

CHAPTER III

RESEARCH METHODOLOGY

The research employed a combination of quantitative and qualitative approaches. However, it is heavily focused on qualitative research. Yet, the quantitative research is used to investigate the statistical data and to support the empirical data to ensure the accuracy. Thus, the research methodology was conducted as follows:

3.1 Population and sample size

Regarding to the population and sample size of the study, the researcher has chosen the population who are mainly involved with the water management including community, water consumers and other relevant groups at Ban Na Mai, Tambon Wang Pai, Amphoe Huaikrachao, Kanchanaburi province including 149 households and 20 local consumers.

The population sampling are divided into 2 categories by:

- 1) Purposive sampling of 149 households which consisted of 169 people.
- 2) Referral and snowball technique for 10 groups, approximately 20 people which are as follows:

- **Representatives of householders:** this group comprised household leaders, housewives, or members of the families who are adults and able to provide information, altogether were from 149 households.
- **Representatives of local entrepreneurs:** this group involves several business entities including chicken farming, pig farming, and other related farming in the

community. One person represents for one business. The total sample size must be more than 80 percent of the overall business entities which were up to five people.

- **Leaders of community and the Tambon Administrative Organization (TAO) at Tambon Wang Pai:** this group consisted of village headman, assistant of village headman, members of TAO, chief or representatives related to TAO, totaled to five people.
- **Religious leaders:** there was only one person.
- **Teachers of Ban Na Mai School:** there was one person.
- **Students and youths:** two persons.
- **Senior citizens:** two persons.
- **Representatives from Department of Irrigation:** one person.
- **Researchers from Irrigation Technology and Engineering:** one person.
- **Local people and civil society:** two persons.

In case that additional information might be needed from the existing groups, the researcher would conduct purposive sampling specifically by getting permission from the community or considering relevant information on that aspect.

3.2 Data collection tools and techniques

Tools being used in data collection are as follows (Suchat Pasertrathsit, 2003):

3.2.1 Checklist: the checklist is used to gather data and basic information from the database and other sources including information on:

- (1) Water Quantity: the data sources are based on:

- The 30-year historical data of rainfall is gathered from the methodological station at Amphoe Muang, Amphoe Bo Ploy, Amphoe Panom Tuan, and Amphoe Lao Kwan in Kanchanaburi province.
- Information of runoff quantity is collected from the water station at Amphoe Ta Muang in Kanchanaburit province.

(2) Water consumption within one year: sources of information consist of:

- Number of population (person)
- Rate of usage per day (liter)

(3) Expected future water use: information includes

- Year for prediction
- Total population in the current year (2008)
- The average rate of population change
- Number of years for prediction
- Number of population in the starting year
- Number of year between the initial to the current year

(4) Quantity of water use in various activities in the community

(4.1) Water use for agriculture outside irrigation areas, the information consists of:

- The coefficient values of different types of plants
- Values of the water use of plants based on Penman-Montieth formula (millimeter)
- Water seepage in the field (millimeter/day)

- Plantation areas (rai)
- Plan for agricultural extension from Amphoe Huaikrachao Office of Agriculture, Kanchanaburi province

(4.2) Water use for livestock, the information includes:

- Number of livestock in the community from Amphoe Huaikra-chao Office of Livestock.
- Water consumption rate of livestock.

3.2.2 Questionnaires for community leaders, units, and local organizations: The questionnaire had 5 sections with 23 questions as follows:

- **Section 1:** Basic information of the interviewees consisting of 6 questions.
- **Section 2:** Water use of the community in the past, present, and the future covering 4 questions.
- **Section 3:** Problems and demands relevant to water resource development and management of the community comprising of 6 questions.
- **Section 4:** Concepts of technology and proper water management for the community consisting of 3 questions.
- **Section 5:** Success factors and important obstacles covering 4 questions.

3.2.3 Issues for group discussion and public forum: This part is being used to understand the condition of water use in the past, present, and the future. There are 5 issues as follows:

- (1) Reasons of land use change, water characteristic, and cost of production and investment are taken into consideration.
- (2) The water use and technological development in the community, conditions of the area, types of plants being

grown, numbers of rai, water utilization, equipments, formats on how to use water for farming, how to bring water into the field, tools, and patterns are taken into account.

- (3) Community water management are examined.
- (4) Co-maintenance and co-utilization are taken into account.
- (5) Understanding in water conservation is also considered.

3.2.4 Issues for public forum in order to develop the proposal and patterns of co-management in water resource:

- (1) Situations analysis of the community in the past, present, and future.
- (2) Analysis of stakeholders' demand, necessity and opportunities.
- (3) Findings of capacity and strength of the community in water planning and management through community participation.
- (4) Development of concepts and patterns of co-management in water resources for the community.
- (5) Planning and organization establishment for effective water management for the community.

