A MODEL OF ENVIRONMENTAL EDUCATION FOR WATER RESOURCE MANAGEMENT IN RURAL COMMUNITIES

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Thesis
entitled

A MODEL OF ENVIRONMENTAL EDUCATION FOR WATER RESOURCE MANAGEMENT IN RURAL COMMUNITIES

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ABSTRACT

The objectives of this research were to 1. study the water resource situation and management in rural communities, 2. create a water resource management model, 3. study the possibility of a created model and the possibility of participation in solving water shortage problems of people in rural communities.

There was qualitative research undertaken by creating the water resource management model. The researcher analyzed the objectives of the National Water Policy, which aimed to systematically manage all human activities related to the importance, value, and attributes of water. The researcher compiled, analyzed, and synthesized water-related activities into four activities consisting of 1. Allocation: A, 2. Development: D, 3. Maintenance: M, and 4. Application: A. After that, the researcher created the water resource management model using four activities. As water is wastefully used, humans have to repetitively comply with four activities. Therefore, the water resource management model is named the ADMA Cycle. The research tools were observation, query, record, analysis, and synthesis.

There was quantitative research by studying the possibility of a created model and the possibility of participation in solving the water shortage problems of people in rural communities. The researcher used the questionnaire to ask the sample group, consisting of 400 household leaders in Chai-Badan district, Lop-Buri Province. Statistics used for data analysis were percentage, mean, the highest value, and Pearson's Correlation Coefficient. The research results show that most of the sample group agrees with the ADMA Cycle. It is highly possible for the sample group to participate in solving the water shortage problems. As for the water situation, the researcher found that almost half of the sample group faces water shortage problems. The important obstacle, which make people unable to solve the problems is a lack of leaders.

Research recommendations are as follows; Apart from rural communities, all groups of civil society are able to use the ADMA Cycle for water resource management. All humans have water-related activities and the government is able to establish new four agencies using the activities of the ADMA Cycle, which will enable the people concerned to clearly understand their duties and proactively work together.

KEY WORDS: WATER SHORTAGE/ FLOOD/ WATER RESOURCE PROBLEMS/ COMMUNITY/ RURAL/ SELF-RELIANCE

183 pages

รูปแบบสิ่งแวดล้อมศึกษาเพื่อการจัดการทรัพยากรน้ำในชุมชนชนบท

A MODEL OF ENVIRONMENTAL EDUCATION FOR WATER RESOURCE MANAGEMENT IN RURAL COMMUNITIES

ยิ่งศักดิ์ นิติสิงห์ 4836873 SHED/D

ศษ.ด. (สิ่งแวดล้อมศึกษา)

คณะกรรมการที่ปรึกษาวิทยานิพนธ์: ภัทรบูรณ์ พิชญไพบูลย์, ศษ.ด., วีร์ ระวัง, ศษ.ด., พรธิดา วิเศษศิลปานนท์, ปร.ด.

บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์ 1. ศึกษาสถานการณ์และการจัดการทรัพยากรน้ำในชุมชนชนบท 2. สร้างรูปแบบการจัดการทรัพยากรน้ำ และ 3. ศึกษาความเป็นไปได้ของรูปแบบที่สร้าง และศึกษาความเป็นไปได้ของการมีส่วนร่วมในการแก้ไขปัญหาการขาดแคลนน้ำของคนในชุมชนชนบท

การสร้างรูปแบบการจัดการทรัพยากรน้ำเป็นการวิจัยเชิงคุณภาพ โดยผู้วิจัยได้วิเคราะห์วัตถุประสงค์ของนโยบายน้ำแห่งชาติในภาพรวม พบว่าหมายถึงการบริหารจัดการทุกกิจกรรมของมนุษย์ที่เชื่อมโยงกับความสำคัญ คุณค่า และคุณสมบัติของน้ำไปพร้อมกันอย่างเป็นระบบ ผู้วิจัยได้รวบรวมกิจกรรมของมนุษย์ที่เชื่อมโยงกับน้ำ แล้วนำมาวิเคราะห์และสังเคราะห์ได้ 4 กิจกรรม ประกอบด้วย 1. กิจกรรมสรรหา (Allocation: **A**) 2. กิจกรรมพัฒนา (Development: **D**) 3. กิจกรรมรักษาไว้ (Maintenance: **M**) และ 4) กิจกรรมการใช้ประโยชน์ (Application: **A**) หลังจากนั้นผู้วิจัยได้นำกิจกรรมทั้ง 4 มาสร้างเป็นรูปแบบการจัดการทรัพยากรน้ำจากการที่น้ำเป็นทรัพยากรที่ใช้สิ้นเปลือง ทำให้มนุษย์จำเป็นต้องปฏิบัติตามกิจกรรมทั้ง 4 ซ้ำเป็นวัฏจักรไม่มีที่สิ้นสุด ดังนั้น รูปแบบการจัดการทรัพยากรน้ำที่สร้างจึงได้ชื่อว่า วัฏจักร ADMA เครื่องมือที่ใช้ ประกอบด้วยการสังเกต การซักถาม การจดบันทึก การวิเคราะห์ และการสังเคราะห์

การศึกษาความเป็นไปได้ของรูปแบบที่สร้างและการศึกษาความเป็นไปได้ของการมีส่วนร่วมในการแก้ไขปัญหาการขาดแคลนน้ำของคนในชุมชนชนบทเป็นการวิจัยเชิงปริมาณ ศึกษาโดยการสอบถามหัวหน้าครัวเรือนในอำเภอชัยบาดาล จังหวัดลพบุรี จำนวน 400 ตัวอย่าง ด้วยแบบสอบถาม สถิติที่ใช้ในการวิเคราะห์ข้อมูล ได้แก่ ค่าร้อยละ ค่าเฉลี่ย ค่าสูงสุด และค่าสัมประสิทธิ์สหสัมพันธ์ของเพียร์สัน ผลการศึกษาพบว่ากลุ่มตัวอย่างส่วนใหญ่เห็นด้วยกับวัฏจักร ADMA และมีความเป็นไปได้สูงที่กลุ่มตัวอย่างจะเข้าร่วมแก้ไขปัญหาการขาดแคลนน้ำ ในด้านสถานการณ์น้ำพบว่าเกือบครึ่งของกลุ่มตัวอย่างประสบปัญหาการขาดแคลนน้ำ และอุปสรรคสำคัญที่ทำให้ยังไม่สามารถแก้ไขปัญหาได้ เกิดจากการขาดผู้นำในการแก้ไขปัญหา

ข้อเสนอแนะจากงานวิจัย นอกจากชุมชนชนบทแล้ว ทุกกลุ่มประชาสังคมสามารถนำวัฏจักร ADMA ไปประยุกต์ใช้จัดการทรัพยากรน้ำได้เช่นกัน เพราะมนุษย์ในโลกล้วนมีกิจกรรมที่เชื่อมโยงกับน้ำเหมือนกันทั้งหมด รวมทั้งรัฐสามารถนำกิจกรรมตามวัฏจักร ADMA ไปจัดตั้งเป็น 4 หน่วยงานใหม่ได้ด้วย โดยจะช่วยให้ผู้ปฏิบัติงานเข้าใจในหน้าที่งานของตนได้ชัดเจน และส่งผลให้สามารถปฏิบัติงานในเชิงรุก

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CHAPTER I
INTRODUCTION

1.1 Background and Significance of the study

Water is the only one substance species which occurred in the three states consisted of liquid, solid and gas. Moreover, it can receive and transmit heat, plays an important role in maintaining the temperature of the atmosphere to some extent. (GWF, 2535: 7).

For such natural phenomena, water is the only one resource that can rotate itself so no end. When the sun shines on the earth, the ocean water evaporates and rising to the sky, because water vapor is lighter than the air. Whenever the water vapor upraise to the sky, it will condense its selves to be water droplets and add up to a "cloud". After it gets the cool, it condensed into water droplets falling onto the earth and called the "water". Then it is heated by the sun, and evaporation of water to float above it. When water vapor and clouds gathered in the cold, it condenses into water droplets. This process occurs continuously throughout the current cycle, the water cycle; the water formed on the earth's surface is uneven.

Water is a compound found as many as three in four parts of the earth's surface. The most status of water, about 97 percent found in salt water in seas and oceans, about 2 percent is the polar ice and the freshwater in rivers has about 1 percent. The features cannot survive, if the earth lack of water.

His Majesty the King addressed about the importance of water that "The main thing is we need water for consumption, for crop production because life is there. If there is water, man can survive; without water, man cannot survive. Without electricity, man can also survive. If there is electricity but no water, man cannot survive." (ORDPB Office, 2547:74).

Addressed at Chitralada Palace,

March 17, 1986.

Water and the state mission

1) The national water vision

The Cabinet's resolution on July 25, 2000 stated that the vision of water resources by the year 2025 Thailand will have sufficient water quality. The management of water resources in the legal system which is fair considering the quality of life and sustained involvement of all levels. (Cabinet, July 25, 2000).

2) The national water policy

The policy was voted by the cabinet on October 31, 2000 for approval. The national water policy launched as:

(1) The Water Resources Act would be accelerated as a law in the management of water resources of the country by reviewing and updating existing legislation. Not only the law enforcing would be expedited the process so that it can lead to effective use but to consider revising the laws and regulations related to compliance as well.

(2) The organization for water management would be provided at the national level, the watershed level and the local levels with the law. The national organization is responsible for policy direction and coordination of the policies into action. The watershed organizations and the local level would take part in responsible for the management of water in the river basin management plans. Moreover, the stakeholders have been involved**.**

(3) To provide an efficient and sustainable water use, the reasonable and fair allocation of water for use in various fields and to meet the basic needs of agriculture and consumer goods would be emphasized base on the priority of the water use in each area. Under the rules of water distribution and the water are responsible for the service, it would be depended on the ability of the client and the service levels.

(4) To provide water supply reasonable cost, efficiency using and sustainable water use, the clear direction in the water supply and water resources development would be set for the quality of all activities with regard to the conservation of natural resources and other relevant matter.

(5) As with the basic services of the other side, the water supply would be provided with acquisition and development of water resources for

agriculture to farmers equally and fairly to meet the basic needs of agriculture and consumer goods.

(6) To achieve gaining awareness of people, the water knowledge curriculum would be adopted in all level. The people should have not only the value of water, understand the importance of using water efficiently but also the need and obligation to maintain the natural environment and water resources that are created.

(7) To encourage and promote participation, the form of participation would be set up promoting clearly the rights and obligations of NGOs and government agencies. Moreover, to manage water resources effectively, the management of water resources should be cleared about the water use, the responsibility, conservation of water resources and the monitoring water quality.

(8) The planning to accelerate relief and flood and drought problems should be provided such as the alarm, the guidelines for disaster relief and reconstruction after disasters effectively and fairly with regard to the use of land and related resources.

(9) For implementation, supporting for policy action plan should be provided as well as research, public relations, to gather information and technology transfer on water and the public adequately.

National water policy that covers all these aspects is the integrated water management (Integrated Water Resources Management: IWRM). The national water related to this research is to create awareness and raise awareness of the necessity and duty of care, the environment of water, nature highlighting the involvement of the community, expedite a solution to flooding and drought and financial support for research.

3) The national water agenda

On May 21, 2007, the Prime Minister Surayud Chulanont has launched the national water agenda at the Santi-Maitri Building, the government house. The year 2007 was declared as a national agenda for all organization such as the government, NGOs, academic institutions, river basin organizations and the general public should realize the importance and participation in water management gaining efficient, fair

and sustainable, (Water Resources Department, 2007). The essence of the meeting was as follow:

(1) To solve the lack water problem, every village must has a water supply system. The industrial estates, the attraction area, the important economic area and the farmers should have enough water supplies.

(2) To modify and mitigate flooding, not only all areas of the community and local economy should have the flood protection system but also should have warning systems in risk areas.

(3) All areas getting sewage should be fixed for water quality is satisfactory.

(4) For the water management, not only the organization development, setting the law, database system but tools and mechanisms for managing water resources should be provided as well. The water supply should be provided for communities with fairness and sustainable. The communities not only could develop self-reliance and social solidarity in the water between basins but also have opportunity for all sectors to participate and play a role in conservation, utilization and management.

A state ceremony

In the past, water took part in many important roles in state ceremonies, such as water Abhisek royal coronation, the secret of water to declare independence of King Naresuan the Great, and the Royal Kathin waterway at Wat Arun etc.

Water and the Thai way of life

Water is a symbol of purity, moisture and shade. It and its stream bound to the Thai way of life dating all ages from birth to death through religious rites, cultural, traditions, transportations and the settlers had started in the first place, such as bathing the baby after birth. So water is the first kind of resource that is used for infants. The mother's milk is baby's first meal of the whole world. When babies grow up to be just an aged marriage ceremony with conch water. It has been a partner also committed to living in Thai as well as to sprinkle holy water and sacred ceremony and Loy Kratong festival. Thai people has believed the spread of the water to pour water called

Dumhaw in Songkran festival, competitive rowing. When people died, water was used watering down on his hand etc.

However, nowadays, many countries in the world, including Thailand, water resources are scarcely.

Water supply problems of the world

In the recent time, it found that the world population is facing a shortage of water problems for the consumer. These problems are focus by scientists and scholars of the environmentalists. It was predicted that the water problem is severe crisis in this century. It has to keep in mind that a world population of around 1,100 million people continues to drink tap water. Each year the world's population, approximately 2 million people died of disease caused by a shortage of clean drinking water. The world population is not less than 2,400 million people worldwide lack water sanitation is poor. The water consumption is sufficient to provide the necessary (Department of Water Resources, Surface Water, 2007: 12)

Water supply problems of Thai farmers

The department of Water Resources (the same volume: 13) presented that the problem of water shortage in the country in 4,762 million cubic meters/year consist of a shortage of agricultural water to 4,691 million cubic meters a year (99% of the absence. water in the country). The volume of water in the basin of northern and central regions of Thailand was 2,576 million cubic meters a year. Considering the river basin, the scarcity of water was the Moon river basin will facing the most water shortage problem with 0.94 million cubic meters/year. In the next 20 years, it is estimated that the amount of water scarcity in the country will increase to 9.182 million cubic meters a year. The estimate that the most water shortages will occur in northern and central basin is 5,414 million cubic meters a year. On a separate area, it found that the Chao Phraya River basin will facing the most water shortage problem with 1,408 million cubic meters a year while in the Pattani River basin and the Tapi River basin will facing a little water shortages problem.

To solve such problem efficiency, the cause of the problem should be solved first.

The causes of water scarcity

Pramote MaiKlud (1993) has summarized that the major causes of water scarcity as follow:

1) The forest and watershed destruction is the main causing the upstream area of the source water, no forest or absorb water helping slow down the rainwater to seep into the soil to retain as much as before by rivers, streams. There is no water in the dry season with this problem.

2) No rain in the rainy season; rain was not uniformly distributed rainfall during the rainy less.

3) The lack of surface water storage reservoirs; as a result of social conditions and harsh terrain or an obstacle for development.

4) Due to the growth of the country and population increase, the amount of water used for agriculture and consumer goods for use in various activities is more preferred.

5) The water storage reservoirs were flattened then water consumption for the crop cannot be stored such as canals, ponds and streams and shallow ponds in the invasion. Then, there is not enough water throughout the year.

6) Wasteful used of water of the people.

The reason why research the shortage of water resources in rural communities

To fulfill his Majesty the king Rama 9’s commitment, therefore he said. "Our economy depends on agriculture since time immemorial it. Income countries that used to grow are the most income from agriculture. We could say that the prosperity of the country's prosperity relies on agriculture as a key" (Office of Special Projects due to the initiative, was the developer, 2005: 95).

To meet the objectives of the Constitution of the Kingdom of Thailand, A.D. 2007as follow;

Section 66 "Which people who together make up the community, the local community, or local communities shall have the right to manage, maintenance and utilization of natural resources and environment."

Section 67 "Individuals have the right to engage with the public and communities for conservation, maintenance and exploitation of natural resources and biodiversity. Not only to protect, promote and maintain environmental quality but also to living a normal life, the environment will not cause harm to human health, welfare or quality of their lives. It should be protected by appropriate"

Section 87 "The state shall implement a policy on the participation of people as follows; 1) Promoting public participation in policy formulation and planning economic and social development in both national and local level", etc.

According to the National Water Agenda, the significant part of the statement stated that "The objections of water management were for adequate community water consumption, fair and sustainable water allocation and to develop self-reliance and social solidarity in the water between the basins"

However, more than 20 years ago, Thai farmers have suffered through a drought.

This research is the part of the curriculum in environmental education. It focused on the growing environmental awareness and encourage communities to work together to help conserve and improve the environment. Researcher wishes to participate in solving problems of water resources by the environment study. The research's dates would be analyzed and synthesized by the researcher to create a model for water resources management.

The study area

The documents were reviewed on the drought situation in the province of Lop Buri. The researcher collected data of the natural environment in Lop Buri province, including soil, water, air, plants and animals. Furthermore, the education about environmental cultural conditions, traditions community, professional and community leaders were collected to find out the nature of the community. In addition, exchange ideas on what to study for the issues of water resources was held. It was found that Lop Buri is a province that suffered through the drought. The majority of agriculture area at Chai Badan district is almost all rained area. In the past, farmers have enough water for cultivation. But about 20 years ago, farmers began to lack of rain water. This issue has not been solved thoroughly. Some farmers are also facing water shortages. As a part of problem solutions, researcher wishes to conduct research in this district.

1.2 Research objectives

The Integrated Water Resources Management (IWRM) under the National Water Policy has been adopted as regulation for water management in Thailand. This means that most scholars manage all aspects of water along a system. The objective of this analysis means that the water management in all human activities related to water together in a systematic way. To meet the national water policy, in this study, the collection of human activities related to water was conducted. The data were collected and analyzed to identify the event details then the synthesis and activity to the activity were done. It led to the creation of synthetic forms of water management. The researcher wants to create a model. Due to the model shows an overview and links to all the obvious things clearly, this will facilitate its implementation.

1.2.1 To study water resource situations and management in rural communities.

1.2.2 To create a water resource management model.

1.2.3 To study the possibility of water resource management created model and possibility of participation in solving the water shortage problems of people in the rural communities.

1.3 Scope of the study

1.3.1 The research was conducted in Chai badan district, Lop Buri, except for the municipality area.

1.3.2 The research content included water management, agriculture and households of the community.

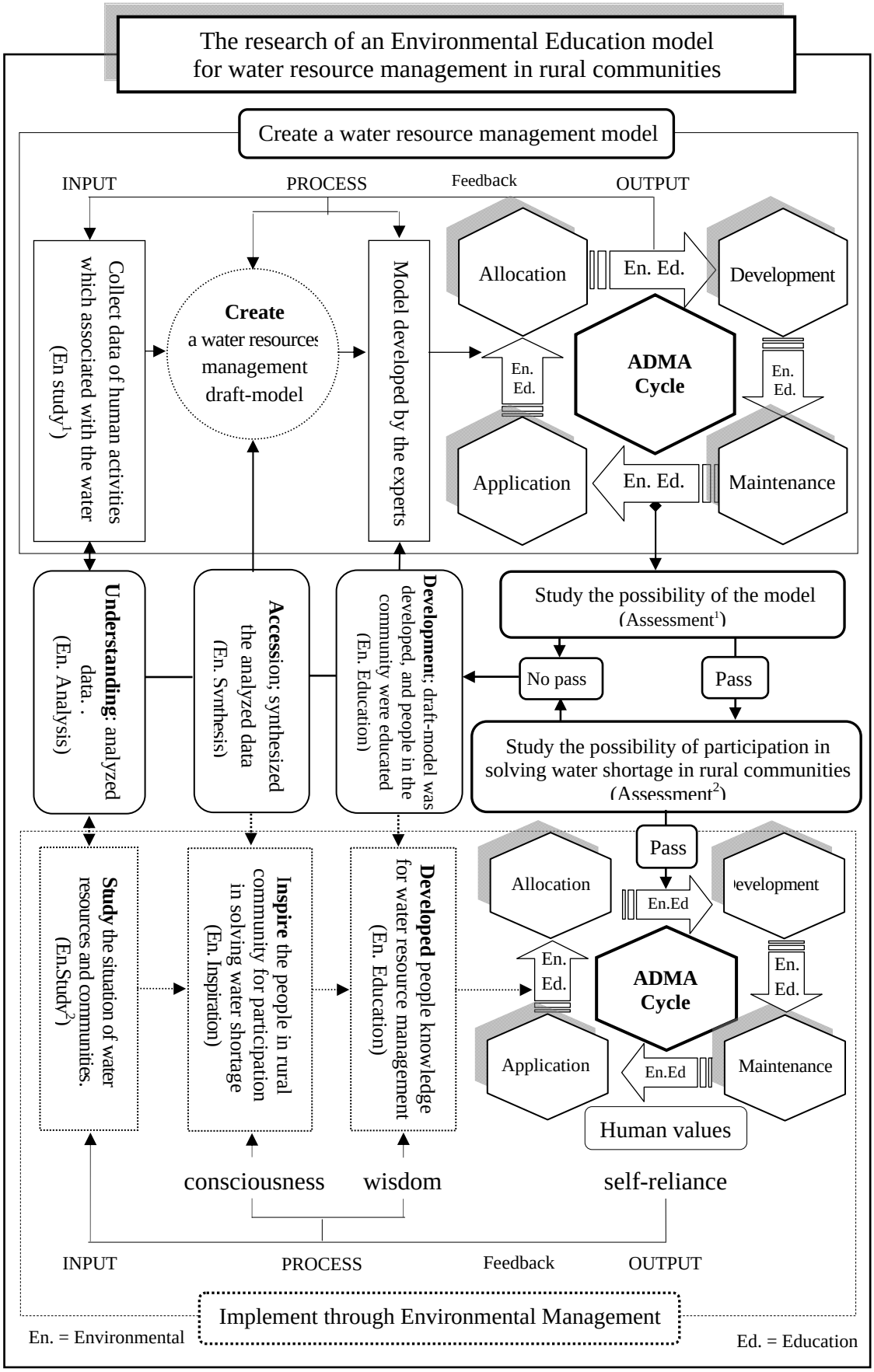
1.3.3 The research was conducted by the households in the Chai Badan district, Lop Buri province, except for the households in the municipality area.

1.4 Research conceptual framework

The most scholars have agreed that The Integrated Water Management launched in The National Water Policy which stated that "The management of water

all along the way together." The researcher analyzed the management of water, according to scholars, refers to water management in all human activities related to water along the way. Then the water management model has been built in accordance with the national water policy. After collected data of human activities on the water, the Conceptual Framework was created.

In addition, this study proposes a conceptual framework for the management of water resources in rural communities to whom interested in model application.


The research of an Environmental Education model
for water resource management in rural communities
Create a water resource management model
INPUT
PROCESS
Feedback
OUTPUT
Collect data of human activities which associated with the water (En study1)
Create a water resources management draft-model
Model developed by the experts
Allocation
En. Ed.
Development
ADMA Cycle
Application
Maintenance
Understanding: analyzed data. . (En. Analysis)
Accession; synthesized the analyzed data (En. Synthesis)
Development; draft-model was developed, and people in the community were educated (En. Education)
Study the possibility of the model (Assessment1)
No pass
Pass
Study the possibility of participation in solving water shortage in rural communities (Assessment2)
Study the situation of water resources and communities. (En.Study2)
Inspire the people in rural community for participation in solving water shortage (En. Inspiration)
Developed people knowledge for water resource management (En. Education)
Pass
En.Ed
Human values
consciousness
wisdom
self-reliance
Implement through Environmental Management
En. = Environmental
Ed. = Education

The Environmental Education model for water resource management in rural communities consists of as follow;

1. To create a water resources management

2. To study the possibility of the created model

3. To study the possibility of participation in solving water shortage problems of people in rural communities

4. The model applied in rural communities through environmental management

For the details of each step, it was depicted as follow;

1. To create a water resources management; it was done with the following order.

1.1 Finding the source of the structure

A better model would come from a reliable structure. In addition, the reliable structure would come from reliable sources. In the form of water resource management, the National Water Policy Research would be adopted as a major consideration. By providing a summary of national policy, the source of the structure would be used to create the patterns. Many scholars have concluded a National Water Policy 9 (detailed in Chapter 1, "a mission of the State") that represents all aspects of water management together in a systematic way. Whereas, it was no explanation as to what this entire means. Researcher analyzed the meaning of human activities related to water. The definition would be used as a source of structure-based model.

