g. disease incidence, success in artificial insemination and percentage of nonheat periods etc.
- Fodder feed and concentrate feed used

2.3.1.2 Socio-economic Variables

- Land holding, land type and land distribution
- Farm size
- Household composition by age and family size
- Education status and distribution
- Income and cost of dairy farming

- Loan and loan repayment
- Source of loan,
- Size of loan
- Objective of loan
- Security of loan
- Pay back period
- Labor used on dairy farming
- Attitude and future plan on dairy farming
- Government service
- Marketing on dairy product
- Dairy farm cooperatives
- Years of farming.

2.3.2 Secondary Data

Secondary data on debt and loan repayment was collected from BAAC. Information on literature review was collected from research reports , books and journals. Data on topography, annual rainfall, temperature, transportation and soil type were obtained from relevant government agencies. Records of farmers' total raw milk output were collected from milk collection centers.

2.4 Data Analysis

To achieve the first objective i.e. to describe the biophysical and socioeconomic conditions of dairy farming in the study area, the result from semi-structured interview, formal survey and interview were analyzed using descriptive statistics. This includes farmers' practices and performance in relation to BAAC.

To achieve the second objective, i.e. to assess productivity among BAAC's dairy farmers, multiple regression analysis was employed to estimate the production function. Determinants of milk production function included information on capital, land, labor, material, fodder feed, concentrate feed, years of raising, farm size and management factors. Different groups of dairy farmers were assessed in term of their milk output e.g. using production function groups with 3 level of loan repayment performance (good, average, bad) and farm size.

After the production function has been estimated, the coefficients of the function then, were evaluated to determine the productivity of different groups of farmers e.g. loan repayment performance and farm size.

To achieve the third objective, the study analyzed profit maximization condition using the estimated production function. Such analysis yielded the optimum level of all input used at their optimum level at their corresponding prices including the farmers' optimal capital level. As in objective 2, the dairy farmers were grouped into three according to their loan repayment performance and farm size for the analyses of production performance and capital need.

Specifically, the model of production function was a Cobb-Douglas function as follows:

$$Y = f(Ln, Lb, BE, Mt, F, CF, YR, FS, M_i, D1, D2)$$

or

$$Y = aLn^{b1} Lb^{b2} BE^{b3} Mt^{b4} F^{b5} CF^{b6} YR^{b7} FS^{b8} G^{b9} M^{b10} AI^{b11} NH^{b12} e^{b13D1} e^{b14D2} e^{u}$$

where,

Y = Total milk output (kg/year)

Ln = Land (rai)

Lb = Labor (manday)

BE = Building and equipment input (baht/year)

Mt = Material input (baht/year)

F = Fodder feed (kg/year)

CF = Concentrate feed (kg/year)

YR = Year of raising (years)

FS = Farm size (No. of dairy cows)

M_i = Management factors e.g. genetics, disease incidence, success in Artificial Insemination (AI), etc.

D1 = Loan repayment performance (group 1) D1=1 if good performance or 0 otherwise.

D2 = Loan repayment performance (group 2) D2=1 if average performance or 0 otherwise.

a, b_i = coefficient

e = 2.71828

u = error term

2.4.1 Variables Defined

2.4.1.1 Output Variable

The output variable (Y) is the annual raw milk output for each farm household measured in kg per year. This was obtained from farmers' raw milk collection centers.

2.4.1.2 Input Variables

The land variable (Ln) included two types of land: farm land is the area used for homestead land and pasture land is the area used for pasture. Both were measured in rai.

The labor variable (Lb) is the summation of farm family labor and hired labor used in the production of dairy products only. Labor includes all animal husbandry activities such as feeding, milking, cleaning, management etc. Labor was measured in manday per year that one manday is 8 hours/day.

The building and equipment variable (BE) is cost of building and equipment in dairy farm measured in baht.

The material variable (Mt) is the aggregate value of cash expenditure items purchased and used only in the production of dairy products, including mineral, purchase of animal feed used in the production of dairy, and other expenses.

Consumption of feeding stuff is classified into two main categories. Concentrate feed (CF) is the total amount of concentrate feed used on farm measured in kg per year.

Fodder feed (F) includes grass and other fodders such as baby corn husk, baby corn stalk and rice straw in farm. The total annual amount of fodder feed in farm, which is converted in term of kg of dry matter per year.

Years of raising variable (YR) is the experience of dairy farmers in day do their dairy farm. It was measured in year.

Farm size variable (FS) is the number of dairy farmers' cows.

Management factors variables (M_i) were classified in 4 issues which includes

a) genetic composition (G) or breed variable: the HF (Holstein Friesian) crossbreed was the dominant breed in this study area. The average percentage of HF was calculated from the record of dairy cows in the farms.

b) mastitis is the important disease that it have effect on milk quality. Mastitis variable (M) was taken to be the frequency of the mastitis that occurred in the farm in one year.

c) success in artificial insemination variable (AI) was measured as an average number of times in artificial insemination attempts AI is successful.

d) nonheat variable (NH) is dairy farmers' cow failed to earn heat following a milking cycle, and could not be breed. It was calculated in percentage of nonheat cows per total milk cow per year.

Loan repayment performance variable is a dummy variable that it was classified into three groups according to their loan repayment rate (LR) that it was calculated as follows:

$$\text{Loan repayment rate (LR)} = \frac{(x2 - x4)}{x2} * \frac{x3}{(2540 - x1)} * 100$$

where,

X1 = Year loaned
X2 = Initial loan
X3 = Payback period
X4 = Outstanding loan
If $X4 = 0$, LR will be 100 and $X1 \neq 2540$

Three groups of loan repayment performance are a) the first group is good repayment performance (LR is more than 80%), the second group is average repayment performance (LR is 41% to 80%) and the last group is poor repayment performance (LR is 0% to 40%).