CHAPTER 3

Research Methodology

This study was aimed to explore the perception on drought of maize farmers and their adaptation practices to cope with this climate phenomenon as well as analyze factors impact on farmers' adaptation in the study area. Therefore, this chapter will present the method to select the research samples, collection data tools and especially, the methods to analyze data for writing research results.

3.1 Site selection

According to the objectives of the study, the selection of the study communes was based on the following criteria:

- Maize is the main crop in these communes (maize cultivation land area occupies more than 20% of agricultural land area).
- The communes are suffering strong impact of drought on maize production, low households' maize productivity due to drought.
- The communes have to represent for difference from socio-economic and topographic characteristics of the district. This indicator will contribute to create the diversification in collected data.

The process of site selection was based on criteria above mentioned and also discussed with Head of Agricultural and Rural Development Department. Three communes including Ba Long, MO O and Dakrong were chosen.

3.2 Sampling technique

The number of samples for this research was calculated by using Yamane's formula (1967) which determines the error at the level of significance.

Yamane formula:

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

Where: n = Sample size

N= Total number of farm household

e = Error of sampling (7.5%)

By this method, 180 households were selected randomly (in total households of 8,286) from three communes (60 households per commune) which satisfied with requirements of the study.

3.3 Data collection

Data collection process divided into three steps. First step was study site selection, being conducted by setting up criteria and getting consults from knowledgeable people. Second step focused on key informant interview, focus group discussion and secondary data collection before getting ideas from agronomic and meteorological experts. And the last step was household survey (Figure 3.1).

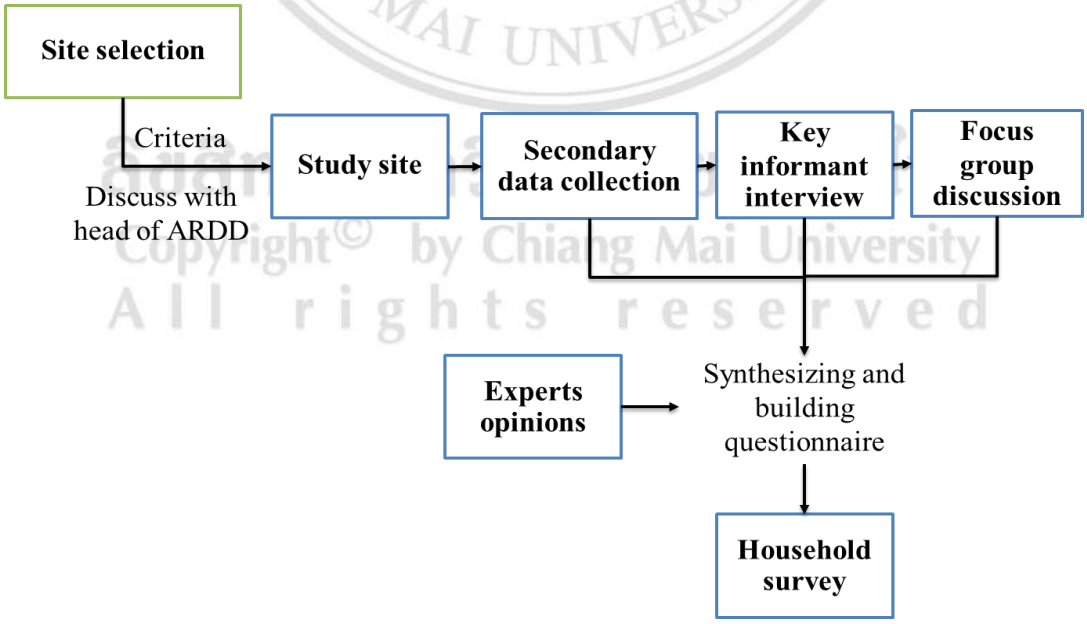

Figure 3.1 Data collection flow

3.3.1 Primary data collection

Primary data were collected through key informant interviews (informal survey), focus group discussion and household survey (formal survey). Specifically, 5 key informant interviews were fulfilled with the involved persons are as follows:

- Head of Agricultural and Rural Development Department. This interview aimed to get general information related to (1) characteristics and situation of agricultural production in the district, (2) maize cultivation and issue of maize cultivation, (3) climate hazards and especially, drought and its impact on maize production, and (4) the solutions had been applying to cope with drought in the area.