1.2 The study and collection of human activities related to water (Environment Study[1]) were collected from the documents, related researches. Furthermore, the field study and monitoring were conducted. Then the data were analyzed by an ill-considered carefully to achieve understanding (Validity) of such factors as the relationship of human activities related to water. The idea of such a result, think of to find fault I think the relationship is a chain. Not only It was focused on the cause identify and reflective elements but also it was considered the conditions and relations of the causes of human activities related to the properties of water.

1.3 The model was constructed using the related human activities associated with water features that were fused together (Environment Synthesis) and group activities. After the activity, each group created a model for water resources management.

1.4 The model development stage; the model was created to obtain instructions from the 3 groups of 3 persons, including a group of experts, the scholars of the country and the leader in the research area. Finally got a developed model is named the ADMA cycle consisting of Allocation: A, Development: D, Maintenance: M, and Application: A.

2. To study the possibility of a created model (Assessment[1])

The ADMA cycle possibility study; through the population research which are the households in the Chaibadan district. Lopburi province. Study by asking about the implement of such the ADMA cycle. If the result of "pass" the population of the majority opinion, it would be on going adopt. After that the possibility of involvement in solving water supply problems of the people in the rural community would be assessed. If the results were "no pass" it must be gone back to check for completeness and accuracy of the ADMA cycle through the Input, Process and Output. The Karun's theory of justice "understand access and development" would be used as the tool for verification.

3. To study the possibility of participation in solving water shortage problems of people in rural communities (Assessment[2])

A study of participation in solving the problem of water scarcity in rural communities through their study population would be applied. If the results of the study show that it is possible to share the rural water supply problems by themselves, it would be used to implement in such area. On the other hand, if it does not pass the assessment, it have to go back to check the completeness, accuracy, and the business cycle, ADMA via input (Input) process (Process) and output (Output). The Karun's theory of justice "that the development" would be used as the tool for verification.

4. The model applied in rural communities through the process of environmental education (Environment Management)

Step 1; the Environment study: a study of water resources and community issues (Environment Study[2]) through the data obtained from the analysis (Environment

Analysis) in order to understand the cause of the problem of water resources and opportunities for local people to participate in the solution.

Step 2; the spark of inspiration: the results of the analysis, synthesis to provide access to the spark of inspiration (Environment Inspiration) to the community to participate in the water resource management.

Step 3; the development of knowledge: the people who were interested in joining the management of water resources studied the details of each activity under the Water Resources Management (ADMA Cycle). After that, the participants would be grouped into 4 groups according to their preferences and needs. This includes the allocation activity group, the development activity group, the maintenance activity group and the application activity group. Next, each group learns the mission of the group. Then the study of relevant documents, listening to lectures by academics and scholars. Then, studying with practical work place in order to know how deep and real would be provided.

For the implementation, it should be happy and enjoy working as the teachings of Buddhadasa Bhikkhu the researcher has adopted. "Human Values" which include behave like a real peace, love and mercy and not hurting others would be used in the operations as the principles.

1.5 Research definitions

1.5.1 The general definition

1) Water means fresh water.

2) Water resources means water used for agriculture and households.

3) Water used in household means potable water and water used for household.

4) Agricultural water means water used for agricultural cultivation and animals.

5) Runoff water means water in rivers and streams.

6) The too less water situation means the situations those Thai farmers have the cultivated water less than their needed; cause of the human activities to lack of the forest abundant; lead to the forest lost the ability to release water in the dry season.

7) Drought means the situations those Thai farmers severely face to water shortage problem; cause of the El Nino occurred.

8) The drought problem means "too less water and drought".

9) The too much water situation means the situations those Thai farmers have the cultivated water more than their need; cause of the human activities to lack of the forest abundant; lead to the forest lost the ability to absorb water.

10) Flood means the situation those Thai farmers have much cultivated water more than their demand; cause of the La Nina occurred.

11) The flood problem means "too much water" and "flood".

12) The repeated of drought and flood situations refer to the occurrence of too less water and too much water for more than 10 consecutive years.

13) The water resource problem means the problems those Thai farmers suffered from the drought and flood.

14) Reuse means the activities that helping to save water with the introduction of water used in the activity to the next activity without reducing benefits.

15) Recycle means the activities that the water used in the improvement of quality to achieve the desired water quality.

16) Water use suitable for activities means used of lower quality water which creates the same benefits as better quality water.

17) The Community refers to a group of community residents who live together or scattered having intercourse communication, the cooperation and dependence. There are similarities in the profession, culture and local wisdom. Their spirit and commitment to their area, changes relatively slowly and under the same regime.

18) The rural refers to a rural location outside the municipality or Special Administrative Region (SAR). The most people who settled in such places as farmers.

19) The research area means the Chai Badan district, Lopburi province area, outside the municipality.

1.5.2 Operation Definition of Terms

1) Allocation means the selection of the activities that make up an increasing the quantity of water, not including the water storing.

2) Development (in the case of water resource) means the selection of the activities that make up an achieving the quality of water.

3) Maintenance means the activities of water storing for solving drought and floods as well as to maintain the quality and quantity of water.

4) Application refers of water supplying and water draining as well as the activities to useful for the own users and to indicate the awareness of the water resources value.

5) Understanding means to know the cause of the drought and flood problems, that are the result of data analysis, the document related researches and research areas.

6) Accession means to access the methods of drought and flood problems solving as well as to inspire the community to work together to solve water problems of drought and floods.

7) Development (in case of the water resource management model) means to develop the water management draft-model and (in case of the model implement) means to improve the knowledge of water resources management of people in rural community.

8) The ADMA Cycle refers the water resource management model aims to support the demand of the national water policy; consist of the activities of allocation, development, maintenance and allocation.

9) Consciousness means being aware of their negligence aims to find the way to prevent drought and floods.

10) Wisdom means the right way to manage the water resources.

11) Self-reliance means the good inspired of the rural community *to continue to perform their duties* the common problem of water resources in the community, *their full capacity, the unconscious conscious, intellectual cognition, with honesty and sincerity. It sake of the common is better than the other.* (Royal remark of His Majesty the King Rama 9)

1.6 Usefulness of the research

1.6.1 To fulfill the promise of His Majesty the King. His commitment to resolve the water problem for farmers in rural areas throughout Thailand would be adopted.

1.6.2 To get the water management model for supporting the national water policy.

1.6.3 To know the problems, suggestions and solutions for water resources in rural communities.

1.6.4 To approach the model implement in rural communities, it would be applied for the benefit of interested parties and agencies or to study further.

CHAPTER II
LITERATURE REVIEW

The water resource management model in rural communities' research. The researcher reviewed literatures, theories, related researches and related laws as followings topics:

2.1 The water management concepts and theories related

2.2 The environmental education concepts and theories related

2.3 Community Participation concepts and theories related

2.4 The theories underlying the research.

2.5 Related Researches

2.6 Related Laws

2.1 The water management concepts and theories related

Sadja Sethabuthra (1992:36) stated that there are 2 period of water management as follow;

1) Early Sukhothai-lately Thonburi era; the concepts of water management were "human should adept themselves to the nature". The migration of people toward to or away from water, as needed, for example, toward to the water for growing rice and away from water when flood.

2) Early Rattanakosin - Present era; the concept was focus on supplying, to bring water into the fixed areas such as digging the Rangsit canal, built reservoirs and expansion of irrigated areas.

Food and Agriculture Organization of the United Nations (FAO,1993:341) stated that the concepts and methods of providing clean water and hygiene for the rural poor was very important, by as the following;

1) The National water policies should be provided budget and more widely available.

2) The technology provided should suitable.

3) The proper way to restore the damage. You can determine how to handle it correctly.

4) The right of people to use the community water and sanitation.

5) IT should be provided for the monitoring and assessment system.

6) The water supply and sanitation in rural areas should be developed with the appropriate institutions for the efficient management and the amount used.

7) Educate about health and how to get of germs should be aware.

8) The suitable wastewater treatment technology should be provided.

9) The environments verify instrument should be provided to control the spread of insect pathogens.

The European Environment Agency (EEA, 2009: 46) launch the process to relieve result of drought by using the efficient instrument and implement and giving positive attitude to change “critical” to “opportunities”.

World Bank (1993: 12) determined the guidelines for the management of water resources as follow;

1) Industrial sector; focus on water conservation and surface water protection. For many industrial experiences, they comment that pollution control and pesticide residues could be decrease the amount water used.

2) Water supply and sanitation sector; focus on increase efficiency and access to water such service, including dirty water, water treatment and water benefit. The propose agenda items for the accessing to have water as much as possible.

3) Irrigation and energy sector; focus on building a dam at a cost, a drainage system, canal though all farmland, agricultural pollution control standards setting, plans for protecting ecosystems and water resources.

4) Environment and starvation solutions, should preserve the biological diversity, there are the plans to prevent ecosystem and water resource.

Carter Brandon, and Ramesh Ramankutty (1993: 151-153) determined the water management strategies as follow;

1) The operations should be run quickly as possible with all invest and real action technique not only for protection and preservation all remaining resources but the ecosystems that cannot be rebuilt as well.

2) The water policy and management strategy should be discussed and made decision.

3) To effective in practice, the law need to launch to enforce and all water involved institution be reconditioned.

4) Every according projects and plans should be done.

5) People would be capacity built as the most important resources in water conservation. They should keep all knowledge and capacities forever.

In conclusion, the water resources management should be managed in a holistic method that all human activities related to water simultaneously.

Thai farmers face water shortages every year. The growing trend both household and farming areas as shown in table 2.1

Table 2.1 Thailand drought situation statistics from 1989-2007

Year	Facing drought Areas					Damage				
	Province	District	Sub-district	Tambol	village	Suffer people			Animals	Cost (Baht)
						People	House-hold	Areas (Rai)		
1989	29	222	35	1,517	6,628	1,760,192	496,062	1,294,240	197	121,966,702
1990	48	253	41	1,490	7,234	2,107,100	536,550	1,970,703	872	92,170,601
1991	59	479	38	2,120	12,192	4,926,177	1,221,416	1,037,271	290	262,170,159
1992	70	676	43	2,410	25,766	8,100,916	2,430,663	5,334,471	417	176,180,163
1993	68	650	48	1,970	24,176	9,107,675	2,533,194	2,040,443	726	198,760,140
1994	66	645	40	2,360	29,191	8,763,014	2,736,643	17,923,817	510	98,762,160
1995	72	671	46	5,020	26,354	12,482,502	2,661,678	3,001,437	462	177,620,420
1996	61	588	44	4,125	21,067	10,967,930	2,277,787	101,900	573	289,164,000
1997	64	657	45	4.924	25,426	14,678,373	3,094,280	1,431,296	197	249,160,170
1998	72	698	52	4,170	18,902	6,510,111	1,531,295	1,789,285	1,107	69,170,111
1999	*58*	*568*	*42*	*3,197*	*16,170*	*6,127,165*	*1,546,107*	*3,144,932*	*980*	*1,520,500,651*
2000	59	584	49	3,754	20,593	10,561,526	2,830,297	472,700	2,071	641,712,873
2001	51	571	48	4,968	24,176	18,933,905	7,334,816	1,712,691	192	71,962,973
2002	68	640	69	4,489	25,299	12,841,110	2,939,139	2,071,560	0	508,781,944
2003	63	373	39	2,288	12,904	5,939,282	1,399,936	484,189	0	174,329,410

Table 2.1: Thailand drought situation statistics from 1989-2007 (cont.)

Year	Facing drought Areas					Damage				
	Province	District	Sub-district	Tambol	village	Suffer people			Animals	Cost (Baht)
						People	House-hold	Areas (Rai)		
2004	64	446	43	2,936	19,027	8,388,728	1,970,516	1,480,209	0	190,668,884
2005	*71*	*682*	*74*	*5,244*	*44,519*	*11,147,672*	*2,768,919*	*13,736,660*	*0*	*7,565,861,139*
2006	61	524	58	3,709	31,115	11,862,358	2,960,824	578,753	0	495,275,738
2007	66	669	0	4,344	34,874	16,754,980	4,378,225	1,350,118	0	198,304,732
Total						**181,960,671**	**47,648,347**	**60,956,675**	**8,594**	**13,102,522,970**

Source: Mitigation center; Disaster and mitigation Department 2007

Table 2.1 shows that during the past 19 years, there were the many areas faced the drought problem growing up. In 2007, there were 66 provinces got such problem. It was observed that some of the agricultural area has been damaged as many as 17,923,817 Rai in 1994. However, in 1996, the number dropped to just only 101,900 Rai, which differ significantly, as opposed to 175 as well. Then, what were the independent variables causes in changes of water for agriculture was the main question of this study.

For such analysis, Thailand located in the Southeast Asia where a tropical storm winds blow and so many variables that will result in changes of water for agriculture consist of: 1. The size of the forest areas; as the moisture from the larger forest areas is more than which from smaller one then the rain fall will fall over. 2. The integrity of the forest; the dense forests with biodiversity can produce dew more than that the sparse forests. The forests with an abundance of trees not only have many leaves, many plants but also have weeds that can absorb water. It can hold more water resources than that the infertile forest one. 3. The number and severity of the monsoon blown; it have been shown that the number and severity of the monsoon have effect on the rainfall in such areas.

The studies for 20 years have been shown that forest areas in Thailand were not significantly reduced. Then, the size of forest would be cut from the Independent Variable. On the other hand, the abundance of forest decline steadily over the past 20 years. It can be found that bald mountain in the north is increasing because of illegal logging in the forest continues. The number of trees, weeds, leaf litter and forest cover were reduced. As a result, the ability to absorb water into the wild with diminished. It is not surprising that in the past 7-8 years the Northern provinces such as Phrae, Nan and Uttaradit province have been faced flood and erosion disaster every year. Due to the ability to absorb water of forest decline, the amount of water from such forest in Thailand was reduced. As a result, forests have the potential to release less water in the dry season. It was found that in the dry season that farmers growing water scarcity. The lacks of water and flooding have caused farming in Thailand consecutively. It was said that all the rural communities have repeatedly faced with drought and flooding problems.

Under consideration, the lack of water in the dry season was took place every past 20 years related to the fertility of forest was cut down every year. In addition, the fertility of forest related to the capacity of storing and releasing water. This implies that the abundance of forest destruction is the beginning of the drought and repeated flooding. The agricultural areas have been damaged by the drought, there is a lot wrong in some years. As shown in table 2.1, it was found that it related to the El Nino phenomenon which brings fewer monsoons through the Southeast Asia and the north of Australia causes that areas face less water situation but the opposite side of areas as Peru, Ecuador and the northern America facing flooding. As it occurred from time to time, it can be implied that The El Nino phenomenon is not the nuisance Variable which aggravated the drought in agricultural areas.

In the present time, the rural communities not only facing the repeated drought and flooding but also facing their heavy flood disaster, in the end of 2011, the flood damaged in all sectors cost millions baht. From the review literature, it found that the nuisance Variable caused aggravated the flooding is La Nina phenomenon which bring many monsoons through the Southeast Asia and the north of Australia causes that areas facing more water situation but the opposite side of areas as Peru, Ecuador and the northern America facing the drought. It occurred from time to time as the El Nino phenomenon.

As the rural communities in Thailand faced the water resource problems from difference variables, in this study, the harsh lack of water for agriculture caused by the El Nino was defined as " the drought", the drought caused from declined fertility of forests was defined as "the too less water situation", the too much water for agriculture caused by the La Nina was defined as "the flooding" and the too much water for agriculture caused by getting more fertility of the forest was defined as "the too much water situation". With the classification previously, it can be concluded from the table 2.1 that only in 1994 and 2005 that "the drought" happened, for the rest years, it just "too less water situation" happened.

According to results of calling water situations according to said variables, the researcher is able to divide cultivation-related water situations into five situations as follows;

1) Drought means the situations those Thai farmers severely face to water shortage problem; cause of the El Nino occurred.

2) The too less water situation means the situations those Thai farmers have the cultivated water less than their needed; cause of the human activities to lack of the forest abundant; lead to the forest lost the ability to release water in the dry season.

3) Sufficient water means the situations those Thai farmers have suitable water for cultivation.

4) The too much water situation means the situations those Thai farmers have the cultivated water more than their need; cause of the human activities to lack of the forest abundant; lead to the forest lost the ability to absorb water.

5) Flood means the situation those Thai farmers have much cultivated water more than their demand; cause of the La Nina occurred.

As there are several situations of water for cultivation, it is necessary to have suitable measures for water management as shown in Table 2.2.

Table 2.2 Average suitable rainfall level per year for cultivation and management measures.

Rainfall for planting		**The problems level**	**Measures to manage**
Level	**Average per year (milliliter)**		
Mahidol V.5	over 40% more than Average	*Floods*	Prevention
Mahidol V.4	less 40% more than Average	*Over water level 4*	Solve
Mahidol V.3	less 30% more than Average	*Over water level 3*	Solve
Mahidol V.2	less 20% more than Average	*Over water level 2*	Solve
Mahidol V.1	less 10% more than Average	*Over water level 1*	Solve
Mahidol M	**average 1,400**	***Suitable water***	**Conservation**
Mahidol L.1	less 10% less than Average	*Less water level 1*	Solve
Mahidol L.2	less 20% less than Average	*Less water level 2*	Solve
Mahidol L.3	less 30% less than Average	*Less water level 3*	Solve
Mahidol L.4	less 40% less than Average	*Less water level 4*	Solve
Mahidol L.5	more 40% less than Average	*Drought*	Prevention

From the table, given that the rainfall for the cultivation of the average/ year 1,400 mm. and an increase of the average/ year 1,374 mm. of precipitation falling as the average between the years 2493 to 2540 (Committee on Natural Resources and Environment, National Legislative Assembly, n.d.: 17). However, the average rain fall (1,400/ year), and the difference in the degree to which the rate 10 percent of the criteria. Research musts continue to be true in related fields.

For the level earned “Mahidol” was the level of rainfall that will help farms, agencies involved can more easily understand the situation. As with all levels of an earthquake appropriate measures to deal with the situation in each case. It found that the too much water situation level 1- level 4 and the too less water situation level 1- level 4 can be solved by balancing the rain forests with the region. On the other hand, the flooding and the drought cannot be applied by the solve measures because of it caused by the natural phenomenon. However, it can be prevented as well.

In the same time there are natural disasters and you must stay by them. To happily live among these disasters, the researcher has established measures for the management of natural resources and natural disasters as figure 2.1;

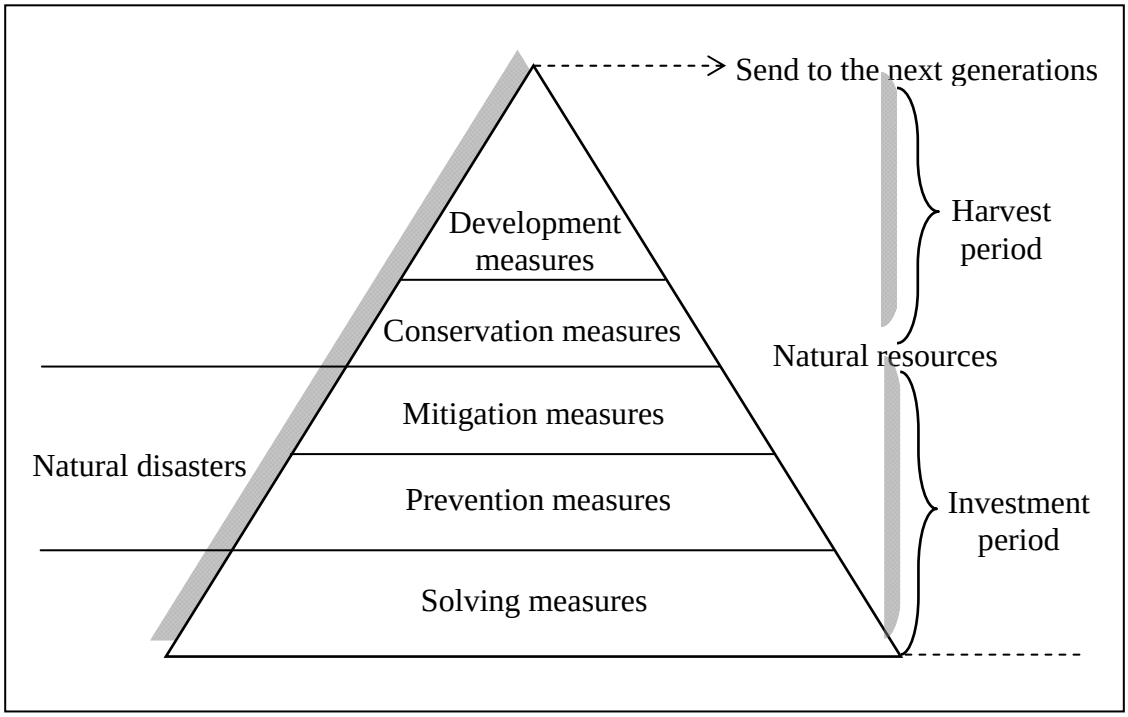


Figure 2.1 The measures for natural resources and natural disasters management

The natural resources management consists of 2 periods as follow;

1. Investment Period; consists of the 3 steps

The 1st. Step: The solving measures; it was adopted in order to stop the damage of natural resources; mainly caused human activities, for example, if the conditions were too less water and too much water was stopped. It started with solving measures with the cessation of illegal logging destroys and afterward plant the trees for the forest restoring.

This measure, it cannot apply to use for the case of natural disaster and natural phenomenon because it is beyond human control.

The 2nd. Step: The prevention measures; this measure can be used for the case of natural resources and natural disasters. It is intended to support the solving measures, for example, after the forests were planted. It is necessary to take prevention measures for the forest further invasion stopping. In the case of natural disasters, it aimed to minimize damage or don't allow damage occur at all. For example, in case of the Tsunami, the warning system has been installed to helping the people can run away from their habitat when it will occur.

The 3rd. Step: Mitigation measures; this measures would be provided to the victims. Furthermore, it found that the measures in step 2 and step 3 have shared their objectives that aim to reduce damage. However, there was a difference in "time to provide". The prevention measures provide before the damage occurs and the mitigation provide after the damage already occurs.

2. Harvest Period: consists of the 2 steps continued from the investment period

The 4th. Step: The conservation measures; it should be used after the step1-3 be provided already. When the natural resources are completed in the state desired, it should be provided to maintain their fertility for ready to reap the benefits.

The 5th. Step: The development measures; it should be used when the natural resources have their fertility and want to develop for more their fertility. It would help people for more harvest and become heritage to the next generations.