3.2.5 Process of public forum:

- (1) Introduction: the researcher had to do self-introduction and inform the objectives of the forum before providing all participants major information of the community. This action creates an atmosphere of familiarity and tension-free (20 minutes spent).
- (2) Thoughtful information: the researcher showed water situation, demand, and community future trend by power-point show or illustrations in order to let the participants think and analyze along with the information

(30 minutes spent). In addition, the researcher showed a video of water management at Lim Thong village (15-20 minutes spent).

- (3) Brainstorming: In order to share ideas among themselves, the researcher divided all of them into 2 sub-groups (10 persons in each group). Later, the researcher raised questions as to let them discuss important issues by drawing pictures, symbols or other illustrations. Those issues were:

- Problem situations
- Technology development and proper innovation: possible methods
- Effective water management
- Proper water management plans for community
- Establishment of water management organization
- Knowledge management in water management

This step of action took 5-10 minutes to explain the issues and 40 minutes for the brainstorming.

(4) Proposing results: two groups proposed their outcomes and let anyone who wanted to ask questions and provided comments (each group spent 15-20 minutes).

(5) Conclusion: the researcher concluded major issues of all the above process (15-20 minutes spent).

Remarkably, the researcher took notes, sound record, and photos with the help of two research assistants.

3.3 Data validation

For the accurate calculation of current water quantity and demand, the researcher directly examined the statistical information from the Royal Irrigation Department. And for the qualitative data gained especially from the in-depth interview, the researcher employed triangulation method for data reliability.

3.4 Data analysis

Concerning to the qualitative data, the researcher categorized and identified data before doing content analysis, and later interpreting and synthesizing main issues. For the quantitative data like water demand and supply, the researcher employed different calculations as follows:

- (1) Water balance is the natural changes of water, which exists from the required water for human activities taken from the available water. The formula can be shown as:

$$\text{Water balance} = \text{Water availability} - \text{Water requirement}$$

Where:

Water availability is water quantity available for use. The data is gathered from the meteorological and hydrological data analysis of river basins.

Water requirement is the amount of water needed for human activities.

- (2) Water quantity needed for utilization and consumption within a year. The formula is as follow:

$$\text{Water demand} = \text{total population (people)} * \text{the rate of water use (liter/day)} * 365/1000 \text{ (Cubic meter/year)}.$$

(3) Future trend of water use

The calculation of water demand of the current and increasing population in the future is based on the abundance of water resource available for each community. In the community where they are able to manage water sufficiently, the demand for water use is approximately 60 liter per person per day. Therefore, the calculation on water demand for current and increasing population which are likely to increase can be calculated by the formula from National Statistical Office. The calculation formula is shown as follow:

$$P_n = P_o \frac{(1+r)^n}{100}$$

Where P_n = Estimated number of population in the examined years

P_o = Number of population in the current year (2009)

r = Change ratio on the average populations (%)

n = Number of years for prediction

$r = [\text{Ln}(P_n/P_o)/t]*100$

Where r = Change ratio on the average populations (%)

$\text{Ln} = \text{Log}_e$

P_o = Number of population in the calculated year (8 years back to the year 2002)

P_n = Number of current population (in the year 2010)

t = Number of years between the calculated and the current years.

(4) Quantity of water use for community activities

(4.1) Water use for agricultural purpose outside irrigation areas

The water demand for agriculture is needed for plantations. Since plants need water to grow, the study will focus on water quantity used in nature, evapor-transpiration, and water seepage. The assessment is examined through the referral water use, usable rainfall, seepage rate, and water use for field preparation.

However, the study area is located inside the rain-fed zones. Therefore, the water that the plants need might be obtained from the rainfall. Therefore, the calculation on water demand for the area outside irrigation zones could be found from the water use for agriculture referred by Wiboon Boonyatharokul (1983). The formula is shown as follow:

$$\text{CWR} = [(Kc \times ETo) + P] \times 1.6 \times \text{Area}$$

Where CWR = Water demand for agriculture outside the irrigation areas

Kc = Coefficient value of each plant

ETo = Water use value referred by Penman-Montieth formula
(millimeter)

P = Infiltration rate in the field (1 millimeter/day)

Area = Plantation areas (rai)

Regarding to the agriculture areas in the future, the data of agricultural area expansion from Huaikrachao Office of Agriculture, Kanchanaburi province is being examined.

(4.2) Water use for livestock includes: (Pramote Maiklad, 1992; Mansin Tantullavej, 1983)

(1) Cattle, Buffalo	50	liter/head/day
(2) Pig	20	liter/head/day
(3) Chicken	0.15	liter/head/day
(4) Goat, Sheep	5-15	liter/head/day