- Head of Agricultural Extension Station. The information from this interview was mainly focused on cultivation techniques what station had transferred to farmers to cope with drought, the situation of applying new techniques in maize production in the area.

- Agricultural officer of communes. Three agricultural officers of three communes were interviewed. The collected information was focused on (1) characteristics of maize farmers, (2) maize production characteristics of local farmers, (3) drought events and its influence in maize production in households, and (4) difficulties in maize production in the commune.

Regarding focus group discussion, six focus group discussions were conducted in which, each commune was included one male group and one female group with 12-15 experienced farmers/group who selected by heads of villages. In these group discussions, collected information was focused on (1) cropping system in the community, (2) maize production and characteristics of maize production, (3) climate hazard phenomena often occurred in the area, (4) drought event occurred in last ten years (2003-2013), its characteristics and impacts on agricultural and maize production, (5) coping measures to cope with drought in the community, (6) difficulties in coping with drought in maize production.

Household survey was conducted after completing key informant interviews and group discussions. Structure questionnaire was used for asking household heads. We spent 30 minutes for a questionnaire. Additionally, observation method was used to get a more comprehensive view of the characteristics of households.

Table 3.1 Summary of data collection tools and types of information for the research

Objectives	Tools	Type of information
1. To assess Farmers' perception toward drought	- Household survey	- Farmer's experience of drought - Farmer's drought memory - Farmer's drought definition - Farmer's expectation of drought
2. To examine farmers' adaptation in maize cultivated activities	- Focus group discussion - Key informant interviews - Transect work	- Agricultural production and maize cultivation activities in the district and communities - Climate phenomena, drought and its impacts on agricultural and maize production. - Farmers' adaptation activities in maize cultivation in communities.
	Household survey	- Adaptation activities in maize cultivation that households applying - The response of farmers in maize growing if drought occurs.
3. To analyze factors impact on farmers' adaptation to drought in maize production	Household survey	- Individual characteristics of household heads. - Socio-economic characteristics of households - Information and credit approach - Geographical characteristics

Besides, expert opinions mothed was used to confirm information related to drought characteristics, drought effects, drought causes and drought coping measures which have been occurring in the area before using these information to test the understanding of farmers in Dakrong district.

3.3.2 Secondary data collection

Secondary data such as rainfall, temperature, socio-economic data, etc. were collected from Hydro-meteorological Centre, Statistics Department, Agriculture and Rural

Development Department, Agricultural Extension Station, Local Government Offices to achieve better understanding of the drought phenomenon as well as maize production activities and farmers' adaptations in Dakrong district.

3.4 Data analysis

3.4.1 Descriptive statistics

The data gathered from survey was processed and analyzed with quantitative and qualitative analysis technique. For the analysis Statistical Package for Social Sciences version 22 (SPSS 22), Limdep 9.0 and Microsoft Excel were used.

In respond to the first objective regarding to assess farmers' perception toward drought, farmer's knowledge was score by asking twenty questions, called items (appendix A), relating to drought definition, drought experience, drought memory and expectation of drought of the farmers (Taylor *et al.*, 1998). Depend upon the number of correct answers of farmers. The total score across these items was calculated for each household. The class intervals were computed and divided into 3 class intervals (high, medium and low), following Harshbarger (1977) formula:

$$\text{Perception interval range} = \frac{\text{The highest score} - \text{the lowest score}}{\text{The number of intervals}}$$

By this way, the highest score that got from household interview was 37 and lowest score was 0, thus, farmers who had score from 0 to12 was ranked into low perception level, from 13 to 24 ranked in medium perception level and the rest of farmers ranked in high perception level.

The classification was meaningful in evaluating the level of perception of farmers regarding to drought. It also would be used as a predict variable in analyzing factors impact on adaptation of the farmers in the third objective.