The repeated drought and floods can be solved. After their solved, it becomes the cost of the prevention measures and the mitigation measures as figure 2.2;

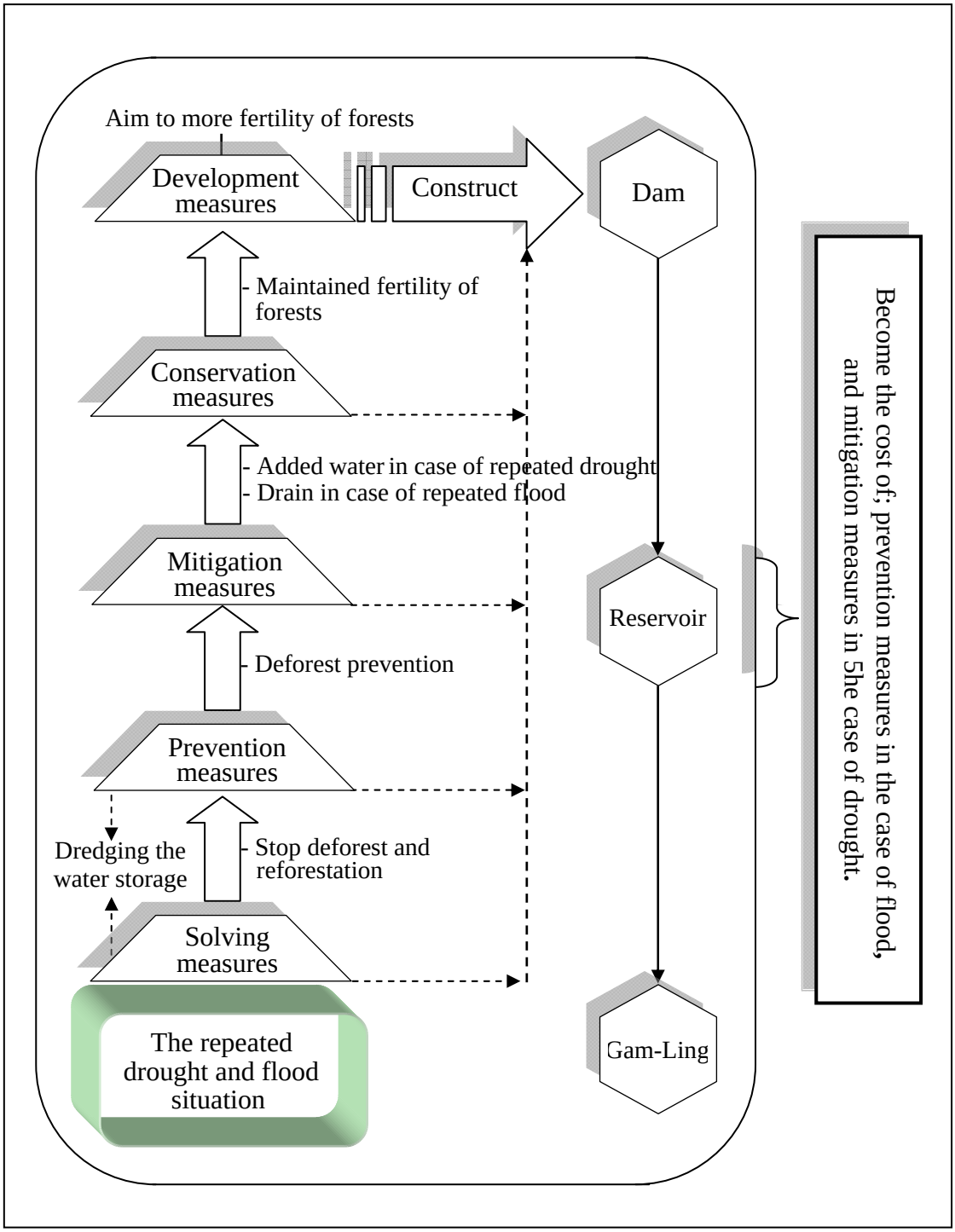


Figure 2.2 The example of solving the repeated drought and floods

The repeated drought and flood were not the result from the natural phenomenon but caused by the human activity declined abundance of forests by illegal logging. Their purposes were to get the wood, slash-and-burn agriculture, industrial

crop and also construct resorts. It leaded to decline the storage and release water capacity of such forest. That problems need to be solved from the root of such problems as human activities. We should be started from applying the prevention measures such as the public campaign to illegal deforestation and cooperate with the government sector for reforestation (Allocation activity)

After that, the prevention measures should be applied by the government such as providing a conduit for seamless forest which let people clearly determined the territory of the forest. It was noted that such the solving and prevention measures cannot help such problems away immediately, but will gradually improve the integrity of the forest. At the time of the two measures applying, the mitigation measures help relief to the selection of the shortage such as providing rain (Allocation activity), or if there is too much water, it can be drained as it was planned in advance (Application activity).

After solving and prevention measures were done and such problems gone permanently. The conservation measures should be applied to maintain the integrity of such forest. Finally, the development measures should be provided encourage the forest have its ability to produce and store up water such a dam in such forest be constructed (Maintenance activity). When the dam has enough water, the reservoir should be provided in the below areas. Such process should be done from top to bottom, respectively. It should not be done with shortcut or bypass process. Otherwise, it will cause problems as a reservoir before the dam is the result of a lack of water storage.

However, the reservoir can be done all time during applying all 5 measures. It would be recommended that it should be minded for the consistent with their production and storage capacity. Furthermore, if the reservoir has its excellence management, it can be not only the cost of the prevention measures when the floods caused by La Nina phenomenon occurred but also the cost of the mitigation measures when the drought caused by El Nino phenomenon occurred. However, the floods and drought problems can be healed only by the prevention and the mitigation as shown in figure 1**.**

For the dredging (Maintenance activity), it can be the prevention measures in case of the repeated floods and also the solving measures in case of the repeated drought.

However, the drought occurred in Thailand and neighboring countries which located in the tropical areas would be noted caused by the global warming, not

the natural phenomenon. The former study found that such drought had happened; it has been going on for thousands of years since the Buddha era to the present. The mind of Buddha or Buddha Reap the soothing rain stick, a motion was standing. The right hand raised in the manner seen. Turn left-hand side up manner. (Khai-Sri Bun-Pan, 2003: 31). This image was first done during 160-180 B.C. in Gandhara city, India by lord Milindha-raja. That Buddha image would be created now at Kanchanaburi province for His Majesty the King on the occasion of 7 around his age, 5th December 2011 with The Queen patronize. In addition, there is also other evidence such as “Raek Nakhun ceremony” when was assumed that a pilot since the Sukhothai period. In this traditional, the prediction about water amount upcoming year was provided as “The shorter the Sarong, the Bigger amount of Rainfall”. In the rural agricultural areas, the “hae-nang-meaw” or “female cats parade” which cats were dressed and put in cage parade, were held before planting season to ask water from Phraya-Thenh, giving rain angel, that share common belief with many country in this region like The Philippines which believes that it will be raining when cats were taken a bath. (Sor. Play-noi, 1966: 38). Asking rain tradition, not only in Thailand but also in another country which have strange asking rain tradition as Java both male and female cats were taken a shower and release (Benchamas Phaetong, 1997: 233). Those traditions showed not only the drought occurred in Thailand but also occurred in many countries such as the Philippines and Indonesia. The dictionary, document department (1927:333) stated that the crisis suffering was when rice is very expensive. That means that before the year 1927 would be subjects to drought in Thailand. At that time, global warming has not occurred. And 84 years ago, the rain forest in Thailand still plenty abundant. Those reasons showed the drought was not caused by global warming or human activities as well. It has been doubted for long time. Not too long ago, it was observed that the drought occurred in the Southeast Asia and the North Australia caused natural phenomenon known as “El Nino”

For the flood cases, it has been occurred for a long time for example, it flooded in Bangkok in 1932 or 69 years ago, at that time the global warming was not occur, and forest has fertilization. Then, Thai style houses were constructed in high platform basement for preventing floods, (the National Identity Office, 1993: 29). The Thai calendar in the past showed the Naga picture, it was spraying water, and

predicted that water would suitable, too much or too less for cultivation by the amount of Naga. For the one of Naga, it means much more water but for the many amounts mean less amount water. However, floods occurred long time ago but no one knew the cause well. Until recently, It was observed that the floods in Southeast Asia and the North Australia caused natural phenomenon known as “La Nina”

In present time, not only the La Nina was caused the drought but also the global warming. Global warming leaded snow decrease size in every year caused the amount of water in the rivers less than the past. In addition, the scientist also noted that global warming was likely to be a major impact to natural phenomena such as Hurricanes which have occurred in more numbers and violent.

2.2 The environmental education concepts and theories related

The environmental education concepts were established from using the education to solve the environmental problems. It appeared in 1972 when the United Nations conference on the human environment held in Stockholm, Sweden. The meeting result, the environmental education was an important tool to solve problems and improve environmental quality in the long run and permanently. Afterwards, in the year 1975 the operation conference was conducted by the organization of UNESCO at Belgrade, Yugoslavia to call for the international cooperation to manage in environmental education to their citizens, and declared as The Belgrade Charter.

2.2.1 The Environmental Education meaning

There were many scholars defined the meaning of environmental education as follow;

Kasem Chankaew (1993:71) defined that Environmental Education is a process in which people are encouraged to value and aware of their dependency on environment, economics, society and politics. People are educated to change their perception and behaviors to prevent and protect a balanced environment as well as to form better living habits individually, as a group and socially.

Laddawan Kanhasuwan (1992: 4) concluded that the environmental education is the process learning which makes the learner have their values of environmental responsibility and also educate the main ideas to develop their skill and attitude to understand and appreciate the relationship between humans and the environment. In addition, it trains the learners to decide, can act suitable about the conflict issue involved environment quality.

Vinai Veerawattananon (1996: 15) defined Environmental Education as a process focusing on knowledge about physical and social environment, concrete and abstract factors which effect a changing environment and human beings. Environmental Education is designed to encourage a proper belief and habits of people to protect and develop better quality of the environment and living standard of people in general.

Waraporn Srisuwan (1996: 65) said that the environmental education was a process that will make people know nature and realize their role related environment. It has its goal to let people would live well to their environment in local, nation and global level with peppiness.

William B. Stapp (1981: 55-59) said that the environmental education means the citizen developing process to have awareness, understand, responsibilities for their environment and also to be able harmony living with nature.

Steidle, E. Water (1971: 21) said that environmental education is the study of the relationship between human and their surrounding environment both natural and manmade environment. It would be relationship between the population, pollution, resources conversation, transportation and both urban and rural areas technology planning.

Mare Lyne Cox Bowman (1974: 1), the university of Michigan professor of Environmental Education defined the Environmental Education as a public process to develop knowledge of both physical and social environment around people. Its propose was to make people have more awareness and how to solve those problems occurred.

We can conclusion that the environmental Education means the process of developing an awareness of the value of the environment, for realization that every human being is responsible for solving environmental problems together. Not only their quality of life but the environmental quality would be improved better.

2.2.2 The concepts, principle, the objectives and goals of the environmental Education

1) Guiding Principles of Environmental Education

The guiding principles of environmental education obtained from the Environmental Education conference held in Belgrade in 1975, were as follows; (UNESCO, 1976: 2)

(1) It should be both natural and man-made environment.

(2) Due to changing of environment every times affected people both direct and indirect, it should be long life education.

(3) For education, integration method should be employed because of it is inter disciplinary the many subjects were integrated with the ecology was the core subject.

(4) It should emphasize on environmental moral made people conducted moral to protect their environment.

(5) Due to everything having relationship to gather, it should be systematical learning process.

(6) The present and future situation should be educated.

(7) It should focus on encourage awareness, value, attitude and ethics.

(8) It should provide the participation to protect their environment resources.

Vinai Veerawattananon (1996: 29) concluded that the meeting held in Belgrade, the world's first environmental education depicted 8 principals as role model for all countries to be used to fit the circumstances of countries, including Thailand.

Tamdoung Rattanatassanee (1992: 169) Quoted from the IUCN; National Resources Commission of Education International Working Meeting on Environmental Education in the School Curriculum conference report held in the UNESCO office, Paris, France in 1970 that the environmental education is a valuable process also clear ideas to develop skills and attitudes in order to understand and appreciate the relationship between humans and their environment, and cultural,

biological and physical as well as relevant to their decisions and behavior to create a quality environment.

2) The Environmental Education Concepts

Laddawan Kanhasuwan (1998: 98-100) has concluded and determined the many levels Environmental education main concepts as follows;

The kindergarten level, children will be able to create a learning environment with an emphasis on love, an appreciation of nature around them, especially at their home and school. The learning process should use their senses, not the content be emphasized in the habit of a person's ethics, moral be start from conducting their habit, Thai culture and Thai being as well.

Primary level, it could be teach more the environment concepts using the senses to perceive the environment as much. It should learn and understand the relationship between living together and organism and their environment, simple ecosystem, the core concepts of family and community environment, activities in daily life in their family and community, the way to use energy efficiency, the impacts of their activities, conduct their hygiene habit, healthy eating habit, have their moral and ethical environment and appreciate in the values of natural resources.

High school level, it should be emphasized on understanding of the ecosystem, awareness in environmental problems and their important, learning about the natural resources, also every energy: their development and the development through environment, pollution caused by human activities, conservation to increase pollution , the habit of saving, the ethical environment, cultural heritage, Thai culture and Thai being as well.

Higher education level, interest in idealism and readiness to participate in social protection environment, then they would be educated about environment both wider and deeper awareness, knowledge, skill and attitude. For the method, it should provide learner to study problems by planning to protect and solve problems, evaluate and also practice. The learning by doing method should be employed that direct experience be provided, more than just a technology, ecology, energy, pollution etc., have a deep understanding of global environment problems. It should cooperate in solving international environmental problems, for the internal subject, it should educate the economic, social policies and the environmental laws.

However, what must be emphasized at all levels was the discipline; good people, moral and ethical environment, in addition, keeping Thai traditions were one way to prevent environmental problems.

3) The Environmental Education Objectives

To achieve everything in environmental education, individuals and groups have to get the environmental education objectives as follows (UNESCO, 1976: 3)

(1) Awareness in environmental education makes individual aware of environmental problem, create awareness, being alert and responsive to environment and existing problems.

(2) Knowledge in environmental education provides individual worth basic knowledge and understanding in environment, problems and guidelines for solving problems.

(3) Attitude in environmental education gives individual value and concern about the surrounding environment as well as being the driven force for practicing and solving environmental problems.

(4) Skill in environmental education provided individual with skill and practice necessary for correcting and protecting environment.

(5) Participation in environmental education gives individual the chance to participate in changing and protecting environment in all levels.

(6) Evaluation ability in environmental education makes individual able to forecast and decide to act properly toward environment.

4) Goals of Environmental Education

Laddawan Kanhasuwan (2001: photocopy) said that the goals of the environmental education has 2 aspects were related and consisted were follows**;**

(1) The environmental education used for protect environment.

(2) It used for improvement people quality of life, it was causing environmental for sustainable development which refers to the need to develop an appropriate current without compromising the needs of the next generation. The development must be done under the supervision of natural resources were used widely. It would lead to a better quality of life.

From its principals, concepts, objectives and goals as state earlier, It could be concluded that people of all ages, all professions and the private sector need to

learn developing their awareness, attitude values and ethics about the environment and life in order to participate in the solution, protect the environment.

2.2.3 Knowledge transmission of Environmental Education

Joan Webb, (quoted from Adisak Dherakeaw, 2005: 28) stated that environmental education could be transmitted many ways such as

1) Environmental education programs study such as integrating environmental education into the subject.

2) The outside class Environmental education as a community learning, housing including education on environmental issues at the local, advertising and community events that take place within the exhibition.

3) The environmental education in the industrial site as more aware in the work place by setting the policies or conduct the training programs to the employee and the employer.

4) The environmental education in the community has its main purpose to provide people in participation for protection and solve their problems.

5) The environmental education through mass Medias such as printing, television, radio and field trips.

6) The environmental education field trips such as eco-tourism and the history site education etc.

2.2.4 The National Education Act and Environmental Education

The National Education act B.E. 2542, section 23 (2) introduced that the education should be integrated the knowledge and experience with management, maintenance and utilization of natural resources and balancing environmental sustainability.

From that section, concluded that the National Environmental Education Act aimed to manage in 3 items of the natural resources environment; management, maintenance, and application that concern to balancing for the natural resources environment sustainable.

2.2.5 The planning and design activities of Environmental Education

The planning and design activities were the steps in practice that would allow natural resource management and environmental goals.

Adisak Theerakeaw (2005: 36) mentioned that the planning and design process should focus on the main principal as follow;

1) It was the long life education beginning from pre-school level continues for both formal and informal education.

2) Its learning style was interdisciplinary.

3) There was no way that the environment can be studied separately from each individual. Since all components were interrelated, the system would be studied in a holistic environment that was naturally occurring or man-made environment such as technology, social, economic, politic, cultural and aesthetic traditions.

4) It should be concerned in the relationship between environment in local level, nation level and global level that made learner understanding widely about daily behavior and environment related.

5) It was focus on social experience learning.

6) To encourage students to explore, finding the root cause of environmental problems should be provided by themselves.

7) The education, cultural and socio-economic from local to global level important agenda should be assessed.

8) Connect their action by promoting personal responsibility in caring for their environment should be done.

9) Using a variety of teaching strategies such as outdoor education, stimulating research and practice, information technology and experience in housing as camping.

10) The inquiry method teaching should be employed to know the facts of the problem instead of learning abstract patterns also analysis to protect and solve problem and decision-making process.

11) Those direct experience should be employed to teach students in both natural and man-made environment, encouraged to try bringing the experience linked or integrated their past experience.

12) The relationship of schools, teachers, students and their community should be done.

13) The learners should be promoted to develop their skill in scientific and social investigation such as observation, measurement, classification, testing, analysis, evaluation, forecasting and decision making etc.

14) The sustainable, democracy and morality of social should be concerned to be the principle keys in deciding when answer any questions.

15) Encouraged the learner for satisfaction is active learner, wonder and excitement in learning.

16) Focused on community study, by giving students gain their opportunity to take the issue of community-based programs they were assigned in order to gain experience in social and community involvement.

17) The students should be encouraged to work with communities to improve the quality of life and environmental quality of the community.

2.2.6 The general people & adult Education

1) The general people education

Laddawan Kanhasuwan (1998: 91-104) stated that the way to educate the population target as follow;

(1) The environmental education training should be held aimed the objectives of environmental education.

(2) Promoting the awareness in actual environment problems in the community giving basic knowledge with emphasis on planning, working group and collective action.

(3) People should be encouraged and promoted for environmental stewardship in local communities.

(4) The environmental education training short course should be held by using local issues linked to activities also integrated into the main concepts, themselves learning process using direct experience to explore the issue (practice field). There were solving planning, group discussion and setting the project to cooperate group working.

2) The adult teaching technique

There were 6 techniques teaching adult as follows;

(1) Group Discussion; in this technique, 6-20 people attended by the monitor or chairman controlled, the main purposes were let people discus as much as possible, talk together on their interest issue to exchange their opinions.

(2) Panel Discussion; there were 3-4 debaters who are expert in that issue also have much ability to use language communicated as well.

(3) Role playing; for this technique let the member act the real situation in each situation and condition, the learning arises from the acting they displayed. The role players unnecessary having ability to display, then after the show, the study was discussed, interpretation of the show.

(4) Demonstration; that shows the actions which need to prepare carefully. This process was shown in term of speech, visual expression, answer and explain more. In the first step, the demonstrator should show and explain. After that, the learner conducted themselves.

(5) Seminar; there were 5-30 people to attend to gain the knowledge by the academic experts to provide an opportunity for participants to study under the guidance of the staff.

(6) Symposium; this method would be described from 2-5 people who expertise in the matter or matters that were associated with each issues. Presentation should take about 3-20 minutes depended on the number of experts. The narrator did not need to talk about the other speakers.

2.2.7 The training program assessment

Upon completion of the evaluation, training and environmental education was an important step to say that. Environmental education and training having achieved the goals and objectives set for the evaluation or the training process to improve efficiency.

Joan Webb (Adisak Dheerakeaw, 2005: 38) said that the way to evaluate the training programs if it have effective or not was were as follows;

1) The trainer told trainees to do the knowledge test form.

2) Wrote a short article about what they have done during training

3) Wrote a short article about what they like or the impress during training

According to the previous concepts and theories, and the field study, it can be concluded that the environmental education is a process that consists of: 1. Study the relation between human and their environment to understand their relationship and to construct the natural resources management. 2. Develop the learner intellectual; they will gain the environmental awareness and concerns with knowledge, understanding the ecosystem, attitude and values that are good for such environment, ability to identify such problems, and the ability to analyze the impact of the environment. 3. An environmental management; it refers to the knowledge gained from research to practice by yourself or transfer to others. People should get involved in the protection, conservation and the environmental mitigation as well as the ability to evaluate performance and 4. The environmental application; it should be used a well-balanced and adequate to ensure the quality of life and enhanced environmental quality.

In the overall conclusion, the Environmental Education is a process that includes 4C principles as shown in figure 2.3;

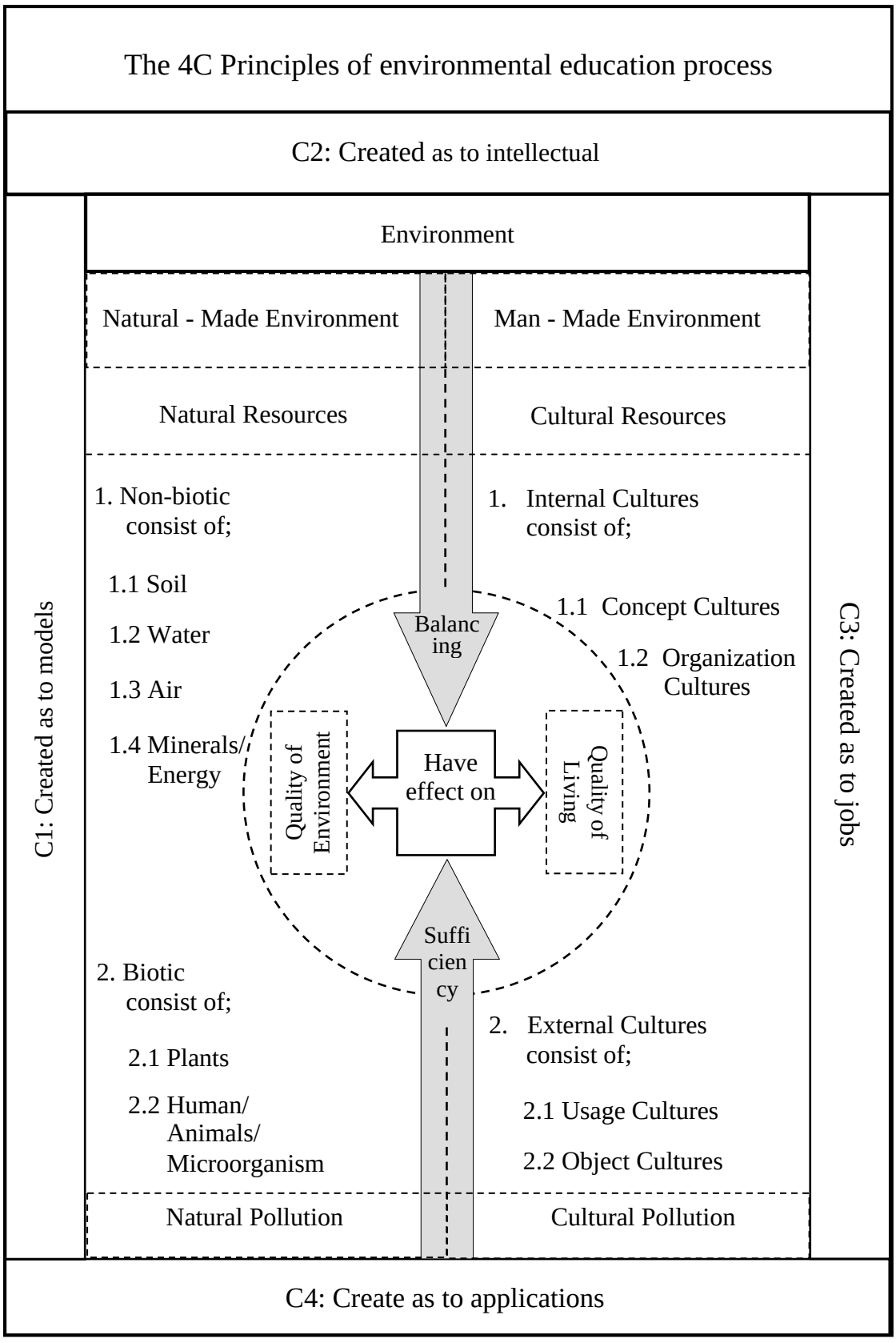


Figure 2.3 The 4C principles of environmental education process

Figure 2.3 shows that the 4 C Environmental Education process consists of;

C1 is created as to the models of natural resources management. It is a result of environmental study linked to human activities.