Besides, one way ANOVA and descriptive statistics were also used to illustrate farmer's awareness in different communes or farmer's groups that would contribute to demonstrate a more comprehensive view of the farmer perception in study area.

In order to fulfill the second objective regarding the examining adaptation of farmers in maize cultivation, the primary data collected from household interview using questionnaire was analyzed using descriptive statistics, frequency distributions, means and standard deviations. Especially, information from group discussions was very important in explaining adaptation options of farmers in maize production.

3.4.2 Multinomial Logit model

Multinomial Logit model was used to explain the third objective. This method was used to analyze maize adaptation choices as methods to adapt to the negative impacts of drought.

The multinomial (polytomous) logistic regression model is a simple extension of the binomial logistic regression model. It is used when the dependent variable has more than two nominal or unordered categories, in which dummy coding of independent variables is quite common. In using multinomial logistic regression in risk analysis, the dependent (response) variable is dummy coded into multiple 1/0 variables. This means that there is a variable for all categories but one, so if there are M categories, there will be M-1 dummy variables. All but one category has its own dummy variable. Each category's dummy variable has a value of 1 for its category and a 0 for all others. One category, the reference category, does not need its own dummy variable, as it is uniquely identified by all the other variables being 0. With regards to the above, the model of choice behavior between four adaptation options can therefore be represented using three (i.e., M -1) logit models:

$$z1(x) = \ln\left(\frac{(\Pr(Y=1|x)}{(\Pr(Y=0|x)}\right) = \ln\left(\frac{P1}{P0}\right) = \beta 10 + \beta 11x1 + \beta 12x2 + \cdots + \beta 1pxp$$

$$z2(x) = \ln\left(\frac{(\Pr(Y=2|x)}{(\Pr(Y=0|x)}\right) = \ln\left(\frac{P2}{P0}\right) = \beta 20 + \beta 21x1 + \beta 22x2 + \cdots + \beta 2pxp$$

$$z3(x) = \ln\left(\frac{(\Pr(Y=3|x)}{(\Pr(Y=0|x)}\right) = \ln\left(\frac{P3}{P0}\right) = \beta 30 + \beta 31x1 + \beta 32x2 + \cdots + \beta 3pxp$$

(i) Logit function for Y =1 relative to logit function for Y = 0

(ii) Logit function for Y = 2 relative to logit function for Y = 0

(iii) Logit function for Y = 3 relative to logit function for Y = 0

Category Y = 0 is called a reference group.

Recall: dichotomic logit model, the logistic function:

$$z1(x) = \ln\left(\frac{(\Pr(Y=1|x)}{(\Pr(Y=0|x)}\right) = \ln\left(\frac{P1}{P0}\right) = \beta 10 + \beta 11x1 + \beta 12x2 + \cdots + \beta 1pxp$$

$p_0 = \Pr(Y=1|x) = \frac{e^z}{1+e^z}$; $p_1 = \Pr(Y=0|x) = \frac{e^z}{1+e^z}$

with $p_0 + p_1 = 1$.

For Multinomial Logit with 4 categories:

$$p_0 = \Pr(Y=0|x) = \frac{1}{1+e^{z1}+e^{z2}+e^{z3}}$$

$$p_1 = \Pr(Y=1|x) = \frac{e^{z1}}{1+e^{z1}+e^{z2}+e^{z3}}$$

$$p_2 = \Pr(Y=2|x) = \frac{e^{z2}}{1+e^{z1}+e^{z2}+e^{z3}}$$

$$p_3 = \Pr(Y=3|x) = \frac{e^{z3}}{1+e^{z1}+e^{z2}+e^{z3}}$$

with $p_0 + p_1 + p_2 + p_3 = 1$.

The model is estimated using Maximum Likelihood Method.

For this study, the dependent variables (*Y*) were the adaptation options or response probabilities which selected from group discussion and in-depth interview. In fact, the adaptation options in the study area were quite abundant, includes: cultivate one season, change to another crops, change sowing day, plant the drought tolerant varieties, inter-cropping and other measures (water for maize, shade, etc.). However, for convenience in using the model, the adaptation measures were group into four adaptation options which include:

- Y = 0 (ADP_0): no adaptation.
- Y = 1 (ADP_1): adapt by reducing in cultivation area (for farmers who cultivated one season or changed to another crops).

- Y = 2 (ADP_2): adapt by improving in cultivation techniques (for farmers who changed sowing day or planted the drought tolerant varieties or practiced inter-cropping)
- Y = 3 (ADP_3): adapt by combining measures in ADP_1 and ADP_2.

The independent variables are defined in Table 3.2. In this study, individual characteristics of household head, household socio-economic characteristics, information and credit approach capacity and perception factor were considered in the analysis of factors impacting on farmers' adaptation to drought in maize production;

(1) Individual characteristics of household head: Age, gender, ethnicity, education, maize experience.
(2) Socio-economic characteristics: Household type, household size, agricultural labor, maize land area, maize productivity in normal year, maize productivity in drought year, non-farm income, maize income, distance from central market.
(3) Information and credit approach capacity: Access to climate information sources, access to credit facilities.
(4) Perception level: The level of farmers' perception on drought.

The vectors of explanatory independent variables are showed in Table 3.2 and can be hypothesized as follows:

1) Age of household head (x_1): It is hypothesized that, elder farmers will more likely to be adapted in maize production. Old farmers have higher experience and they pay more attention on adaptation because their main job is agriculture.

2) Gender of head household (x_2): It can be hypothesized that maize production is mainly conducted by women, thus, they may have better adaptation than male ones.

3) Ethnicity of head household (x_3): It is expected that ethnic majority people have better adaptation than ethnic minority people.

4) Education of head household (x_4): A higher level of education increases farmers' ability to obtain, process and adapt coping measures in maize production. Education thus increases probability of adaptation.

Table 3.2 Independent variables

Variables	Measurement	Expected sign
AGE (x_1)	Age of household head (years)	+
GENDER (x_2)	Gender of household head (1 = male, 0 = female)	+
ETHNIC (x_3)	Ethnicity of household head (1 = majority, 0 = minority)	+
EDU (x_4)	Education of household head (years)	+
MAIZEXP (x_5)	Maize experience (years)	+/-
HHTYPE (x_6)	Type of household (1 = no poor, 0 = poor)	+
HHSIZE (x_7)	Number of household members (people)	+
TOTLAB (x_8)	Household total labor (people)	+
DISMARK (x_9)	Distance from central market (km)	-
MAILAN (x_{10})	Maize land area (sao)	+
NFINC (x_{11})	Non-farm income (1000 dongs)	+/-
MAINC (x_{12})	Maize income (1000 dongs)	+
NORPRO (x_{13})	Maize productivity in normal years (kg/sao)	+
DROPRO (x_{14})	Maize productivity in drought years (kg/sao)	-
NUMINF (x_{15})	Access to information sources (number of sources)	+
CREDIT (x_{16})	Access to credit facilities (1 = yes, 0 = no)	+
PERCEPT (x_{17})	Farmers' perception on drought (score)	+

5) Maize experience (x_5): The previous experience of farmers can be expected to either enhance or diminish their level of confidence. It is anticipated that with more experience, farmers could become risk-averse regarding the adaptation to drought in maize production. Thus, this variable could have either a positive or a negative effect on farmers' decision to adapt coping measure.

6) Type of household (x_6): Non poverty households will have better condition to cope with drought in maize production. Therefore, it can be hypothesized that type of household has positive impact on farmers' adaptation.

7) Household size (x_7): Large households are expected to adapt drought better than small households because large households are more abundant labor force.

8) Total household labors (x_8): It is hypothesized that the households who have more labors can easily adapt coping measures.

9) Distance from home to central market (x_9): It hypothesis that farmers live far from the market get more difficulty in buying input to cope with drought than others.

10) Maize land area (x_{10}): Farmers who possess larger areas planted to maize are better adapters of coping measure in maize production.