C2 is created as to the intellectual. It is a result of the studies to achieve the objectives of environmental education consisting of awareness, knowledge, attitude, skill, participation and ability on evaluation

C3 is created as to the jobs. It is a result of knowledge gained from study environmental education to prevent and mitigate the environment damage caused by both human and nature. It also covers the conservation, environment development and transfers their knowledge to the others.

C4 is created as to the environmental applications. It is a result from the use of adequate and balanced environment. The goals of the applications are the quality of people life and enhanced environmental quality.

2.3 Community participation concepts and theories related

The participation of the community took many forms, depending on the purpose of research, knowledge and experience of researchers, field research would be used and backgrounds of the community those affected to different community projects for example, the village spay project, the royal Thai polis's project, It have its purpose to let local community to participate in the invigilated crimes .

Prushchaya Weasaruch (1985: 177) the expert group had commented at the UN conference that the public participation could not exactly cover defined in the one word. The definition may vary from country to country or even the same country. If it was not clear, the definition of public participation should be limited to economic, social and only political as well.

Many scholars have involved in the definition of participation as followSaluk Pana (2007: 45) defined the community participation as the process that allows people to be involved in the development of collaborative management. Since the decision to the co-beneficiaries, co-monitoring and co-evaluation in the form of community benefit or impact of the development.

Kanit Sukkarat (2007: 47) depicted that Community Participation mean to get involved with any activities of the mind and emotions in the group. This will result in achieving the objectives of the group. Participation expressed as a joint force joined this group or the group members. The pro was start from determined the requirements, planning,, implementation and monitoring. Furthermore, the concepts of community participation have many conditions that will lead to participation and emphasize the mutual benefits.

Nirun Jongwutdhivej (1984: 183-186) said that the people participation mean the mental and emotional involvement of a person in the group situation which result would cause a provocation to commit to achieving (contribution) and the purpose of the group. It also gives a sense of the responsibility to the group discusses the conditions of participation that have at least three reasons as follows:

1) People have their independence in Participation
2) People should to consider carefully
3) People willing to participate

Yuwat Wutthimathee (1983: 20) stated that people participation mean to allow people to participate in the initiative, decision, co-operation and was responsible for a variety of effects to the people themselves that can cause people to be involved in rural development and to fix the problem and bring the living conditions of the people better. Leaders must accept the philosophy that community development. Every human being has a desire to co-exist happily with others, to be treated fairly and be accepted by other. In addition, people ready to contribute to community activities. We must accept the fact that humans can develop if given the chance and be guided correctly.

Arpornpan Chansawang (1979: 19) explained the people participation was the result of concurrence in term of demand and direction of change. The agreed that must be large enough to be initiated and realized. Action on behalf of all the action through the organization then it must serve as a conductor to achieve the desired change.

United Nations (1975: 4) stated that the participation was as follows;

1) The decision-making process would be done on social purpose and resources allocation.

2) Carrying out voluntary activities and programs.

In summary, the people participation means the activities focus on benefit of the community. It was a need to solve community problems take action by community to community.

2.4 The concepts underlying the research

2.4.1 Buddha teachings

Teachings about the wisdom and self-reliance.

Phra Dhammapitaka (P.A. Payutto) (2003: 21) described consciousness as " general means that the conscious mind and sometimes mean remember such Arnon has been recognized as a master in his Buddha. In this case, it use the word consciousness as the Buddha said a great deal of joy as the disciples of consciousness. It also called "unconsciousness" emotions were drawn to it. It has function to control mental and emotion don't let they go away. Then consciousness was the means to cover recall thinking.

Phra Phromkunaporn (P.A. Payutto) (2004: 8) has described a precaution as " The Buddha wanted us to never underestimate the intelligence of the people was by the conscious mind intentionally, be alert to events what happen affecting on social, religion not passive inaction, not abandoned. The result of events should be checked be good or bad, furthermore, If knew the cause for the decline, protection would be conduct, or would cause growth to be done."; The wisdom has been described as " It was easily the most intelligence and understanding(meaning it was clear or fully understood" and the process of developing wisdom has been described as " Issues in the development process in this individual. It should be considered in relation to the 3 wise ways as follow;

1) Image wisdom; the wisdom derived from their own contemplation for seeking the reasons.

2) Listening wisdom; the wisdom derived from their learning or pass on knowledge continuously.

3) Practical wisdom; the wisdom derived from practice or train.

However, apart from the main mean there were many methods to inform wisdom. Tin particular, in the 3th way, the key activity was to ask people to inquire (like brightness and volume interrogative), the discussion, observe and watch carefully, considered, weighing reason, the deliberate and careful experimental investigation testing and make familiar practice.

His majesty the king has been described about wisdom on the occasion of the royal palace Amarin Vinitchai on Saturda, December 5, 2009 that *"The growth will be succeed if all people and all parties in the country are concentrated in their job on their full capacity, consciousness, intellectual, and sincerity; entirely aim to common interest more than the other"*.

Kanchana Keawtep and Kanoksak Keawtep (1987: 34) stated that self-reliance have its characteristics as follows:

1) It was the individual events were made by individual s and households to achieve the security of his livelihood.

2) The self-reliance in a group means a group or society was organized. So that people could meet their needs (self Fulfillment) in collaboration with others in similar situations. The true self-reliance including people were free to achieve the goal through their efforts and force.

In concluded, the conscious mind and self-reliance means being conscious and aware of no negligence in suffering, and use his own intellect to find out the source of suffering, afterwards, join together to solve the problems in faith and sincere.

2.4.2 The King's working principles

The office of the King development (2005: 33) "From the beginning of the King's projects to the end of fiscal year 2002, there were 3,083 projects under his majesty approach which could be classified into 8 categories such as agriculture, water resources development, environment, public health, promote occupation, transportation, communication, and social welfare. For these all project, the water resources development took the most as 33.73% of the entire projects."

As this research aims to create the water management model, is the part of the commitment of His Majesty to develop the water resources for agriculture. This research has led the King's working principles to be the initiative as the following;

The office of the royal development projects Board; the developer King (2007: 3-14)

The systematic study information; before bestow on the project, His Majesty will carefully study all of the project information in systematic, from the preliminary data, documents, maps, enquire of; authorities, scholars and people in the area to get validity data in order to be properly and meet the needs of the people.

The inside explosion; human development was focused. His Majesty said "The inside is must be exploded" means before start to develop any communities, the first thing to do is the people in community must be already developed, afterwards go out to the other, not takes any prosperities and outside persons into the community till they had already prepared.

Solution at the small point; His Majesty always treats the problem as a whole, start from the small point. His stated opinion as "If you got headache before do any things you must relieve your headache first, this is for a state of mind. The example of habitat, if you want to demolish the entire house, I disagree. You said this house is much decay, it is not worthwhile to repair and you explode the entire house. Where do we stay? It is not the right way; to little demolish and little repair at the same time is the good idea."

The hierarchy of work; His Majesty's work usually started at the most requirement of the public. The King's state on 17 July 1964 "To develop the country, must work on the hierarchy, the basic need of the people is sufficiency, should be established first. Then add the higher economic prosperity in the order".

The geo-social concerned; the development must be concerned with topography, sociology, and region cultural, because they are different. His Majesty speech stated that "The development must be based on terrain, sociology and social landscape. We cannot force the people to think into otherwise or the same as ours thought. When we enter the community, look for really their need and explained to them"

The holistic approach; His Majesty thinks as a holistic and integrated. Before give the project ideas to the people, His Majesty forecast for the future occurred and the ways to solve such as the new theory.

Do not too much based on books; The king's development idea come to terms with the environment and the social psychology, that means do not too much based on books, not a commitment to academic texts, focus for the actual living conditions of the Thai people.

Saving, simplifying for getting the maximum benefit; to develop and help the people, the King's development idea was adopted the saving, simplifying ways, and people can do it themselves. The local materials were applied to use, without much of investments and high technology, as his speech; "A forestation without planting, freeing up by naturally, the way to save budget."

Simply doing; means be consistent with the well-being of such society. That is the problems were solved by the law of nature.

Participation; The public hearing method was used in the administration, this is the way to give the people or the officials all levels to come together to express their opinions on the public issues. As the part of His Majesty speech "The most important is to learn to listen all of comments and criticized. It is wise to listen for the variety of intelligence then collected and applied it to use for successfully of administration."

The common interest; as the development and helping people, the King reminded and focused on the common interest as his speech "Many people said the personal should sacrifice for the public, I get bored to listen such words. Some people might think; always give, what did we get? Please reconsideration, you are not only give the public but you are giving yourself for being to live together with the other as well"

2.4.3 The human values

Another mission of this research, people in the community must work together that hard to avoid conflicts. To prevent such problems, and to increase the power of love, peace and sincerity, the researcher applied the "human values" to guide the implementation of the community.

Art-Ong jumsai Na Ayudhya (n.d.: Introduction) stated that “the goal of the study is a good habit” and another one said “In order to develop good habits, the five human values were as follows;

1) Right Conduct
2) Peace
3) Truth
4) Love
5) Non-Violence (Ahimsa)

In English it was called “The five human values and human excellences” now has spread throughout the world on every continent also has been translated into various languages. In order to prove and test the principles of such a study, the Sathya Sai School has informed, located at Lam Narai sub-district, Chai Badan district, Lopburi since 1992 by supporting Satya Sai foundation. It was a boarding school that set its objectives to grow students into a complete human. There was a moral excellence in academics and sports can live happily in society.

The Sathya Sai School has the free education principle. Therefore, no fees (parents actually pay for meals and personal use only), it accords with the constitution of Thailand 1997 section 43 stated that “All person shall have equal right to educate basis of not less than 12 years, the government shall provide thorough and quality without the cost

The principle of the experiment was written in the book used in school, we found that the child has been in a good moral and happy life”

1) Right Conduct; “Treat others as you want others to treat you that were morals” Life was continuous learning. There may be some periods of life, learning was suspended. Throughout the day we receive from those around them through their senses. Our minds were in contact with the outside world through the five senses. So we need to train our minds to recognize the external data correctly. To raise up our mind when we get back, we should have a better moral every minute that passes. Because our children were not taught to know, the perception was correct. When they heard people talked that irritability to them treaded them the bad mood, when this occurred it would fall rather than rise.

Our act would well, have compassion as a basis. Love without selfishness in our hearts, our act would appear in the form of philanthropic service. When our eyes and ears filled with the love and mercy, we would see and hear what good is a good thing.

2) Peace; "Everybody seek a peaceful, but the peace did not find it from the; outside, wealth and power", we can find the peace only in our mind.

When we meditated, we learned to calm the mind. The result was a sense of inner peace. Meditation was very beneficial to everyone because we can concentrate on running up and help us remember better.

When we used computers, we put data into, finding the old data in memory. The computers would start the program in memory. If no data was in memory, or missing, it will not work. In the same way, when we see or hear anything, we will find the information in the subconscious that we have the experience of the past. Then be compared to, before we knew it would come out. If we find it not in the subconscious, consciousness was not something that came through our senses. Assume that the information we received from the subconscious had related to events in the past that made we nervous. It was this subconscious also emotion to consciousness. This is the reason why sometime we saw something we feel upset or hear something we were frustrated. Therefore, we should realize that our real enemy was within ourselves. It was in the subconscious. It was what happened in the past been saved by our actions and thoughts. We can control our emotions without letting it appear in our consciousness, how let us see an example of nature we try to walk before the sun was up everything was dark out, but when the sun rose the darkness was gone. Sun has to fight to expel the darkness or rather what the sun was hanging high up to the light only. The darkness was gone. Where there was light it was not darkness.

3) Truth; "It does not change in any time"

Since we were born, we were curious to know everything around us. We were eager to discover the truth. We started our search by going out to increase our knowledge like pie, what was in the circle was what we know. The scientists have researched around the circumference of a circle, when they discovered something new by researching it further widen the circle of knowledge was another. Then we discovered that in fact the opposite the more we know how much, the more we do not

know. On a small circle, we think we know everything, the circle expands even wider circle what was even more outside the circle, we found that there were many thing that we did not know. There was a solution for this problem or not? What about when we discovered it, we knew everything. We began to realize that scientific knowledge to make the pie higher. It does not make it beyond the circle. We found it anywhere on the earth and the stars and galaxies was one that we never found it. That was within us when we search deep within ourselves. We would discover the truth or wisdom we were looking for. When there was no circle of knowledge was no longer outside the circle. Because we know everything then our search was ended. The road to find the truth let we went everywhere but finally, we found that the truths were in ourselves.

When we started practicing human values in our lives, we were starting up our minds to a higher level of training in mind, but what good visibility, but the good in everything. It sounds like a good thing we have to save them into our subconscious. This will help bring about peace in our hearts. When we used our bodies in the right way, useful saying, and love and serve everyone, do their best without selfishness. These good habits were in the subconscious. Our minds would always have a good idea and a peaceful rose. When we recognized the emotions of jealousy, anger, lust and pride, we were in a state of peace in their life time. Our minds to rise above any level of spiritual realization, meditation helped to elevate the soul to go faster. Mental realization of the spiritual purity, we all know this was a conscience that was within us. We were guided in our lives. It was the teacher that was within us was the source of inspiration and the intuition within us.

In the past, some of the greatest scientists have discovered a theory that was critical to the world. No experiments or calculations, but it was from spiritual discernment in them.

Albert Einstein, who was the most famous scientist in the 20^{th} century, discovered special and general theories of relativity and a particle of light. He believed that scientific theories can be discovered by intuition**.**

Sir Isaac Newton, born in 1642, in his childhood, he lived quietly in meditation. His friend said that “He was a young man who was sober earnest, did not like to play with anyone”. He discovered the gravity’s theory. It enables scientists today sending satellites to orbit the earth. When he discovered that, he sat quietly

under the apple tree, and the apple fell, this finding was not made in the laboratory or from any calculation.

4) Love; "The greatest virtue is love. Love is the foundation of good habits". We all can love and be loved. The pure love that we get, it has not been sent through the physical senses, but it a special feature of everyone. When we lived with the Saints, we feel very peaceful. Because we lived in an atmosphere of purity and love making us feel calm. On the other hand, if we were among those who were confused and harsh. We would not have peace in our minds it. When a child fell and injured, their mother would run into them and embrace them with love. They stopped crying and pain would disappear entirely. That was because the love of a mother. Love is the most important thing. In the development of human values to children who were growing. We found that in the hospital, children orphaned since birth, were abandoned or their parent have high mortality rate than children who live with their parents as much. Nurses would act as mother to those children and held, talked and gave them love; the death rate would fall back to normal.

In schools, teachers must have compassion in their heart. When a teacher filled with love, he would teach them what it would captivate young children before they were filled with peace and would concentrate on learning and to understand the lessons easily.

5) Non-Violence; "It means our body and mind live together in peace with our environment". Our environment consists of people, social, animals, natural, the earth and universe. We should stay happily with these environments, should not create any trouble for the environment, either body or mind of it. The reason of this was very simple. When we hurt others or whether any way harming the environment, we were hurting ourselves too. If we put our head against a pole, pole forces that were against us, as much as we hit it. We feel that it hurts. This is a reaction equal and opposite reaction force. The fencing would die with sword, this statement reminded us to remember that, if we do violence to others, we would be violent as well, but if we love others, we would love to get back. If we want to be happy, we should make people happy before. Therefore, we should love everyone and serve everyone. Harm to others, not only refers to physical harm but also with words and ideas.

Words are powerful, when we talk one negative, it would be buried in the subconscious of the child. When a child grows up, they might have forgotten those words. But in his subconscious mind, those words will remain lifelong and influence them. At the same time, we recorded a negative word to say them in our subconscious and it will affect us negatively too. When we tell people the bed news of the disaster or serious disasters, that person may be exhausted and fainted away. In contrast, if we were close to saint, our mind will be happy with clam as be got their good ray.

2.4.4 The human values integration

Art-Ong Jumsai Na Ayudhya (2007: 45-54) has described as consisting of inspiration and the self value as follow;

1) To inspire people for doing anything; give them love and mercy, as the example; the research which was a suburb of the Bronx in New York, USA. Bronx has faced many problems such as the quarrel youth, mingle and drug addicts. There were ordinary schools which their alumni were observed. It was found that most did not as a source. The problems really, however there was one alumni group have their good professionals who have regular jobs as well. And successful, the study had to interview these people that there was nothing that makes them successful. The answer was, a teacher who has inspired them .researchers were looking for a teacher who was still alive but retired long ago. The teacher has been saying his technique, however, or what was taught to help the pupils success “there was nothing special but I shown my love and sincere and to love kindness throughout.” Of such research, as you could see that the teacher can inspire students to work best. The children will grow as well and succeed in life with their teacher to love on them.

2) The value in ourselves; everyone, including the things that were around us was valuable in themselves. We just have to find them as the example below;

Trees

The students observed trees during the day under the sun. When all were sitting under a tree, it would be peaceful. The teacher asked the children then they were thinking and talking.

Teacher: What are benefits from trees to us?

Children would answer that, Trees provide shade for all of us.

Teacher: Shade trees, for only some people like the rich man, or different or not?

Children would answer that would not discriminate; the trees provide shade to everyone. We should be like a tree, allows everyone to be happy without discrimination.

Water

If the teacher taught only the water formula is reacted by hydrogen and oxygen.

$2\ H_2 + O_2 = 2\ H_2O$

Children would be proficient on up to the professional chemist but our goal was to create a good education not only to get a career but to be the perfect man. So we would have to pull the human values that were in the water as the example;

In the human body, the water contains about 75% of our body.

Teacher: When we tell ourselves that we love ourselves, what do we love?

Children: Water because our body contains 75% water in our body.

Teacher: When we love the water, due to we have 75% water in our body, then should we hate others or not?

Children: We love the water; we just have to love everyone.

Teacher: In the body of animals, they have the same 75% of water.

Children: We have to love animals; do not kill any living creature.

Teacher: Everyone please observe the river, and that there is some water in the river, what are benefits we got from the rivers?

Children:

- The water used for cooking.
- Some people bathe in the river.
- Farmers used water for agriculture.
- Used for transportation.
- Engage in fishing.
- Build a dam to generate electricity.

The conclusion that children were thinking:

- Water is life.
- Water was useful for all life.
- We love the water; we must take care to clean without polluted.

Teacher: From the observation to the water, what we have been learning about our lives?

Children: Water flows through any way, all people and all lives in that way can get the benefits. So as human, we should be beneficial to all people and all lives, whether we were going to be anywhere.

2.5 Related researches

2.5.1 Research studies on water supply problems and solutions

Pubeswre Moungmool (2008: 95) studied about the participation in water management and solutions for agriculture problems of the farmers; the case study of Baan Mae Sa Mai reservoir, Mae rim district, Chiang Mai province, The finding were the difficulties in the management of water resources for agriculture were as follows;

1) The farmers have lack knowledge in water management.

2) To manage water for agriculture, Farmers cannot be done manually. It should be compatible with multiple operating units.

3) The farmers' lack of knowledge and have experience with growing plants that use less water.

4) The establishment of a community group has no authority to manage water for agriculture in the community.

Naraintre Ponin (2003: 21-23) studied the problem of water shortage on the Koh Srichang, Chon Buri province. It found that most of the mainland as a rock. The steep slopes and thin soil, arid desert area, there were no nature surface water such as rivers, canals, lagoons, pond, streams and groundwater sources. It has small pond caused by rain water flowing into the low because the terrain was mountainous and mostly rock and very sleep. The water flows into the overflow to the surface quickly.

In summary, the shortage of water on the Koh Srichang result of unfavorable topography. There were no natural resources; it was only a few pools of water that flows from high to low. However, because of rain fall on about 114 days per year, some of which have large water storage tanks to store water backed up. Prevent water shortage during the dry season; water trapped in the basin cannot be taken for public use only. It can be said that the fresh water of the rain mainland only. Due to the lack of natural surface water and groundwater, the solution was as follows:

1) Increase the capacity of the community for their good quality of life by supporting infrastructure special the water use.

2) Career development, employment and incomes of all groups should be provided for having quality labor in marine tourism service.

3) Reconstruction of natural resources and environmental degradation, To better and prevent damage with certain area and conduct the community awareness for the environment.

4) Increase the local people role or local organization to involve in the management of all forms, encourage their leadership.

2.5.2 The related research about water using of the sample groups

Kornwilai Yeawya-satawa (2001: 311-333) studied the management of the household's water use: the royal monastery grade in the service area of the authority case study. The samples were the control of the household and individuals living in households with a total of 436 people. The content analysis technique was employed to analyze described the situation as a whole with descriptive statistics show the percentage of mean and standard deviation.

The result were as follow; Conditions, water used in the past 3 years (1996-1998) of the sample households, the water rate increase by the year 1997 and 1998, a decrease in the water supply to the consumer was the 1^{st} , the 2^{nd} was storage of rainwater and water from a nearby public water supply for household use. The water was boiled or filtered before drinking by the most members of the household, washing their bodies and appliances and use in their toilet. There was no management of household water seriously or clearly and concretely. It was just practice for the purpose of tidiness and well-being of its members. The cost controls in water supply

were similar as assign the amount of water for each household for their necessary use and they have their responsibility to look after and repair their infrastructure system by common. A notice warning would be sent to who have higher costs in extra.

Wanee Wuttiwong-sampan (1998: 83-94) studied the knowledge and behavior regarding the use of public water supply in the area of responsibility of the authority of the Metropolitan waterworks authority. The samples were 400 people who live in the area of the Metropolitan waterworks authority**.** The descriptive analysis was employed to analyze, represented by the percentage, standard deviation and the one-way analysis of variance.

The result shown that public knowledge about water-saving in the high level, there was different of the knowledge of water and efficient use of public water supply varies according to gender, average household income per month, the frequency of perception through the daily newspaper. People's behavior regarding the use of water was desirable. There was the different of behavior of people using public water supply varies according to gender, occupation, education level, number of household members and the frequency of perception through television and brochures/flyers.

Tanyaporn Sumakka (1996: 80-89) studied the conservation of water resources and water use efficiency. The training course constructed was experimented with the 60 samples who were Mathayomsuksa 1, students of Srilacharapipat school, selected by simple sampling from the students who have 2.5-3.5 GPA score. They were divided into 2 groups, experimental and control group, each group consists of 30 students. The pre-test and post-test, with R=0.79, were adopted to test all of them, in addition, the course was evaluated by questionnaire researcher constructed.

The result showed that the training courses have qualification can be used for high school students. It should be assessed knowledge and practice after train 3 or 6 months in order to improve training to complete before being applied to others students.

2.5.3 The research studies on the communities' participation of water resources management

Phamaha Nivej Kittichetto et al (2007: 3) studied the participation development process project for restoration of the Mae San River's water, Tambol Buo Ban, Tambol Pa Sak, Tambol Vieng Yong, Amphoe Mueang, Lumphun province. The core objective was to find out the restoration of natural resources participation process of the Mae San River. The minor objective was to collect data about the village history, the Mae San River history, to find a way to gather information about animals and plants along the water, the past and present life of the villagers along the river and to gather the knowledge, the wisdom of those who living with water and took part in the management of the river.

The result showed that it has an irrigation system for the rich, variety of both plants and animals species that were ecologically valuable river to take advantage of the community. The restoration of water returned to the consumer.

Lt.Col Rung Sanpakeaw (2007: 3) studied the participation of people in construction of upstream dam in Baan Paksam, Amphoe Wianghaeng, Chiang Mai province. The objectives of the research were to study the level of participation of the people in construction of upstream dam, to study knowledge level of people in construction of upstream dam and to study the problems and issue barriers in construction of upstream dam.

The result showed that people were got knowledge and understood to the subject of ongoing development and the problems. The people stilled hoped the help from the government to manage water resources. People lack of knowledge (Illiteracy) as well as how to build a dam upstream, however, when using a one-dimension view of the state, it also found that the community would be needed**.**

Sansana Tantichat (1988 :66-68) studied the participation of Tambol council in the development of small water sources in Kalasin province. It found that the official council committee were the most participated in the development of small water sources, Furthermore, the status of position cause differences in the development of small water sources participation and the time in position, position in the village, the areas occupied, expenditure of the Tambol council, receive training on water resources caused differences in participation in the development of small water were significant.

2.5.4 The research studies on the use of environmental education process for training to conduct the environmental awareness

Tanyaporn Sumakkd (1996: 56) stated that The Pha Nakorn teacher training collage organized the 5-days intended workshop for teachers to allow them teaching environmental education activities more efficiency. Not only let them know and understand the environmental problems situation but also gain their awareness of the importance of the environment.

The National Environment Protection Council (NEPC) organized the short-term training course for the academic middle by the collaboration with the universities and the government such as the ministry of education and the ministry of agriculture etc.

Arthorn Tong Prasong (2004: Abstract) studied the environmental awareness of the effects of dust in the air staff toll expressway. The staff were trained and have the knowledge and skills to significantly increase the statistical confidence level (t=5.84) and students were aware. The air pollution in the border area with heavy traffic through the more significant statistical confidence level (t=6.409) . To evaluate the effectiveness of your training in air pollution, the training manual was in very good shape and in a good 39% and 60%.

2.6 Related laws

The constitution of the Kingdom of Thailand 2007 state that;

“Section 66; people who informed together make up the community or the local community should have the right to manage, maintenance and utilization of natural resources and environment”

“Section 67; there are rights of the individual to the state and communities in the conservation, maintenance and exploitation of natural resources and biodiversity. To protect, promote and maintain environmental quality, living a normal life and the environment would not cause harm health, welfare or quality of their lives, the environment should be protected as appropriate.”

"Section 87; the state should implement a policy on the participation of people as follows;

1) Promote public participation in policy formulation and planning, economic and social development at both the national and local levels"

This research aimed to create the water resources management model for rural communities to use as a guideline to solve the problems of water resources. Due to the water resources problems belong to the community, it should be solved by the community and the benefit result is for the community. All said above accord with the objectives and concepts of the constitution. It also corresponds to the idea of democracy. The words of Abraham Lincoln, The 16th president of the United States was; democracy belong to the people, by the people, and for the people as showed in the figure 2.4

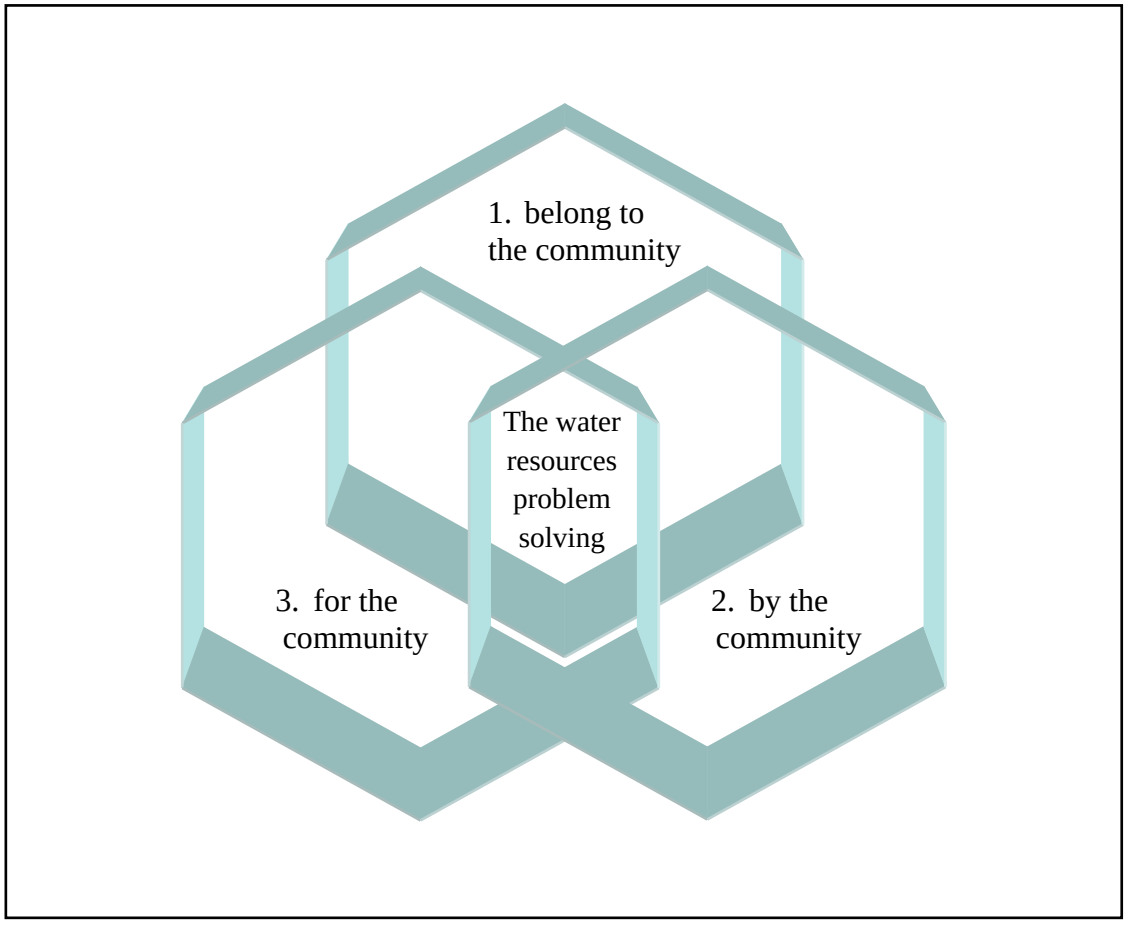


Figure 2.4 The concept of democracy is to used for solving the water resources problems in rural community

CHAPTER III
RESEARCH METHODOLOGY

As for this mixed method research, the researcher used qualitative research to create a model of water resources management and used quantitative research to study possibility of the model of water resources management and possibility of solving the problem of water shortage of people in the community. The researcher determined study guidelines, collected, and analyzed data as follows;

3.1 The study of water resource situations and management in the research area

3.1.1 Preparation. The researcher reviewed related literatures.

3.1.2 Implementation. The researcher went to Chai-Badan District, Lop Buri Province to collect empirical data on situations and management of water for cultivation, survey the area, and make unstructured interview with community leaders and villagers.

3.1.3 The research instruments. The research instruments were writing down, analysis, and synthesis.

3.2 Create a model of water resource management

The researcher found that almost half of all agriculturists in Chai Badan District have faced the problem of water shortage in the dry season. To solve said problem, the researcher used the qualitative research to create the model of water resources management as follows;

3.2.1 Qualitative research.

Inductive analysis of data was divided into three methods as follows; (Phanthip Ramsoot, 1997: 29)

1) Analytic Induction is to interpret and create conclusion of data derived from visible phenomena such as various activities in the area, tradition, making a living, way of life in the society. The researcher initially created conclusion in the form of temporary hypothesis for examination and affirmation in the next time. The researcher created conclusion in almost every step when the researcher experienced phenomena.

2) Typological analysis is to classify data into types according to steps of events with or without theories by using principles of Lofland (1971, cited in Phanthip Rarmsoot, 1997: 30).

Classification using theory is to separate phenomena into action, activity, meaning, responsibility, participation in activity, impacts, causes such as single cause, complicated cause, accumulated cause, severe cause.

Classification without using theory is to classify according to data appropriateness by using researchers' experience to group, dividing types of events, period of events, people concerned, environment, and relationship between various things, and considering that how those things occur.

3) Constant comparison is to compare data with real phenomena by making a table to find relationship, separating each phenomenon into parts, and considering relationship of various events.

3.2.2 Implementation method.

The qualitative research was used for creating the model as follows;

1) Concept

The created model must be reliable and valid as follows;

1.1) Creation of reliable model

1.1.1) Principle: Reliable model must come from reliable source. And there must be accurate analysis of source to obtain a structure used for creating the model.

1.1.1.1) Source; structural source used for creating the research model was the National Water Policy as mentioned in Chapter 1. Academicians have concluded the nine articles of the policy are systematic and simultaneous management of water in every aspect".

1.1.1.2) Analysis; the researcher analyzed the words "every aspect" in a sentence mentioned above, which means systematic and simultaneous management of water for every water-related activity of humans.

1.1.2) Implementation method:

1.1.2.1) The researcher analyzed the water about its importance, value, and attributes. The analysis results can be divided into four issues as follows; Water is vital to life. Nothing can replaces water compensate. Water can change its status. And water is more valuable than gold.

1.1.2.2) The researcher compiled and elaborately analyzed every water-related activity of humans for more correct understanding of connection of humans' activities and importance, value, and attributes of water by cause-to-effect thinking, effect-to-cause thinking, thinking by seeing continuous relationship, thinking by emphasizing a specific issue causing a problem, and pondering to separate components until there is understanding of condition and relationship of causes of humans' water-related activities.

According to analysis results, there is connection between importance, value, and attributes of water and humans' water-related activities as follows; 1) The issue on "water is vital to life" connects with an activity of humans who have to find water for drinking, called water allocation activity. 2) The issue on "nothing can replace water" connects with an activity of humans who have to improve water quality, called water quality development activity. 3) The issue on "water can change its status" connects with an activity of humans who have to prevent water from evaporation and seepage, called water maintenance activity. 4) The issues on "water is more valuable than gold, water is limited resource and has to be most efficiently used" connect with an activity of humans who have to be aware of water value, called water application activity.

1.1.2.3) The researcher used said four activities to create as model structure of water resources management.

1.1.3) The research instruments: The researcher used writing down, analysis, and synthesis.

1.2) Being valid model

1.2.1) Principle: Valid model of water resources management must come from complete model structure.

1.2.2) Reason: If the model structure of water resources management is not complete, results of complying with the model will not cover every water-related activity.

1.2.3) Implementation method: SWOT Analysis was used for reviewing completeness of activities used for creating the model.

1.2.4) The research instruments: The researcher used writing down and analysis.

2) Implementation was divided into two steps as follows;

2.1) Model creation

2.1.1) Type of research:

Research and Development (R&D) were used as guidelines of creating the model of water resources management.

Research & Development (Reference: nrct.net 2006-02-11) is creative job which systematically implements for increasing and using knowledge of humans, culture, and society to invent new useful things as follows;

1. Basic research is to do laboratory or theoretical research to find new knowledge of causes of phenomena and reality or analyze to find attributes of structure or various relationships to determine and test hypothesis, theories, and laws without expecting specific use.

2. Applied research is to do research to find and use new knowledge or apply knowledge and methods derived from the basic research or find new methods to achieve goals clearly specified in advance.

3. Experimental development is a kind of job systematically done using knowledge derived from the research and existing

experience to create new materials, products, and tools to install new process, system, and service or improve those things.

2.1.2) Implementation method. The researcher used humans' water-related activities connected with importance, value, and attributes of water to create the model of water resources management.

2.2) Model development

2.2.1) Development of theoretical possibility:

The researcher sought advice on theoretical possibility of the model from three thesis advisory committee appointed by the order of Graduate Studies, Mahidol University.

2.2.1.1) Data collection method; the researcher sent the model to three experts in advance, made appointment with these experts, and met an expert a time.

2.2.1.2) The research instruments; the researcher used asking and writing down.

2.2.2) Development of action possibility:

The researcher sought advice on action possibility of the model from three community leaders in the research area consisting of a sub-district head, a village head, and a teacher derived from purposive sampling.

2.2.2.1) Data collection method; the researcher with the model went to see each person after making appointment in advance.

2.2.2.2) The research instruments; the researcher used asking and writing down.

2.2.3) Application of theoretical possibility and action possibility:

The researcher sought advice on application of theoretical possibility and action possibility of the model from three local experts who live in Buri Ram Province, were obtained by purposive sampling, and have achieved success in managing water for cultivation in their land.

2.2.3.1) Data collection method; the researcher with the model went to see each person without making an appointment because people usually go to see and seek advice from these local experts every day.

2.2.3.2) The research instruments; the researcher used asking and writing down.

3.3 The study of possibility of the created model of water resource management and possibility of participation in solving the water shortage problems of people in the rural communities

The quantitative research was used for studying this issue as follows;

3.3.1 Research Scope

1) Population Research

Population were 26,478 households in Chai-Badan district, Lopburi province that stay outside municipalities as shown in table 3.1

Table 3.1 The households in Chai-Badan district, Lopburi province that stay outside municipalities.

Sub-district	Amount of village	Amount of household
1. Lum Narai	3	400
2. Chai Narai	4	1,120
3. Sila Thip	12	2,057
4. Huay Hin	8	1,076
5. Muang Khom	11	2,093
6. Bua Chum	9	2,909
7. Tha Dindam	6	1,833
8. Makok Wan	4	724
9. Sap Takhian	6	1,683
10. Na Som	6	1,057
11. Nong Yaito	8	1,311
12. Kho Rang	10	1,904
13. Tha Manao	8	1,248
14. Nikhom Lam Narai	9	1,546
15. Chai Badan	8	3,086
16. Banmai Samakkhi	6	939
17. Khao Laem	8	510
Total 17 districts	126	26,478

Source: The Registration Technology Development and Management Division, Department of the Interior. (2110).

2) Sample Size

The Yamane's formula was employed to find the sample size by equivalent 1 household as 1 people (Boontham Kijpredaborisutra, 531: 25)

$$\text{Formula} \quad n = \frac{N}{1 + Ne^2}$$

n = District level Sample Size

N = Sample Size

e = Acceptable tolerances was 0.05

$$\text{Substitute} \quad n = \frac{26{,}478}{1 + 26{,}478\ (0.05)^2}$$

$$= 394$$

Sample size was rounded up to 400 for statistic errors prevention.

3) Sample Sampling

After getting each village sample size, simple random sampling was employed to sampling in each village. 400 people were selected .They were sent not only the acceptable letters but done interview appoinment as well. For the rejection cases, sampling replacement were done.

3.3.2 Research Instruments

The data collection of this research was questionnaire. It was consist of 6 parts 106 items.

Part 1 Personal data: The 7 questions about sex, age, religion, education level, occupation, residence period and status were asked.

Part 2 Data on environments in the community: The 36 questions were divided to 2 sections, the first section was natural environment that consists of soil, water, air, energy, plant, and animal, the second one was cultural environment that consists of concepts, organization, usage and usage and object.

Part 3 Knowledge of Environmental Education for water resource management of people in the community: The 20 question about environmental

education objective consists of awareness, knowledge, attitude, skill, participation and the objective were adopted to conduct 20 closed-ended questions which have 3 choices; considerably agree, slightly agree and disagree.

Scoring:	Right answer got	3	point
	Resemble answer got	2	point
	Wrong answer got	1	point

The water recognition grouping criteria divided to 3 levels.

48-60 point	means	high perception group
34-47 point	means	moderate perception group
20-33 point	means	low perception group

Part 4 Opinions on the water resource management model: In this section, the opinion about ADMA cycle would be asked such as Allocation: A, Development: D, Maintenance: M, and Application: A. The ADMA cycle concept were applied to conduct 14 closed-ended questions which have 3 choices; considerably agree, slightly agree and disagree.

Scoring:	Right answer got	3	point
	Resemble answer got	2	point
	Wrong answer got	1	point

The ADMA cycle concept grouping criteria divided to 3 levels.

34-42 point	means	considerably agree group
24-33 point	means	slightly agree group
14-23 point	means	disagree group

Part 5 Opinions on participation in solving the water shortage problem of people in the community: In this section, the opinions about participation and solving the water shortage problem of people in the community were applied to conduct 14 closed-ended questions which have 3 choices; considerably agree, slightly agree and disagree.

Scoring:	Right answer got	3	point
	Resemble answer got	2	point
	Wrong answer got	1	point

The ADMA cycle concept grouping criteria divided to 3 levels.

34-42 point means considerably agree group

24-33 point means slightly agree group

14-23 point means disagree group

Part 6 Problems and obstacles making people in the community unable to solve the problem of water shortage and recommendations: There were 9 open-ended questions to ask the samples.

3.3.3 Research Instruments Monitoring

1) Content Validity

(1) The 6 parts of questionnaire was conducted.

(2) The questionnaire was submitted to dissertation committee to carefully check for legibly and grammatical correct. However, it was face validity.

2) Reliability

After done validity process, the questionnaire was tried out with 20 Non-sample household. Then, the data were analyzed by Cronbach Coefficient of alpha (Puangrat Taweerat, 1997)

Formula $\alpha = \frac{n}{n-1}\left(1- \frac{\Sigma s_i^2}{s_i^2}\right)$

α = confidence coefficient

n = items amounts

Σs_i^2 = whole variance

s_i^2 = each items variance

The analysis result of reliability was 0.697

3.3.4 Data collection

Data collection process used by the researcher was:

1) Official letter was sent to the Lopburi governor and the Chai–badan chief-district for data collection accommodation.

2) Assistant researchers were trained to collect data.

3) 15 assistant researchers collected data in the field study.

4) 4 days collecting data.

3.3.5 Research Statistic

1) Personal data and data on environments in the community were analyzed by percentage, mean, S.D., max., and min.

2) Knowledge of Environmental Education for water resource management of people in the community, opinions on the water resource management model and opinions on participation in solving the water shortage problem of people in the community were analyzed by percentage, mean, S.D., max., and min

3) Variable correlations such as sexes, aged, religions, and education were analyzed by Pearson Product Moment Correlation Coefficient.

3.4 Research guidelines framework

There were 3 periods.

Period 1: Communities study

Study the water resource situation and management in research communities

Period 2: Create a water management model; consists of 3 phases.

Phase 1

Step 1: Identify the qualifications of model.

Step 2: The researcher collected and analyzed the human activities related to the importance, value, and attributes of water.

Phase 2
Create a water management draft-model

Step 1: The analyzed data were synthesized to groups of activities.

Step 2: Used the groups of activities to create a water resource management draft-model.

Step 3: The draft-model was reviewed by SWOT analysis.

Phase 3
Developed the draft-model

The draft-model had been developed by the experts, is named the ADMA Cycle.

Period 3: The study of the possibility of the created model and possibility of participation in solving water shortage problems of people in the rural communities

Study by asking the opinions of household leaders in research communities.

CHAPTER IV
RESEARCH RESULTS

The objectives of this research are to study water resource situations and management in rural communities, create a model of water resource management, and study possibility of the created model of water resource management and possibility of participation in solving the water shortage problems of people in the rural communities. The research results can be divided as follows;

4.1 General data

The rural community used for this research is Chai Badan District formerly called Muang Chai Badan governed by Muang Nakhon Ratchasima and situated at Ban Buachum, Buachum Sub-district. In 1914, Muang Chai Badan was downgraded as Chai Badan District and was governed by Muang Phetchabun. In 1918, Chai Badan District was under responsibility of Saraburi province and Chai Badan District Office was relocated to Ban Chai Badan, Chai Badan Sub-district. On 1st November 1941, it has been governed by Lop Buri province till the present time. In 1971, Thai spellings of Chai Badan were changed. In the past, Chai Badan District had wide areas covering Tha Luang District and Lam Sonthi District. It used to be nominated as the center of Phra Narai province in 2003 and 2010 but was not considered because it did not meet the criteria of establishing a new province.

At present, Chai Badan District has 17 sub-districts and 126 villages. In 2010, there were 26,478 households (not including households in the Municipality) as shown in Table 3.1. It is situated in the east of Lop Buri province. In the north, it is adjacent to Sri Thep District, Phetchabun Province. In the east, it is adjacent to Lam Sonthi District. In the south, it is adjacent to Muak Lek District, Saraburi province, Tha Luang District, and Phatthana Nikhom District. In the west, it is adjacent to Khok Samrong District, Sra Boat District, and Khok Jaroen District. Pa Sak Chonlasit Dam

stores water in the west of the district as shown in the map of Lop Buri Province, a map of Chai Badan District, and a map of Pa Sak Chonlasit Dam as appeared in Appendix D.

4.1.1 Data on populations

The researcher studied characteristics of populations of the sample group consisting of 400 household leaders in Chai Ba Dan District, Lop Buri Province consisting of 17 sub-districts and 126 villages during 4th-5th, and 11th-12th September, 2010 and could collect data by 100%. Analysis results of data on respondents' general condition on sex, age, religion, education, occupation, period of living in the community, and social position were shown in Table 4.1 – Table 4.7.

Table 4.1 Percent of respondents' general status classified by sex

Respondents' general data	**Number of people**	**Percent**
1. Sex		
1.1 Male	143	35.75
1.2 Female	257	64.25
Total	**400**	**100**

According to Table 4.1, there were 400 respondents divided into 257 female respondents (64.25%) and 143 male respondents (35.75%).

Table 4.2 Percent of respondents' general status classified by age

Respondents' general data	**Number of people**	**Percent**
2. Age		
2.1 Aged 25 - 34	32	8.00
2.2 Aged 35 - 44	76	19.00
2.3 Aged over 45	292	73.00
Total	**400**	**100**

According to Table 4.2, there were 400 respondents aged over 20. The oldest respondent is 74 years old. 292 respondents are over 45 years old (73%). 76 respondents are 35-44 years old (19%). And 32 respondents are 21-34 years old (8%).

Table 4.3 Percent of respondents' general status classified by religion

Respondents' general data	**Number of people**	**Percent**
3. Religion		
3.1 Buddhism	397	99.25
3.2 Christianity	3	0.75
3.3 Islam	0	0.00
3.4 Other	0	0.00
Total	**400**	**100**

According to Table 4.3, there were 400 respondents divided into 397 Buddhists (99.25%) and three Christians (0.75%).

Table 4.4 Percent of respondents' general status classified by educational level

Respondents' general data	**Number of people**	**Percent**
4. Educational levels		
4.1 Primary level (Prathom.1 - Prathom.6)	239	59.75
4.2 Secondary level (M. 1 - M.6)	85	21.25
4.3 Vocational Certificate/High Vocational Certificate/Diploma	26	6.50
4.4 Bachelor Degree	35	8.75
4.5 Over Bachelor Degree	7	1.75
4.6 Other	8	2.00
Total	**400**	**100**

According to Table 4.4, there were 400 respondents divided into 239 respondents whose education is the primary level (Prathom 1 – Prathom 6) (59.75%).

The educational level of 85 respondents is the secondary level (21.25%). The educational level of 35 respondents is Bachelor Degree (8.75%). The educational levels of 26 respondents are Vocational Certificate, High Vocational Certificate, and Diploma (6.50%). Eight respondents received other educational level (2.00%). And seven respondents receive education over Bachelor Degree (1.75%).

Table 4.5 Percent of respondents' general status classified by main occupations

Respondents' general data	**Number of people**	**Percent**
5. Main occupations		
5.1 Agriculture	181	45.25
5.2 Trading/personal business operation	97	24.25
5.3 Civil servants/employees in the state enterprise	13	3.25
5.4 Hirelings	77	19.25
5.5 Other	32	8.00
Total	**400**	**100**

According to Table 4.5, there were 400 respondents divided into 181 respondents whose main occupation is agriculture (45.25%). Main occupation of 97 respondents is trading/personal business operation (24.25%). Main occupation of 77 respondents is hirelings (19.25%). 32 Respondents have other occupations (8.00%). And main occupations of 13 respondents are civil servants/employees in the state enterprise (3.25%).

Table 4.6 Percent of respondents' general status classified by period of living in the community

Respondents' general data	Number of people	Percent
6. Period of living in the community		
6.1 Living from birth	164	41.00
6.2 Living for a long time	236	59.00
Total	**400**	**100**

According to Table 4.6, there were 400 respondents divided into 236 respondents who have lived in the community for 5 – 25 years (59.00%). And 164 respondents have lived in the community from birth (41.00%).