11) Non-farm (x_{11}): It is hypothesis that household who have high off farm income either enhance or diminish their level of adaptation. They may be less attention to agricultural production as well as maize production than others. On the other hand, they may have better financial source to invest and adapt to drought.

12) Maize income (x_{12}): The hypothesis is that the increase in maize income will encourage farmers invest and practice drought coping measures in maize production.

13) Maize productivity in normal years (x_{13}): It can be hypothesized that, high maize productivity in normal years will encourage farmers invest and apply adaptation measures. Thus, maize productivity in normal year has positive impact on farmers' adaptation.

14) Maize productivity in drought years (x_{14}): Low productivity in drought years demonstrates that farmers are facing strong impact of drought and they have to practice adaptation more drastic. It hypothesize that, maize productivity in drought years will have negative effect on probability of adaptation.

15) Access to information sources (x_{15}): Ability of approaching information sources (television, radio, media, neighbors, extension officers, association groups, etc.) to get climate information, maize cultivation techniques, etc. will help farmers more confidently in applying drought coping measures. Thus, it is hypothesized that, number of approached information sources will have positive impact on farmers' adaptation capacity.

16) Access to credit facilities (x_{16}): It is hypothesized that, farmers who are accessed to credit facilities can have better adaptation in maize production than others.

17) Farmers' perception level on drought (x_{17}): It is hypothesized that, farmers who have higher perception level will have better adaptation practices in maize production to cope with drought.

3.4.3 Factor analysis

Factor analysis was used to extract the main components which have high multi-collinearity from varieties of dependent variable by using rotation method. The variable with highest loading were selected and named the component according to the commonness of variable. The purpose of factor analysis was to compute a linear combination of the original variables from which factor scores can be constructed. The following groups of variables were used in undertaking the present analysis (Figure 3.2).

The factor scores of the main components were used as independent variables in Multinomial Logit model to find the relationship with farmers' adaptation (dependent variable).

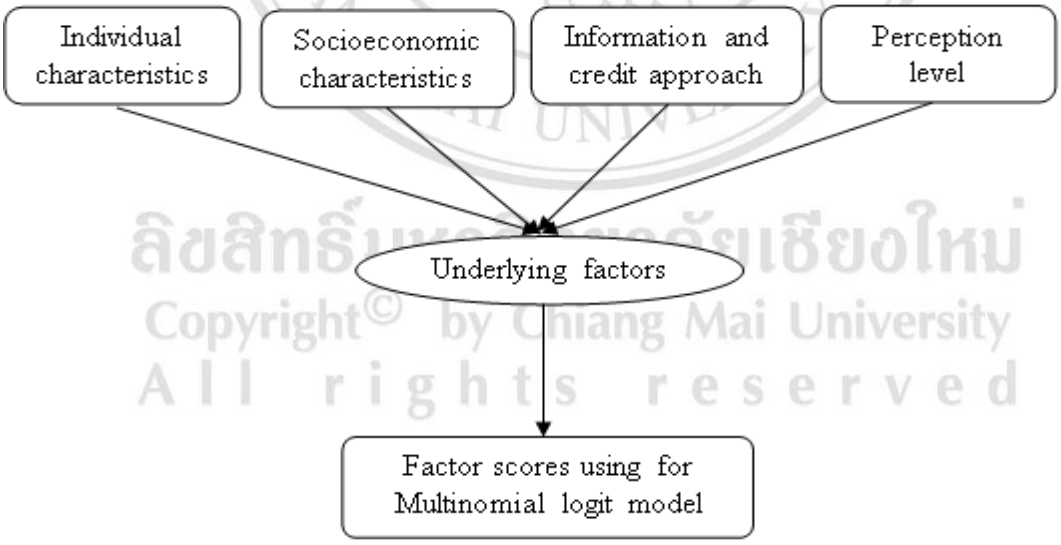

Figure 3.2 Variables and underlying factors.

The results of Multinomial Logit model were interpreted under the sign and magnitude of factors influencing on adaptation practices instead of the original independent variables.