Table 4.7 Percent of respondents' general status classified by social positions

Respondents' general data	Number of people	Percent
7. Social positions (such as Sub-district Head, Village Head, Religious leader)		
7.1 No	318	79.50
7.2 Yes	82	20.50
Total	**400**	**100**

According to Table 4.7, there were 400 respondents divided into 318 respondents who have never taken any social positions (79.50%). And 82 respondents used to take social positions (20.50%).

According to the research results of occupation in general, the researcher found that occupation of most of the sample group in the research area is agriculture. This is consistent with the research objectives which aim to study in the area of people whose occupation is agriculture.

4.1.2 Data on water situation and other environmental situations in the community

The researcher simultaneously studied water situation and other environmental situations in the community because consideration of environments in general will enable the researcher to completely understand water situation in the community and carry out advance evaluation of problems which may occur after doing the research. Details of the research results were shown in Table 4.8 – Table 4.21.

Table 4.8 Percent of respondents' data on community environments classified by natural environments on soil

Respondents' data on community environments	Number of people	Percent
1. Soil		
1. 1 How does your family hold the land?		
1.1.1 Self-ownership	338	84.50
1.1.2 Renting	37	9.25
1.1.3 Other	25	6.25
Total	**400**	**100**
1.2 How is the land held by your family mainly used?		
1.2.1 Agriculture	244	61.00
1.2.2 Industry	0	0.00
1.2.3 Dwelling	143	35.75
1.2.4 Other	13	3.25
Total	**400**	**100**
1.3 Do your family's land face the problems of land quality?		
1.3.1 No	294	73.50
1.3.2 Yes	106	26.50
1.3.2.1 Saline soil	(21)	(5.25)
1.3.2.2 Acid soil	(12)	(3.00)
1.3.2.3 Other	(73)	(18.25)
Total	**400**	**100**

According to Table 4.8, there were 400 respondents divided into 338 respondents who hold the land ownership (84.50%). 37 respondents hold the land by renting (9.25%). 25 respondents hold the land in other forms (6.25%). 244 respondents use the land for agriculture (61.00%). 143 respondents use the land as dwellings (35.75%). And 13 respondents use the land for other purposes (3.25%). And the researcher found that 294 respondents do not face the problem of soil quality (73.50%). 106 respondents face the problem of soil quality (26.50%). 73 respondents most face the problem of soil quality (18.25%).

Table 4.9 Percent of respondents' data on community environments classified by natural environments on water resources and drinking water

Respondents' data on community environments	**Number of people**	**Percent**
2. Water		
2.1 Does your family have your own water resources?		
2.1.1 No	278	69.50
2.1.2 Yes	122	30.50
2.1.2.1 Pond	(32)	(8.00)
2.1.2.2 Artesian well	(26)	(6.50)
2.1.2.3 Other	(64)	(16.00)
Total	**400**	**100**
2.2 Where does your family get the drinking water?		
2.2.1 Rainwater	345	86.25
2.2.2 Underground water	6	1.50
2.2.3 Tap water	15	3.75
2.2.4 Other	34	8.50
Total	**400**	**100**

Table 4.9 Percent of respondents' data on community environments classified by natural environments on water resources and drinking water (cont.)

Respondents' data on community environments	Number of people	Percent
2.3 Did your family use to face the problem of drinking-water shortage in the dry season in the past three years?		
2.3.1 No	315	78.75
2.3.2 Yes	85	21.25
2.3.2.1 Once	(14)	(3.50)
2.3.2.2 Twice	(21)	(5.25)
2.3.2.3 Three consecutive years	(50)	(12.50)
Total	**400**	**100**
2.4 How do you solve the problem of drinking-water shortage in the dry season, if your family used to face this problem?		
2.4.1 Receive water from the state agency.	30	35.29
2.4.2 Other	55	64.71
Total	**85**	**100**

According to Table 4.9, there were 400 respondents divided into 278 respondents who do not have their own water resources (69.50%). 122 respondents have their own water resources (30.50%). 64 respondents use other water resources (16.00%). As for drinking water, 345 respondents receive drinking water from the rainwater (86.25%). 34 respondents receive drinking water from other places (8.50%). 15 respondents receive drinking water from the tap water (3.75%). Six respondents receive drinking water from the underground water (1.50%). In the dry season in the past three years, 315 respondents have never faced the problem of drinking-water shortage (78.75%). 85 respondents used to face the problem of drinking-water shortage (21.25%). 50 out of 85 respondents used to face this problem for three consecutive years (12.50%). 259 respondents who used to face the problem of drinking water shortage in the dry season solve this problem by finding drinking water from other places (64.75%). 141 respondents receive drinking water from the state agency (35.25%).

Table 4.10 Percent of respondents' data on community environments classified by natural environments on household-based water

Respondents' data on community environments	**Number of people**	**Percent**
2.5 Where does your family receive household-based water?		
2.5.1 Rainwater	86	21.50
2.5.2 Underground water	40	10.00
2.5.3 Tap water	269	67.25
2.5.4 Other	5	1.25
Total	**400**	**100**
2.6 Did your family use to face the problem of household-based water shortage in the dry season in the past three years?		
2.6.1 No	284	71.00
2.6.2 Yes	116	29.00
2.6.2.1 Once	(16)	(4.00)
2.6.2.2 Twice	(29)	(7.25)
2.6.2.3 Three consecutive years	(71)	(17.75)
Total	**400**	**100**
2.7 How do you solve the problem of household-based water shortage in the dry season, if your family used to face this problem?		
2.7.1 Receive water from the state agency.	45	38.79
2.7.2 Other	71	61.21
Total	**116**	**100**

According to Table 4.10, there were 400 respondents divided into 296 respondents who receive the household-based water from the tap water (67.25%). 86 respondents receive this water from the rainwater (21.50%). 40 respondents receive this water from the underground water (10.00%). And five respondents receive this water from other places (1.25%). In the dry season in the past three years, 284 respondents have never faced the problem of household-based water shortage (71.00%). 116

respondents used to face the problem of household-based water shortage (29.00%). 71 out of 116 respondents have faced this problem for three consecutive years (17.75%). 71 respondents who used to face this problem solve this problem by finding water from other places (61.21%). 45 respondents receive water from the state agency (38.79%).

Table 4.11 Percent of respondents' data on community environments classified by natural environments on cultivation-based water

Respondents' data on community environments	**Number of people**	**Percent**
2.8 Where does your family receive cultivation-based water?		
2.8.1 Rainwater	245	61.25
2.8.2 Underground water	19	4.75
2.8.3 Tap water	37	9.25
2.8.4 Other	99	24.75
Total	**400**	**100**
2.9 Did your family use to face the problem of cultivation-based water shortage in the dry season in the past three years?		
2.9.1 No	232	58.00
2.9.2 Yes	168	42.00
2.9.2.1 Once	(35)	(8.75)
2.9.2.2 Twice	(44)	(11.00)
2.9.2.3 Three consecutive years	(89)	(22.25)
Total	**400**	**100**
2.10 How do you solve the problem of cultivation-based water shortage in the dry season, if your family used to face this problem?		
2.10.1 Receive help from the state agency	56	33.33
2.10.2 Other	112	66.67
Total	**168**	**100**

According to Table 4.11, there were 400 respondents divided into 245 respondents who receive cultivation-based water from the rainwater (61.25%). 99 respondents receive this water from other sources (24.75%). 37 respondents receive this water from the tap water (9.25%). 19 respondents receive this water from the underground water (4.75%). In the dry season in the past three years, 232 respondents have never faced the problem of cultivation-based water shortage (58.00%). 168 respondents used to face this problem (42.00%). 89 respondents used to face this problem for three consecutive years (22.25%). 112 respondents who used to face this problem solve this problem by finding cultivation-based water from other sources (66.67%). 56 respondents receive help from the state agency (33.33%).

According to the research results of water situation in general, the researcher found that most of the sample group in the research area do not face the problem of household water shortage but almost half of the sample group face the problem of cultivation water shortage. This is consistent with the intention of the researcher who wanted to study water situation in the area where most people do not have enough water for cultivation. Moreover, the researcher found that most of the sample groups do not have their own water resources and they use rainwater for cultivation. Almost half of the sample group used to face the problem of cultivation water shortage. Half of people who used to face this problem have faced this problem for three consecutive years. This indicates that this problem is awaiting solution. Half of the sample group who used to face the flood problem used to face the problem of cultivation water shortage.

Table 4.12 Percent of respondents' data on community environments classified by natural environments on flood which damaged crops

Respondents' data on community environments	**Number of people**	**Percent**
2.11 Did your family use to face the problem of flood which damaged crops in the flood season in the past three years?		
2.11.1 No	304	76.00
2.11.2 Yes	96	24.00
2.11.2.1 Once	(19)	(4.75)
2.11.2.2 Twice	(32)	(8.00)
2.11.2.3 Three consecutive years	(45)	(11.25)
Total	**400**	**100**
2.12 How do you solve this problem if your family used to face this problem?		
2.12.1 Receive help from the state agency.	42	43.75
2.12.2 Other	54	56.25
Total	**96**	**100**

According to Table 4.12, there were 400 respondents divided into 304 respondents who have never faced the problem of flood which damaged crops in the flood season in the past three years (76.00%). 96 respondents used to face this problem (24.00%). 45 respondents used to face the flood problem for three consecutive years (11.25%). 227 respondents who used to face the flood problem solve this problem by seeking help from other sources (56.75%). 42 respondents receive help from the state agency (43.75%).

Table 4.13 Percent of respondents' data on community environments classified by natural environments on polluted water resources

Respondents' data on community environments	**Number of people**	**Percent**
2.13 Did your family use to face the problem of polluted water resources, causing your family not to be able to use the water in the past three years?		
2.13.1 No	338	84.50
2.13.2 Yes	62	15.50
2.13.2.1 Once	(16)	(4.00)
2.13.2.2 Twice	(21)	(5.25)
2.13.2.3 Three consecutive years	(25)	(6.25)
Total	**400**	**100**
2.14 How do you solve this problem if your family used to face this problem?		
2.14.1 Receive help from the state agency.	20	32.26
2.14.2 Other	42	67.74
Total	**62**	**100**

According to Table 4.13, there were 400 respondents divided into 338 respondents who did not use to face the problem of polluted water resources (84.50%). 62 respondents used to face this problem (15.50%). 25 respondents used to face this problem for three consecutive years (6.25%). 42 respondents who used to face this problem solve this problem by seeking help from other sources (67.74%). 20 respondents receive help from the state agency (32.26%).

Table 4.14 Percent of respondents' data on community environments classified by natural environments on air

Respondents' data on community environments	Number of people	Percent
3. Air		
3.1 Did your family use to face the problem of air pollution causing your family not to be able to use the rainwater for drinking in the past three years?		
3.1.1 No	331	82.75
3.1.2 Yes	69	17.25
3.1.2.1 Once	(18)	(4.50)
3.1.2.2 Twice	(24)	(6.00)
3.1.2.3 Three consecutive years	(27)	(6.75)
Total	**400**	**100**
3.2 How do you solve this problem if your family used to face this problem?		
3.2.1 Receive help from the state agency	20	29.00
3.2.2 Other	49	71.00
Total	**69**	**100**
3.3 What causes the problem of air pollution which impacts on use of the rainwater for drinking?		
3.3.1 Industrial smoke	156	39.00
3.3.2 Agricultural smoke caused by burning unwanted plants.	48	12.00
3.3.3 Smoke from vehicles	57	14.25
3.3.4 Other	139	34.75
Total	**400**	**100**

According to Table 4.14, there were 400 respondents divided into 331 respondents who did not use to face the problem of air pollution (82.75%). 39 respondents used to face this problem (17.25%). 27 respondents used to face this problem for three consecutive years (6.75%). 49 respondents who used to face this problem solve this problem by seeking help from other sources (71.00%). 20

respondents receive help from the state agency (29.00%). 156 respondents found that the problem of air pollution which impacts on use of the rainwater for drinking is caused by industrial smoke (39.00%). 139 respondents said that this problem is caused by other causes (34.75%). 57 respondents said that this problem is caused by smoke from vehicles (14.25%). 48 respondents said that this problem is caused by agriculturists who burnt unwanted plants (12.00%).

Table 4.15 Percent of respondents' data on community environments classified by natural environments on energy

Respondents' data on community environments	**Number of people**	**Percent**
4. Energy		
4.1 Does your family use wind energy for water-based benefits?		
4.1.1 No	390	97.50
4.1.2 Yes	10	2.50
Total	**400**	**100**
4.2 Does your family use solar energy for water-based benefits?		
4.2.1 No	392	98.00
4.2.2 Yes	8	2.00
Total	**400**	**100**
4.3 Does your family produce biological gas by fermenting dung or agricultural rubbish for water-based benefits?		
4.3.1 No	364	91.00
4.3.2 Yes	36	9.00
Total	**400**	**100**

According to Table 4.15, there were 400 respondents divided into 390 respondents who do not use wind energy for water-based benefits (97.50%). 10 respondents use wind energy for water-based benefits (2.50%). 392 respondents do not

use solar energy for water-based benefits (98.00%). Eight respondents use solar energy for water-based benefits (2.00%). Moreover, the researcher found that 364 respondents do not produce biological gas by fermenting dung or agricultural rubbish for water-based benefit (91.00%). 36 respondents produce biological gas by fermenting dung or agricultural rubbish for the water-based benefits (9.00%).

Table 4.16 Percent of respondents' data on community environments classified by natural environments on plants

Respondents' data on community environments	**Number of people**	**Percent**
5. Plants		
5.1 What economic plants does your family most grow?		
5.1.1 Rice	110	27.50
5.1.2 Agricultural plants	178	44.50
5.1.3 Home-grown vegetables	48	12.00
5.1.4 Fruits	4	1.00
5.1.5 Other	60	15.00
Total	**400**	**100**
5.2 Apart from the problem of water shortage and the flood problem in the past three years, did your family use to face other cultivation problems?		
5.2.1 No	227	56.75
5.2.2 Yes	173	43.25
5.2.2.1 The problem of seeds	(16)	(4.00)
5.2.2.2 The problem of fertilizer	(52)	(13.50)
5.2.2.3 The problem of low price	(84)	(20.50)
5.2.2.4 Other problems	(21)	(5.25)
Total	**400**	**100**
5.3 How do you solve other cultivation problems if your family used to face these problems?		
5.3.1 Receive help from the state agency	69	39.89
5.3.2 Other	104	60.11
Total	**173**	**100**

According to Table 4.16, there were 400 respondents divided into 178 respondents who grow economic plants on agricultural plants (44.50%). 110 respondents grow rice (27.50%). 60 respondents grow other plants (15.00%). 48 respondents grow home-grown vegetables (12.00%). Four respondents grow fruits

(1.00%). 227 respondents have never faced other cultivation problems except the problem of water shortage and the flood problem in the past three years (56.75%). 173 respondents used to face other cultivation problems (43.25). 84 out of 173 respondents face the problem of low price (20.50%). 240 respondents who face other cultivation problems solve these problems by other methods (60.00%). 160 respondents receive help from the state agency (40.00%).

Table 4.17 Percent of respondents' data on community environments classified by natural environments on animals

Respondents' data on community environments	**Number of people**	**Percent**
6. Animals		
6.1 Does your family raise animals for consumption in the household?		
6.1.1 No	310	77.50
6.1.2 Yes	90	22.50
6.1.2.1 Hens	(23)	(5.75)
6.1.2.2 Ducks	(14)	(3.50)
6.1.2.3 Pigs	(17)	(4.25)
6.1.2.4 Fish	(9)	(2.25)
6.1.2.5 Cows	(15)	(3.75)
6.1.2.6 Other	(12)	(3.00)
Total	**400**	**100**
6.2 Did you use to face the problem of shortage of water used for raising animals if your family raise animals?		
6.2.1 No	78	86.67
6.2.2 Yes	12	13.33
Total	**90**	**100**

According to Table 4.17, there were 400 respondents divided into 310 respondents who do not raise animals for consumption in the household (77.50%). 90 respondents raise animals for consumption in the household (22.50%). 23 respondents raise hens (5.75%). 347

respondents raise animals but have never faced the problem of water shortage (86.75%). 53 respondent raise animals and used to face the problem of water shortage (13.25%).

Table 4.18 Percent of respondents' data on community environments classified by cultural environments on concepts: culture on belief, rituals, crafts, knowledge

Respondents' data on community environments	**Number of people**	**Percent**
7. Concepts: culture on belief, rituals, crafts, knowledge		
7.1 Does your family or your village have belief in water-based rituals?		
7.1.1 No	303	75.75
7.1.2 Yes	97	24.25
Total	**400**	**100**
7.2 Does your family or your village have experts in the following crafts?		
7.2.1 No	315	78.75
7.2.2 Yes	85	21.25
7.2.2.1 Weaving	(6)	(1.50)
7.2.2.2 Basketry	(15)	(3.75)
7.2.2.3 Pottery	(8)	(2.00)
7.2.2.4 Banana leaf-based inventions	(6)	(1.50)
7.2.2.5 Sculpture	(11)	(2.75)
7.2.2.6 Other	(39)	(9.75)
Total	**400**	**100**
7.3 Does your family or your village have folk medicine books?		
7.3.1 No	353	88.25
7.3.2 Yes	47	11.75
Total	**400**	**100**

According to Table 4.18, families or villages of 303 out of 400 respondents do not have belief in the water-based rituals (75.75%). Families and villages of 97 respondents have belief in the water-based rituals (24.25%). Families and villages of 315 respondents do not have expertise in crafts (78.75%). Families or villages of 85 respondents have expertise in crafts (21.25%). Families or villages of 39 out of 85 respondents most have expertise in other crafts (9.75%). Families or villages of 353 respondents do not have folk medicine books (88.25%). Families or villages of 47 respondents have folk medicine books (11.75%).

Table 4.19 Percent of respondents' data on community environments classified by cultural environments on organization: grouping culture

Respondents' data on community environments	**Number of people**	**Percent**
8. Organization: grouping culture		
8.1 Does your village group for doing activities?		
8.1.1 No.	255	63.75
8.1.2 Yes.	145	36.25
8.1.2.1 Club	(27)	(6.75)
8.1.2.2 Cooperative	(103)	(25.75)
8.1.2.3 Other	(15)	(3.75)
Total	**400**	**100**

According to Table 4.19, villages of 255 out of 400 respondents do not group to do activities (63.75%). Villages of 145 respondents are group to do activities (36.25%). 103 out of 145 respondents are group to form of cooperative (25.75%).

Table 4.20 Percent of respondents' data on community environments classified by cultural environments on ceremony: local tradition

Respondents' data on community environments	Number of people	Percent
9. Ceremony: local tradition		
9.1 Does your family or your village have folk songs?		
9.1.1 No	374	93.50
9.1.2 Yes	26	6.50
Total	**400**	**100**
9.2 Does your family or your village have folk tales?		
9.2.1 No	391	97.75
9.2.2 Yes	9	2.25
Total	**400**	**100**
9.3 Does your family or your village have the activity on kid's play?		
9.3.1 No	377	94.25
9.3.2 Yes	23	5.75
Total	**400**	**100**

According to Table 4.20, families or villages of 374 out of 400 respondents do not have local tradition on folk song (93.50%). Families or villages of 26 respondents have local tradition on folk song (6.50%). Families or villages of 391 respondents do not have local tradition on folk tales (97.75%). Families or villages of nine respondents have local tradition on folk tales (2.2.5%). Families or villages of 377 respondents do not have the activity on kid's play (94.25%). Families or villages of 23 respondents have the activity on kid's play (5.75%).

Table 4.21 Percent of respondents' data on community environments classified by cultural environments on materials: material culture

Respondents' data on community environments	Number of people	Percent
10. Materials: Local tradition		
10.1 Does your village have any constructions which should be conserved?		
10.1.1 No	285	71.25
10.1.2 Yes	115	28.75
Total	**400**	**100**

According to Table 4.21, villages of 285 out of 400 respondents do not have any constructions which should be conserved (71.25%). Villages of 115 respondents have constructions which should be conserved (28.75%).

As for the research results of other environments in general, the researcher found that number of the sample group moving to live in the research area is higher than that of the sample group who was born and were grown up in the research area. As for natural resources, the researcher found that most of the sample group own the land, do not face the problem of quality of soil used for cultivation, and more considerably grow farm crops than other plants. Few people used to face the problems of air pollution, production of alternative energy, and raising animals for consumption. As for cultural resources, the researcher found that few people have belief in rituals, have expertise on handicraft, have folk medicine textbooks, gather together to jointly do activities, have folk songs and folk tales, and have constructions which should be conserved.

4.1.3 Data on management of water resource and other resources in the community

As for the research results of data on management of water resource and other natural resources in the research area as shown in Table 4.9 – Table 4.16, the researcher found that number of the sample group solving the problems of water resource and other resources by self-reliance is higher than that of the sample group

waiting to receive help from the government. As for solution to the problems of water shortage of the community living outside the village water supply zone, the researcher found that most of these people solve the problem of household water shortage by using big earthen jars to store the rainwater. And they solve the problem of agricultural water shortage by using a new theory of His Majesty the King by digging a pond in their land. This latter method is able to solve the problem of household water shortage and the problem of agricultural water shortage as shown in the photos of Appendix C.

4.2 The model for water resource management

A model of water resource management created by analyzing the National Water Policy in general means management of water-related activities of humans. After compiling water-related activities of humans and analyzing importance, value, and attributes of water, the researcher obtained four activities consisting of allocation, development, maintenance, and application. The researcher used four activities to create a model of water resource management and develop the model as advised by environmental experts, community leaders, and local experts until the researcher obtained a model of water resource management called ADMA Cycle as shown in Figure 5.

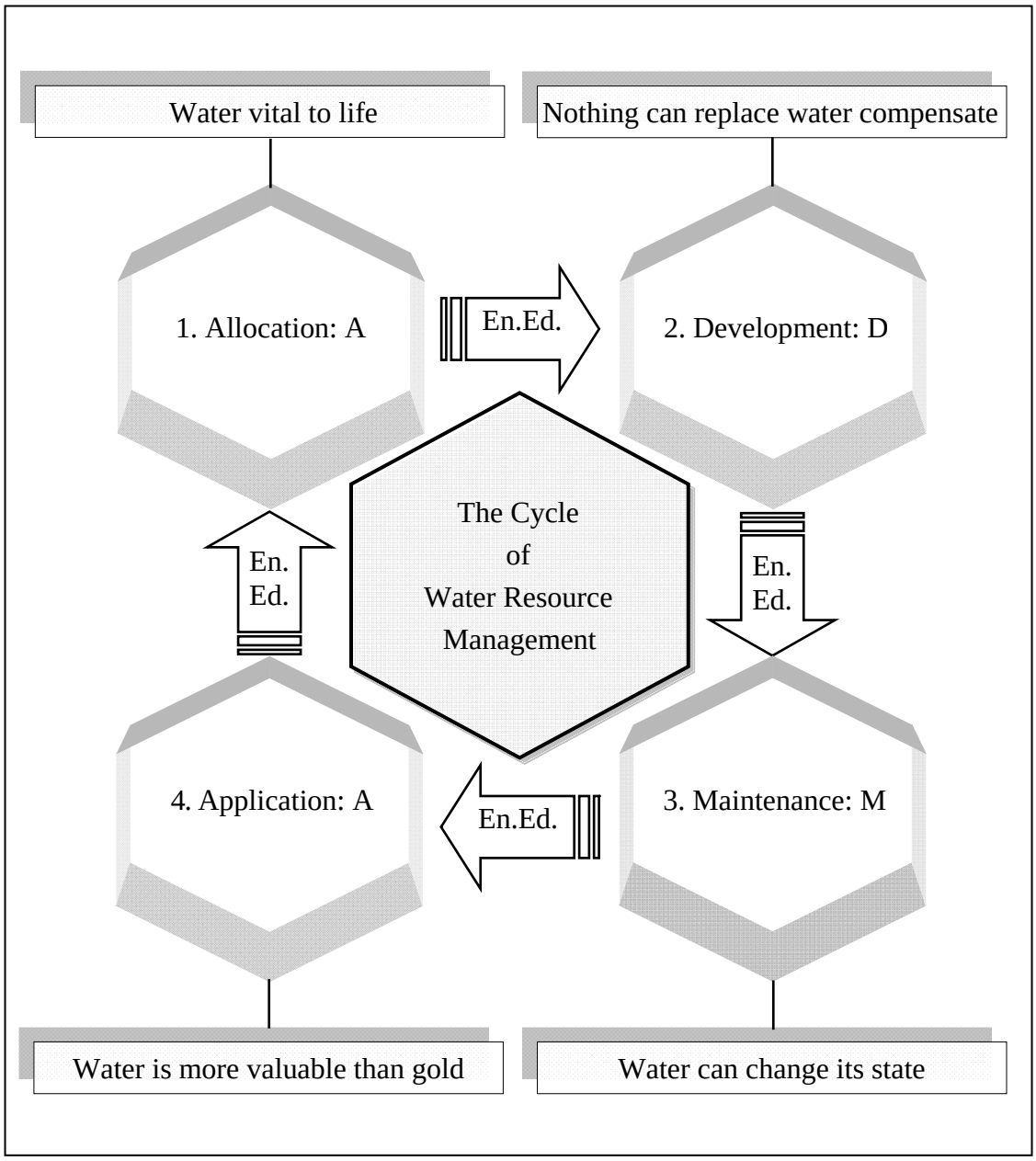


Figure 4.1 The Cycle of Water Resource Management "ADMA Cycle"

A model of water resource management called ADMA Cycle consists of four activities as follows;

1) Allocation means activities to provide water without retaining. Activities to provide water consist of activities of providing water and activities of retaining water. Both activities aim to obtain water but using different methods. As for the activities of providing water, people have to invest using money or labor to reach water resources such as investing to make artificial rain, investing to desalinate,

investing to buy water from neighboring countries, investing to dig artesian wells, and investing to grow forests to make trees help produce and retain water. As for the activities of retaining water, people do not have to use money or labor for reaching water resources because water resources reach people who retain water and only build places for retaining water by storing water from the forests, rivers, streams in the reservoirs, dams, Kaem Ling or using big earthen jars to store the rainwater.

Expenses used for water retention and water provision are different. As for water retention, people have to invest to build a place for retaining water once. As for water provision, people have to invest every time when they want to reach water resources. For example, although people dig artesian wells, they are not able to use water in the artesian wells until they take water out of the artesian wells every time they want to use. However, growing forests is a one-time investment because forests are the living things so they are able to work by themselves. As water retention is a one-time investment, most of the countries in the world like to solve the problems of water shortage by building runoff- retaining dams. Runoff retained in the dams tends to continuously decrease due to decreasing snow quantity resulting from the global warming and fertility of decreasing forests.

Water in various rivers tends to continuously decreases. As upstream countries try to most retain water, they have severer conflict with downstream counties. To solve said problem, people have to most provide water instead of most retaining water because water provision is to obtain water using real capability of people without impacting on other people. An efficient way to provide more water is to establish an agency being directly responsible for providing water and having to forecast the country need for using water in the next ten years and do a research to find ways to provide more water. While every country in the world forecasts need for using electricity in the next ten years and finds way to provide more electricity.

2) Development means water quality development activity, consisting of elimination and treatment.

Elimination is to remove disease, contamination, or unwanted things out of the water. At present, there are five methods of elimination as follows; Filtration is to remove micro-organism out of water. Elaborate filtration depends on use methods. For example, Reverse Osmosis is the most elaborate filtration. Boiling and distillation

is to kill micro-organism using heat. Energy transmission is to release water through energy which can kill micro-organism such as Ultraviolet, Ozone. For example, United Nation Organization has accepted that drying a bottle of water under the sunlight for two weeks by Africans is called SODIS (Solar Water Disinfection) which is effective and economical disinfection. It takes only six hours for disinfection if a bottle of water is placed on the metal sheet under the sunlight because the metal sheet will more considerably reflect heat and UV. And the last method of elimination is to use chemicals such as chlorine.

Treatment is to improve water quality. There are three methods of treatment as follows; 1. Oxygenation is to give oxygen to Aerobic Bacteria to make this bacteria help digest residues. 2. Deposition is to separate suspension substances from the water. For example, alum is used to create electric charge to make suspension substances cling together. When these substances increasingly and continuously cling, they have more weight and sink to the bottom of vessels. 3. Filling micro-organism. There are three types of micro-organism: effective micro-organisms, ineffective micro-organisms, and neutral micro-organisms. Filling E.M. in the water requiring treatment helps digest organic matter in the water.

3) Maintenance means water storing activity aiming to solve the problems of drought and flood including activities for maintaining water quantity and quality.

The activity of storing water aims to prevent situations of drought and flood because water retention will help reduce water during water excess and increase water during water shortage. If people want to build any water-retaining places, they have to first do a research for the highest benefits. There are two types of water-retaining places as follows; the water-retaining places made by humans are reservoirs, dams, Kaem Ling. Natural water-retaining places are canals, marsh, swamps.

Water quantity maintaining activities mean infiltration prevention and evaporation prevention. And water quality maintaining activities mean contamination prevention.

4) Application means water supplying activity and water draining activity including activities which attach importance to consumers, and activities which attach importance to water resources.

Water supplying activity means water supplying capability with least loss and most maintenance of water quality. Water draining activity means capability to quickly drain water. The activity which attaches importance to consumers can be divided as follows. 1. Use of water for self-benefits such as use of water for consumption, agriculture, transport, industry, and use for increasing and conserving aquatic animals. 2. Use of water for benefits of other people by sharing. For example, state agencies distribute water to people in the dry season. Upstream people allow downstream people to jointly reach water resources. The activity which attaches importance to water resources means use of water by being aware of water value, consisting of economical use and appropriate use. In other words, it aims to attach importance to water resources.

Economical use is to 1) use less water such as taking a bath by using a shower instead of a bowl or watering plants by using the drip irrigation system, 2) reduce number of time used or use water as necessary such as washing vehicles once a week instead of washing every day, 3) repetitively use such as using water which is used for washing clothes in the last time to clean the house and water the trees for reducing water quantity used without reducing benefits.

Appropriate use means no use of better quality water which creates the same benefits as the lower quality water for reducing expenses on development of water quality.

To make people in the country economically use water, it is necessary to instill conscience from childhood. For example, Israel has instilled conscience of its people to see importance of water from childhood with the motto “Don’t waste a drop”.

4.3 Community’s opinions on the model of water resource management

The researcher studied possibility of a model of water resource management called ADMA Cycle by asking the sample group consisting of 400 households living in 126 villages of 17 sub-districts in Chai Badan District, Lop Buri Province except households in the Municipality during 4^{th}- 5^{th} and 11^{th} -12^{th} September 2010 about knowledge of Environmental Education as follows; awareness,

knowledge, attitude, skill, participation, ability on evaluation on water resource of rural communities. Research results were shown in Table 4.22 – Table 4.49.

Table 4.22 Classification of perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province

Items	Number of people	Percent
1. Low perception group	0	0.00
2. Medium perception group	5	1.25
3. Considerable perception group	395	98.75
Total	**400**	**100**

According to Table 4.22, villages of 395 out of 400 respondents considerably perceive Environmental Education for water resources management (98.75%). Five respondents perceive said issue in the medium level (1.25%).

Table 4.23 Mean, standard deviation, perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Ba Dan District, Lop Buri Province

Items	$\overline{X}$	S.D.	Perception levels
1. Awareness	2.71	0.48	high
2. Knowledge	2.37	0.71	medium
3. Attitude	2.73	0.52	high
4. Skill	2.96	0.19	high
5. Participation	2.97	0.16	high
6. Ability on evaluation	2.47	0.76	medium
Mean	**2.70**	**0.47**	**high**

According to Table 4.23, villages of 395 out of 400 respondents considerably perceive Environmental Education for water resources management with the mean ($\overline{X}$) = 2.70 from the highest mean of 3 and standard deviation of 0.47

Respondents most have similar opinions on the topic of participation with the mean ($\overline{X}$) = 2.97 and standard deviation of 0.16, followed by skill with the mean ($\overline{X}$) = 2.96 and standard deviation of 0.19.

Table 4.24 Mean, standard deviation, perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Ba Dan District, Lop Buri Province on awareness, divided into each article

Items	$\overline{X}$	S.D.	Perception levels
Awareness			
1. *"It is important to have water for consumption, use, and cultivation because life is there. If there is water, humans can stay alive. If there is no water, humans cannot stay alive".*	2.99	0.13	high
2. "As there is plentiful water, it is not necessary to economically use it".	2.29	0.93	medium
3. "Rain falls above the forests rather than other places because the air above the forests is more humid than the air above the ground".	2.87	0.40	high
Mean	**2.71**	**0.48**	**high**

According to Table 4.24, respondents considerably perceive Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on awareness, divided into each article with the mean ($\overline{X}$) = 2.71 from the highest mean of 3 and standard deviation of 0.48. After considering each article, the researcher found that respondents most perceive the topic "It is important to have water for consumption, use, and cultivation because life is there. If there is water, humans can stay alive. If there is no water, humans cannot stay alive" with the mean ($\overline{X}$) = 2.99 and standard deviation of 0.13, followed by the topic "Rain falls above the forests rather than other places because the air above the forest is more humid than the air above the ground" with the mean ($\overline{X}$) = 2.87 and standard deviation of 0.40.

Table 4.25 Mean, standard deviation, perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on knowledge, divided into each article

Items	$\overline{\overline{X}}$	S.D.	Perception levels
Knowledge			
4. "The first living thing in the world originates in water".	2.50	0.74	high
5. "Water is a single resource which can be found in three statuses: solid, liquid, and vapor".	2.80	0.49	high
6. "Distilled water is the most suitable for drinking because it is pure and free from disease although it does not contain any minerals"**.**	1.81	0.92	medium
Mean	**2.37**	**0.71**	**medium**

According to Table 4.25, respondents perceive Environmental Education for water resources management on knowledge, divided into each article in the medium level with the mean ($\overline{X}$) = 2.37 from the highest mean of 3 and standard deviation of 0.71. After considering each article, the researcher found that respondents most perceive the topic "Water is a single resource which can be found in three status: solid, liquid, and vapor" with the mean ($\overline{X}$) = 2.80 and standard deviation of 0.49, followed by the topic" The first living thing in the world originates in water" with the mean ($\overline{X}$) = 2.50 and standard deviation of 0.74.

Table 4.26 Mean, standard deviation, perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on attitude, divided into each article

Items	$\overline{\overline{X}}$	S.D.	Perception levels
Attitude			
7. *"Progress will occur if everybody in the country fully performs his duties with consciousness, intellect, and sincerity by mainly thinking of common benefits"*.	2.97	0.22	high
8. "The problem of water shortage and the flood problem are the community problems which should be solved by the community for community benefits".	2.89	0.43	high
9. "Water is less available than gold".	2.35	0.93	medium
Mean	**2.73**	**0.52**	**high**

According to Table 4.26, respondents considerably perceive Environmental Education for water resources management on attitude, divided into each article with the mean ($\overline{X}$) = 2.73 from the highest mean of 3 and standard deviation of 0.52. After considering each article, the researcher found that respondents most perceive the article "Progress will occur if everybody in the country fully performs his duties with consciousness, intellect, and sincerity by mainly thinking of common benefits" with the mean ($\overline{X}$) = 2.97 and standard deviation of 0.22, followed by the article" The problem of water shortage and the flood problem are community problems which should be solved by the community for community benefits" with the mean ($\overline{X}$) = 2.89 and standard deviation of 0.43.

Table 4.27 Mean, standard deviation, perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on skill in water use. People have to practice efficient use of water and know to share, divided into each article

Items	$\overline{\overline{X}}$	S.D.	Perception levels
Skill			
10. "We should practice consciousness by practicing correct use of water according to use type".	2.96	0.28	high
11. "We should practice intellect to know how to think by practicing use of water by being aware of its value".	2.95	0.16	high
12. "We should practice correct methods by practicing use of water as necessary".	2.98	0.16	high
13. "We should practice sharing to widely use water"	2.95	0.17	high
Mean	**2.96**	**0.19**	**high**

According to Table 4.27, respondents considerably perceive Environmental Education on skill, divided into each article with the mean ($\overline{X}$) = 2.96 from the highest mean of 3 and standard deviation of 0.19. After considering each article, the researcher found that respondents most perceive the article "We should practice the correct methods by practicing use of water as necessary" with the mean ($\overline{X}$) = 2.98 and standard deviation of 0.16, followed by the article "We should practice consciousness by practicing correct use of water according to use types with the mean ($\overline{X}$) = 2.96 and standard deviation of 0.28.

Table 4.28 Mean, standard deviation, perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on participation in water resource management, divided into each article

Items	$\overline{X}$	S.D.	Perception levels
Participation			
14. "We should have preparedness on thought by thinking to jointly solve environmental problems with other people such as jointly growing the forests or jointly digging canals and swamps".	2.99	0.14	high
15. "We should have preparedness on mind by being ready to jointly solve environmental problems with other people".	2.98	0.19	high
16. "We should have physical preparedness by being ready to jointly solve environmental problems with other people".	2.96	0.16	high
17. "We should have preparedness on social humanities by being ready to persuade neighbors to jointly solve environmental problems".	2.97	0.18	high
Mean	**2.97**	**0.16**	**high**

According to Table 4.28, respondents considerably perceive Environmental Education for water resources management on participation, divided into each article with the mean ($\overline{X}$) = 2.97 from the highest mean of 3 and standard deviation of 0.16. After considering each article, the researcher found that respondents most perceive the article "We should have preparedness on thought by thinking to jointly solve environmental problems with other people such as jointly growing the forests or jointly digging canals and swamps" with the mean ($\overline{X}$) = 2.99 and standard deviation of 0.14, followed by the article "We should have preparedness on mind by

being ready to jointly solve environmental problems with other people" with the mean ($\overline{X}$) = 2.98 and standard deviation of 0.19.

Table 4.29 Mean, standard deviation, perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on ability on evaluation in the water situation, divided into each article

Items	$\overline{X}$	S.D.	Perception levels
Ability on evaluation			
18. "Thailand is a breadbasket country so the problem of water shortage does not have to be solved".	2.44	0.87	Medium
19. "Deforestation causes reduction in the rainfall".	2.84	0.47	high
20. "In the future, the problem of vying for water will not occur although there are more people because our world has plentiful water"	2.14	0.95	medium
Mean	**2.47**	**0.76**	**medium**

According to Table 4.29, respondents perceive Environmental Education for water resources management on ability on evaluation, divided into each article in the medium level with the mean ($\overline{X}$) = 2.47 from the highest mean of 3 and standard deviation of 0.76. After considering each article, the researcher found that respondents most perceive the article "Deforestation causes reduction in the rainfall" with the mean ($\overline{X}$) = 2.84 and standard deviation of 0.47, followed by the article "Thailand is the breadbasket country so the problem of water shortage does not have to be solved" with the mean ($\overline{X}$) = 2.44 and standard deviation of 0.87.

This research tested the sample group's knowledge of water resource according to the objective of Environmental Education using three questions in each table as shown in Table 4.24 – Table 4.29. The research results in general showed that most of the sample groups have knowledge in the high level in almost every table

because most of people in rural community were born and were grown up in the nature. As most of the sample group have knowledge in the high level, the study of opinions on possibility of the model is reliable.

Table 4.30 Results of analyzing variance of mean of perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on different sexes

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.647	0.647	2.823	0.094
Within the groups	398	91.230	0.229		
Total	**399**	**91.877**			

According to Table 4.30, the researcher found that Sig. was 0.094 which was higher than 0.05. This indicates that people with different sexes differently perceive Environmental Education for water resources management without statistical significance of 0.05.

Table 4.31 Results of analyzing variance of mean of perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on different ages

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.620	0.620	1.599	0.207
Within the groups	398	154.380	0.388		
Total	**399**	**155.000**			

According to Table 4.31, the researcher found that the Sig. was 0.207 which was higher than 0.05. This indicates that people with different ages differently perceive Environmental Education for water resources management without statistical significance of 0.05.

Table 4.32 Results of analyzing variance of mean of perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on different religions

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.000	0.000	1.038	0.845
Within the groups	398	2.977	0.007		
Total	**399**	**2.978**			

According to Table 4.32, the researcher found that Sig. was 0.845 which was higher than 0.05. This indicates that people with different religions differently perceive Environmental Education for water resources management without statistical significance of 0.05.

Table 4.33 Results of analyzing variance of mean of perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on different educational levels

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.915	0.915	0.633	0.427
Within the groups	398	574.835	1.444		
Total	**399**	**575.750**			

According to Table 4.33, the researcher found that the Sig. was 0.427 which was higher than 0.05. This indicates that people with different educational levels differently perceive Environmental Education for water resources management without statistical significance of 0.05.

Table 4.34 Results of analyzing variance of mean of perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on different main occupations

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	3.281	3.281	1.696	0.194
Within the groups	398	769.909	1.934		
Total	**399**	**773.190**			

According to Table 4.34, the researcher found that the Sig. was 0.194 which was higher than 0.05. This indicates that people with different occupations differently perceive Environmental Education for water resources management without statistical significance of 0.05.

Table 4.35 Results of analyzing variance of mean of perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on different periods of living in the community

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.770	0.770	3.193	0.075
Within the groups	398	95.990	0.241		
Total	**399**	**96.760**			

According to Table 4.35, the researcher found that the Sig. was 0.075 which was higher than 0.05. This indicates that people with different periods of living in the community differently perceive Environmental Education for water resources management without statistical significance of 0.05.

Table 4.36 Results of analyzing variance of mean of perception levels on Environmental Education for water resources management of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on different social positions

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.000	0.000	0.001	0.978
Within the groups	398	65.190	0.164		
Total	**399**	**65.190**			

According to Table 4.36, the researcher found that the Sig. was 0.978 which was higher than 0.05. This indicates that people with different social positions differently perceive Environmental Education for water resources management without statistical significance of 0.05.

As for the research results of variance of constant variables such as sex, religion, period of living in the community in general, the researcher found that perception level of a model of water resource management is different without significance.

Table 4.37 Classification of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on the water resources management model

Items	Number of people	Percent
1. A group who disagree	0	0.00
2. A group who agree in the medium level	17	4.25
3. A group who agree in the high level	383	95.75
Total	**400**	**100**

According to Table 4.37, the researcher found that 383 out of 400 respondents agree on the water resources management model in the high level (95.75%). 17 respondents agree in the medium level (4.25%).

Table 4.38 Mean and standard deviation of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on the ADMA Cycle; water resources management model

Items	$\overline{X}$	S.D.	Opinion levels
1. Allocation	2.74	0.39	high
2. Development	2.76	0.45	high
3. Maintenance	2.58	0.53	high
4. Application	2.53	0.56	high
Mean	**2.65**	**0.48**	**high**

According to Table 4.38, respondents' opinion levels on the water resources management model were in the high level with the mean ($\overline{X}$) = 2.65 from the highest mean of 3 and standard deviation of 0.48. Most respondents have similar opinions on the topic of development with the mean ($\overline{X}$) = 2.76 from the highest mean of 3 and standard deviation of 0.45, followed by the topic of provision with the mean ($\overline{X}$) = 2.74 from the highest mean of 3 and standard deviation of 0.39.

Table 4.39 Mean and standard deviation of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on the ADMA Cyle as for Allocation, divided into each article

Items	$\overline{X}$	S.D.	Opinion levels
Allocation			
1. "Water allocation is to sufficiently provide water for use in the family and cultivation, including storage of water provided".	2.95	0.24	high
2. "Growing the forests is to permanently solve the problem of water shortage because the forests are the origin of river sources".	2.94	0.27	high
3. "It is not necessary for you to sufficiently store the rainwater for use in the family throughout the year because the government always distributes water when people do not have enough water in the household".	1.92	0.97	medium

Table 4.39 Mean and standard deviation of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on the ADMA Cyle as for Allocation, divided into each article (cont.)

Items	$\overline{X}$	S.D.	Opinion levels
4. "Apart from the rainwater used for cultivation, you should use natural water resources such as swamps in case of rainwater shortage".	2.94	0.30	high
5. "If there are no natural water resources in the village or there are not enough natural water resources, we should build water-storing sources in the village".	2.98	0.17	high
Mean	**2.74**	**0.39**	**high**

According to Table 4.39, respondents' opinion levels on the water resources management model were in the high level with the mean ($\overline{X}$) = 2.74 from the highest mean of 3 and standard deviation of 0.39. Most respondents have similar opinions on the topic "If there are no natural water resources in the villages or there are not enough water resources, we should build water-storing sources in the villages" with the mean ($\overline{X}$) = 2.98 from the highest mean of 3 and standard deviation of 0.17, followed by the topic "Water allocation is to sufficiently provide water for use in the family and cultivation including storage of water provided" with the mean ($\overline{X}$) = 2.95 from the highest mean of 3 and standard deviation of 0.24.

Table 4.40 Mean and standard deviation of people's pinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on the ADMA Cycle as for Development, divided into each article

Items	$\overline{X}$	S.D.	Opinion levels
Development			
6. "Development of water quality is to make water have better quality".	2.98	0.16	high
7. "There are two methods of developing water quality: elimination and treatment. Elimination is required if people want to develop household-based water quality to be free from unwanted things. Treatment is required when people want to develop surface water resources quality to have better quality".	2.91	0.37	high
8. "Polluted canals can be treated by oxygenating the water such as using Chai Pattana Water Wheel".	2.90	0.37	high
9. "To preserve community environments, It is necessary to treat industrial wastewater and household-based wastewater before releasing into public canals".	2.92	0.37	high
10. "It is not necessary to treat agriculture-based wastewater caused by chemical contamination such as insecticide before releasing to public canals".	2.10	0.99	high
Mean	**2.76**	**0.45**	**high**

According to Table 4.40, respondents' opinion levels on the water resources management model on the ADMA Cycle as for development were in the high level with the mean ($\overline{X}$) = 2.76 from the highest mean of 3 and standard deviation of 0.45. Respondents most have similar opinions on the topic "Development of water quality is to make water to have better quality" with the mean ($\overline{X}$) = 2.98

and standard deviation of 0.16, followed by the topic "To preserve community environments, it is necessary to treat industrial wastewater and household-based wastewater before releasing it into public canals" with the mean ($\overline{X}$) = 2.92 and standard deviation of 0.37.

Table 4.41 Mean and standard deviation of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on the ADMA Cycle as for Maintenance, divided into each article

Items	$\overline{X}$	S.D.	Opinion levels
Maintenance			
11. "There are two aspects of water maintenance: 1) maintaining water quantity by preventing seepage and evaporation, 2) maintaining water quality by preventing water from dirt and contamination".	2.91	0.35	high
12. "The objective of maintaining pond-based water quantity is to find ways to prevent the pond-based water to least seep and evaporate".	2.93	0.30	high
13. "A method to prevent seepage is to raise buffaloes at the bottom of the pond and wait for buffaloes' dung to be tightly stamped. After that release water into the pond".	2.50	0.80	high
14. "Planting vetiver grass around the pond edge is a method which helps erosion prevent of the pond edge".	2.92	0.33	high
15. "Planting floating plants in the pond does not help reduce evaporation of pond-based water".	1.68	0.87	medium
Mean	**2.58**	**0.53**	**high**

According to Table 4.41, respondents' opinion levels on the ADMA Cycle as for maintenance were in the high level with the mean ($\overline{X}$) = 2.58 from the highest mean of 3 and standard deviation of 0.53. Respondents most have similar

opinions on the topic "The objective of maintaining the pond-based water quantity is to find ways to prevent the pond-based water to least seep and evaporate with the mean ($\overline{X}$) = 2.93 and standard deviation of 0.30, followed by the topic "Planting vetiver grass around the pond edge is a method which helps prevent destruction of the pond edge" with the mean ($\overline{X}$) = 2.92 and standard deviation of 0.33.

Table 4.42 Mean and standard deviation of people's opinion levels on the ADMA Cycle as for Application, divided into each article

Items	$\overline{X}$	S.D.	Opinion levels
Application			
16. "Use of water by being aware of water value is to economically use water and use water according to use types".	2.97	0.20	high
17. "Economic use of water is to use less water without reducing benefits".	2.91	0.40	high
18. "Use of water according to use types is to use water suitable for use activities without using better quality water which creates the same benefits as the lower quality water".	2.94	0.30	high
19. "Use of rainwater used for drinking to water the trees is done according to use types".	2.02	0.96	medium
20. "Change of water use behavior by practicing economic use of water and practicing use of water according to use types is not necessary".	1.85	0.96	medium
Mean	**2.53**	**0.56**	**high**

According to Table 4.42, respondents' opinion levels on the ADMA Cycle as for Application were in the high level with the mean ($\overline{X}$) = 2.53 from the highest mean of 3 and standard deviation of 0.56. Respondents most have similar opinions on the topic "Use of water by being aware of its value is to economically use water and use water according to use types" with the mean ($\overline{X}$) = 2.97 and standard

deviation of 0.20, followed by the topic " Use of water according to use types is to use water suitable for use activities without using better quality water which creates the same benefits as the lower quality water" with the mean ($\overline{X}$) = 2.94 and standard deviation of 0.30.

Table 4.43 Results of analyzing variance of mean of people's opinion levels in the community living outside the municipality, Chai Badan District, Lop Buri Province on the ADMA Cycle as for different sexes

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.071	0.071	0.309	0.578
Within the groups	398	91.806	0.231		
Total	**399**	**91.878**			

According to Table 4.43, the researcher found that Sig. was 0.578 which was higher than 0.05. This indicates that people with different sexes have different opinions on the ADMA Cycle without statistical significance of 0.05.

Table 4.44 Results of analyzing variance of mean of people opinion's levels in the community, Chai Badan District, Lop Buri Province on the ADMA Cycle as for different ages

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.068	0.068	0.174	0.677
Within the groups	398	154.932	0.389		
Total	**399**	**155.000**			

According to Table 4.44, the researcher found that Sig. was 0.677 which was higher than 0.05. This indicates that people with different ages have different opinions on the ADMA Cycle without statistical significance of 0.05.

Table 4.45 Results of analyzing variance of mean of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on the ADMA Cycle as for different religions

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.001	0.001	0.134	0.715
Between the groups	398	2.977	0.007		
Total	**399**	**2.978**			

According to Table 4.45, the researcher found that Sig. was 0.715 which was higher than 0.05. This indicates that people with different religions have different opinions on the ADMA Cycle without statistical significance of 0.05.

Table 4.46 Results of analyzing variance of mean of people opinion's levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on the ADMA Cycle as for different educational

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.490	0.490	0.339	0.561
Within the groups	398	575.260	1.445		
Total	**399**	**575.750**			

According to Table 4.46, the researcher found that Sig. was 0.561 which was higher than 0.05. This indicates that people with different educational levels have different opinions the ADMA Cycle without statistical significance of 0.05.

Table 4.47 Results of analyzing variance of mean of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on the ADMA Cycle as for different main occupations

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.746	0.746	0.384	0.536
Within the groups	398	772.444	1.941		
Total	**399**	**773.190**			

According to Table 4.47, the researcher found that Sig. was 0.536 which was higher than 0.05. This indicates that people with different main occupations have different opinions on the ADMA Cycle without statistical significance of 0.05.

Table 4.48 Results of analyzing variance of mean of people opinion's levels in the community, Chai Badan District, Lop Buri Province on the ADMA Cycle as for different periods of living in the community

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.770	0.000	0.000	0.988
Within the groups	398	96.760	0.243		
Total	**399**	**97.530**			

According to Table 4.48, the researcher found that Sig. was 0.988 which was higher than 0.05. This indicates that people with different periods of living in the community have different opinions on the ADMA Cycle without statistical significance of 0.05.

Table 4.49 Results of analyzing variance of mean of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on the ADMA Cycle as for different social positions

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.016	0.000	0.100	0.753
Within the groups	398	65.174	0.164		
Total	**399**	**65.190**			

According to Table 4.49, the researcher found that Sig. was 0.753 which was higher than 0.05. This indicates that people with different social positions have different opinions on the ADMA Cycle without statistical significance of 0.05.

As for the research results of the sample group's opinions on a model of water resource management in general, the researcher found that the sample groups agree in the high level and have similar opinions. Most the sample groups have similar

opinions on development. As for variance of opinions on a model of constant variables such as sex, religion, period of living in the community, the researcher found that these variables are different without significance.

4.4 Possibility of community's participation in solving the problems of water shortage

The results of possibility of community's participation in solving the problem of water shortage of people in the community were tables 4.50 - 4.60 as follows;

Table 4.50 Classification of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on participation in solving the problem of water shortage

Items	Number of people	Percent
1. A group who disagree	0	0.00
2. A group who agree in the medium level	3	0.75
3. A group who agree in the high level	397	99.25
Total	**400**	**100**

According to Table 4.50, the researcher found that 397 out of 400 respondents agree on participation in solving the problem of water shortage in the community living outside the Municipality, Chai Badan District, Lop Buri Province in the high level (99.25%). Three respondents agree in the medium level (0.75%). Nobody disagrees.

Table 4.51 Mean and standard deviation of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on participation in solving the problem of water shortage

Items	$\overline{\overline{X}}$	S.D.	Opinion levels
1. Attitudes toward participation	2.80	0.35	high
2. Opinions on solving the problem of water shortage	2.92	0.25	high
Mean	**2.86**	**0.30**	**high**

According to Table 4.51, respondents' opinion levels on participation in solving the problem of water shortage in the community living outside the Municipality, Chai Badan District, Lop Buri Province were in the high level with the mean ($\overline{X}$) = 2.86 from the highest mean of 3 and standard deviation of 0.30. Most respondents have similar opinions on opinions on solving the problem of water shortage with the mean ($\overline{X}$) = 2.92 and standard deviation of 0.25, followed by attitudes toward participation with the mean ($\overline{X}$) = 2.80 and standard deviation of 0.35.

Table 4.52 Mean and standard deviation of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on participation in solving the problem of water shortage as for attitudes toward participation, divided into each article

Items	$\overline{X}$	S.D.	Opinion levels
Attitudes toward participation			
1. "People who help do any activities for the public always receive good things in return".	2.94	0.29	high
2. "As humans are not social animals, they are able to live alone without relying on other people".	2.16	0.96	medium
3. "Help and hospitality of people in the community by helping do activities such as harvesting rice is a good Thai tradition which should be preserved".	2.96	0.16	high
4. "To jointly do public activities such as jointly building a chapel, school, public rest-house is a good action which should be promoted".	2.98	0.15	high
5. "To jointly develop environments such as jointly digging canals and swamps or helping eliminate rubbish is a good action which should be strictly campaigned".	2.97	0.22	high
Mean	**2.80**	**0.35**	**high**

According to Table 4.52, respondents' opinion levels on participation in solving the problem of water shortage as for attitudes toward participation were in the high level with the mean ($\overline{X}$) = 2.80 from the highest mean of 3 and standard deviation of 0.35. Respondents most have similar opinions on the topic "To jointly do public activities such as jointly building a chapel, school, public rest-house is a good action which should be promoted" with the mean ($\overline{X}$) = 2.98 and standard deviation of 0.15, followed by the topic " To jointly develop environments such as jointly digging canals and swamps or helping eliminate rubbish is a good action which should be strictly campaigned" with the mean ($\overline{X}$) = 2.97 and standard deviation of 0.22.

Table 4.53 Mean and standard deviation of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on participation in solving the problem of water shortage as for opinions on solving the problem of water shortage, divided into each article

Items	$\overline{X}$	S.D.	Opinion levels
Opinions on solving the problem of water shortage			
6. "It is time for the community to solve the problem of water shortage".	2.91	0.23	high
7. "The community in the village should not wait for the government to help solve the problem of cultivation-based water shortage but the community should first try to solve the problem as much as possible".	2.90	0.37	high
8. "The problem of drinking water shortage can be solved more easily than the problem of cultivation-based water shortage because to find ways to store more rainwater is able to solve the problem of water shortage".	2.84	0.48	high
9. "The community cooperates to solve the problem of water shortage by jointly thinking to find ways to solve the problem of water shortage. The community jointly makes decision to be jointly responsible. The community jointly does activity to be able to quickly solve the problem. And the community jointly receives benefits resulting from jointly solving the problem of water shortage".	2.96	0.25	high
10. "As for the principle of solving the problem of water shortage, the community has to jointly find the ways to solve the problem".	2.98	0.13	high
11. "Efficient water management method should be made in the form of projects".	2.93	0.29	high

Table 4.53 Mean and standard deviation of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on participation in solving the problem of water shortage as for opinions on solving the problem of water shortage, divided into each article (cont.)

Items	$\overline{X}$	S.D.	Opinion levels
12. "When your village does the project of solving the problem of water shortage, how much do you agree that your family should send a representative to participate in the project?"	2.97	0.17	high
13. "When your village does the project of solving the problem of water shortage, how much do you agree that you should persuade other people to participate in the project?"	2.91	0.17	high
14. "Do you agree that you should follow progress of solving the problem of water shortage?"	2.93	0.23	high
Mean	**2.92**	**0.25**	**high**

According to Table 4.53, respondents' opinion levels on participation in solving the problem of water shortage were in the high level with the mean ($\overline{X}$) = 2.92 from the highest mean of 3 and S.D. of 0.25. Most respondents have similar opinions on the topic "As for the principle of solving the problem of water shortage, the community have to jointly find ways to solve the problem" with the mean ($\overline{X}$) = 2.98 from the highest mean of 3 and S.D. of 0.13, followed by the topic "When your village does the project of solving the problem of water shortage, how much do you agree that your family should send a representative to participate in the project?" with the mean ($\overline{X}$) = 2.97 from the highest mean of 3 and S.D. of 0.17.

Table 4.54 Results of analyzing variance of mean of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on participation in solving the problem of water shortage as for different sexes

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.289	0.289	1.256	0.263
Within the group	398	91.589	0.230		
Total	**399**	**91.878**			

According to Table 4.54, the researcher found that Sig. was 0.263 which was higher than 0.05. This indicates that people as for different sexes have different opinions on participation in solving the problem of water shortage without statistical significance of 0.05.

Table 4.55 Results of analyzing variance of mean of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on participation in solving the problem of water shortage as for different ages

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.303	0.303	0.780	0.378
Within the group	398	154.697	0.389		
Total	**399**	**155.000**			

According to Table 4.55, the researcher found that Sig. was 0.378 which was higher than 0.05. This indicates that people as for different ages have different opinions on participation in solving the problem of water shortage without statistical significance of 0.05

Table 4.56 Results of analyzing variance of mean of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on participation in solving the problem of water shortage as for different religions

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.000	0.000	0.023	0.880
Within the groups	398	2.977	0.007		
Total	**399**	**2.977**			

According to Table 4.56, the researcher found that Sig. was 0.880 which was higher than 0.05. This indicates that people as for different religions have different opinions on participation in solving the problem of water shortage without statistical significance of 0.05.

Table 4.57 Results of analyzing variance of mean of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on participation in solving the problem of water shortage as for different educational levels

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.590	0.590	0.408	0.523
Within the groups	398	575.160	1.445		
Total	**399**	**575.750**			

According to Table 4.57, the researcher found that Sig. was 0.523 which was higher than 0.05. This indicates that people as for different educational levels have different opinions on participation in solving the problem of water shortage without statistical significance of 0.05.

Table 4.58 Results of analyzing variance of mean of opinion levels on participation in solving the problem of water shortage of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on different main occupations.

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	6.458	6.458	3.352	0.068
Within the groups	398	766.732	1.926		
Total	**399**	**773.190**			

According to Table 4.58, the researcher found that Sig. was 0.068 which was higher than 0.05. This indicates that people as for different main occupations have different opinions on participation in solving the problem of water shortage without statistical significance of 0.05.

Table 4.59 Results of analyzing variance of mean of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on participation in solving the problem of water shortage as for different periods of living in the community

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.199	0.199	0.821	0.366
Within the groups	398	96.561	0.243		
Total	**399**	**96.760**			

According to Table 4.59, the researcher found that Sig. was 0.366 which was higher than 0.05. This indicates that people as for different periods of living in the community have different opinions on participation in solving the problem of water shortage without statistical significance of 0.05.

Table 4.60 Results of analyzing variance of mean of people's opinion levels in the community living outside the Municipality, Chai Badan District, Lop Buri Province on participation in solving the problem of water shortage as for different social positions.

Variance sources	df	SS	MS	F	Sig.
Between the groups	1	0.050	0.050	0.304	0.582
Within the groups	398	65.140	0.164		
Total	**399**	**65.190**			

According to Table 4.60, the researcher found that Sig. was 0.582 which was higher than 0.05. This indicates that people as for different social positions have different opinions on participation in solving the problem of water shortage without statistical significance of 0.05.

As for the research results of possibility of community's participation in solving the problems of water shortage in general, the researcher found that most of the sample groups agree in the high level. Nobody disagrees. Most the sample groups have similar opinions on the topic of solving the problems of water shortage. This indicates that people in the community are ready to cooperate to solve the problems.

4.5 Research results of problems and obstacles making the community unable to solve the water shortage problems and recommendations

4.5.1 Problems and obstacles making the community unable to solve the problems of water shortage

The research results of problems and obstacles making the community unable to solve the problems of water shortage were shown in frequency of each article in Table 4.61 as follows;

Table 4.61 Problems and obstacles making people in the community unable to solve the problem of water shortage, divided into each article

Items	Frequency (f)
1. Problems and obstacles making people in the village unable to solve the problem of water shortage	
1.1 People do not have a leader to solve the problems.	91
1.2 People do not have a chance to participate in solving the problems.	50
1.3 People do not have unity and have the different opinions.	24
1.4 People do not have a time and are not interested to solve the problems.	13
1.5 People do not have knowledge and understanding of solution to the problems	5
Total	**183**

According to Table 4.61, there are five problems and obstacles making people in the villages unable to participate in solving the problems of water shortage. The topic with the highest frequency of the problem is lack of leaders to solve the problems, followed by the topic of no participation in solving the problems.

After considering the research results of the above tables and the research results of possibility of community's participation in solving the problems of water shortage in general, the researcher found that most of people in the community agree in the high level as shown in Table 4.50. This indicates that people in rural communities are ready to cooperate to solve the problems of water shortage but they cannot solve the problems due to lack of leaders to solve the problems.

4.5.2 Recommendations

The research results of recommendations on solution to the problems of water shortage were shown in frequency of each article in Table 4.62 as follows;

Table 4.62 Recommendations on solving the problem of water shortage, divided into each article

Items	Frequency (f)
2. Recommendations on solving the problem of water shortage	
2.1 How should you do to sufficiently provide water for drinking?	
2.1.1 To build the rainwater- storing places by making big jars for every household.	144
2.1.2 To provide drinking water- storing sources by digging canals, pond, and reservoirs.	68
2.1.3 To drill the artesian well.	6
2.2 How should you do to sufficiently provide water for use in the household?	
2.2.1 To store rainwater for use	73
2.2.2 To drill the artesian well.	10
2.2.3 To use tap water.	6
2.3 How should you do to sufficiently provide water for cultivation?	
2.3.1 To provide water- storing sources such as digging ponds, drilling the artesian well, digging canals, building weirs, irrigation canal, and reservoir,	85
2.3.2 To store rainwater.	11
2.4 How should the water- storing sources for cultivation be built?	
2.4.1 Weir	142
2.4.2 Pond	24
2.4.3 Reservoir	18
2.4.4 Well	16
2.4.5 Basin	5
2.4.6 Irrigation canal	2
2.5 How should you make the pond-based water least seep?	
2.5.1 Tightly press soil at the bottom of pond.	20
2.5.2 Deeply dig the pond and make cement floor or put plastic on the bottom of the pond.	16
2.5.3 Put dung of cows and buffaloes.	5

Table 4.62 Recommendations on solving the problem of water shortage, divided into each article (cont.)

Items	Frequency (f)
2.6 How do you make the pond-based water least evaporate?	
2.6.1 Grow trees around the pond.	57
2.6.2 Grow floating plants (Morning Glory, agricultural vegetables)	33
2.6.3 Grow cover plants.	25
2.7 How do you prevent the pond-based water from insecticide?	
2.7.1 Avoid using insecticide.	67
2.7.2 Use the insecticide far from water resources.	16
2.7.3 Grow Burmuda Grass around the pond and grow plants on the water surface	6
2.7.4 Use biological solution.	4
2.8 How should you do to economically use cultivation-based water?	
2.8.1 Use the drip system.	56
2.8.2 Suitably grow plants according to seasons.	24
2.8.3 Use sprinklers.	18
2.8.4 Use rainwater.	6

According to Table 4.62, respondents had given recommendations on solving the problem of water shortage divided into each article as follows;

1. As for sufficient provision of drinking water: People should make the rainwater-storing sources by making big jars for every household.

2. As for sufficient provision of household-based water, people should make the rainwater-storing sources.

3. As for sufficient provision of cultivation-based water, people should provide water-storing sources such as digging ponds, drilling the artesian well, digging canals, building weirs, irrigation canal, and reservoir.

4. As for building water-storing sources for cultivation suitable for the village: people should build a weir.

5. As for making the pond-based water least seep, people should tightly press soil at the bottom of the pond.

6. As for making the pond-based water least evaporate, people should grow trees around the pond.

7. As for preventing the pond-based water from insecticide; people should avoid use of insecticide.

8. As for economically using cultivation-based water, people should use the drip system.

CHAPTER V
RESULTS DISCUSSION

The objectives of the research were to 1. study the water resource situation and management in rural communities, 2. create a water resource management model, 3. study the possibility of a created model and the possibility of participation in solving water shortage problems of people in rural communities. The research results could be discussed as follows;

5.1 The model of water resource management "ADMA Cycle"

The main objective of this research is to create a model of water resource management. Formerly, the researcher wanted to create the model used for solving problems of Thai agriculturists in the rural communities facing the problems of water shortage and the flood problem which tend to continuously be severer. However, after completely creating the model of water resource management called ADMA Cycle, the researcher found that ADMA Cycle can also be widely used by an individual level to the country level. Moreover, ADMA Cycle can be used in every place in the world because ADMA Cycle is the model of water resource management stemming from compilation and classification of all water-related activities of humans. Each group of water-related activities is used as model structure. All humans in the world similarly have water-related activities with different details of each activity.

5.1.1 Research process used for model creation

The model of ADMA Cycle was created by using Research and Development (R&D) with details as follows;

1) Research process

Academicians have concluded that the National Water Policy is to simultaneously and systematically manage water in every aspect. According to this

research, it means simultaneous and systematic management of all water-related activities of humans. After compiling water-related activities of humans to connect with importance, value, and attributes of water, the researcher found the followings; 1) Water is vital to human lives because human body has water by 70%, especially blood supplying nutrients and oxygen to cell, taking wastes out of body, and helping adjust body balance. Said importance of water has led to humans' water allocation activity called in this research as Allocation: A. 2) Water is an efficient solvent; it can be easily contaminated with the surrounding objects. And people cannot find other things to replace water. Said attributes and importance of water have led to water quality development activity of humans called Development: D. 3) Water can change its status and move according to the global gravity. Said attributes have led to water quantity and quality maintenance activity called in this research as Maintenance: M. 4) Water is considerably important because people cannot live without water. This leads to application activity of humans called in this research as Application: A. After that, the researcher used four activities to create model structure of water resource management.

2) Development process

To obtain the complete model of water resource management, the researcher developed the model by seeking advice from environmental experts, community leaders, and local experts.

3) Tools

The research instruments consisted of asking, recording, observing, analyzing, and synthesizing.

The model of ADMA Cycle was shown in Figure 5.1.

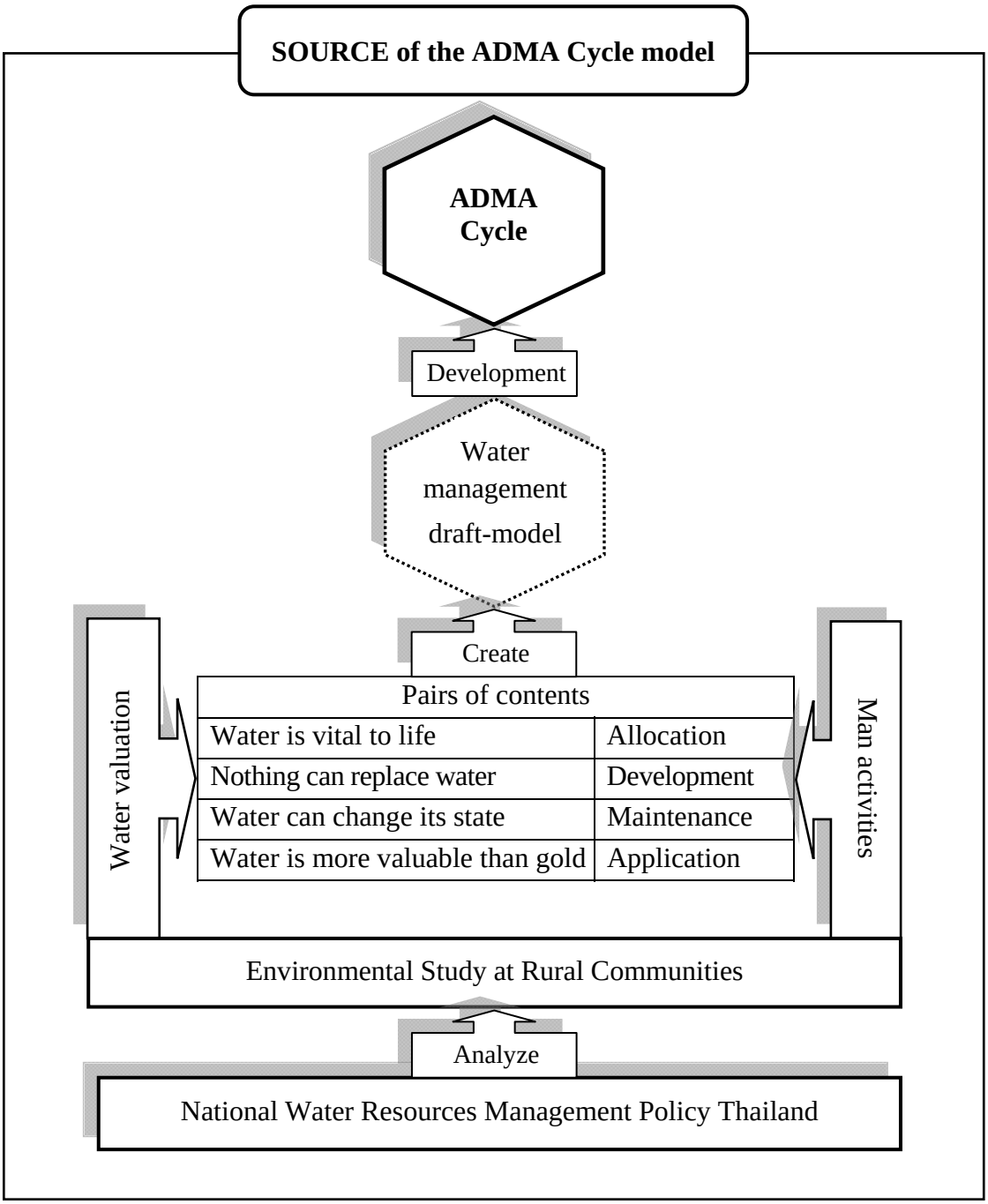


Figure 5.1 Source of the ADMA Cycle model

5.1.2 New knowledge

After creating the model of water resource management called ADMA Cycle, the researcher examined and found that nobody used to create the model of water resource management.

5.1.3 International use

The ADMA Cycle can be used by every group of the civil society ranging from the individual level, family level, and community level to the country level. Any water-related action done by anyone in any place, any method, and any status is under activities of ADMA Cycle as shown in Figure 5.2.

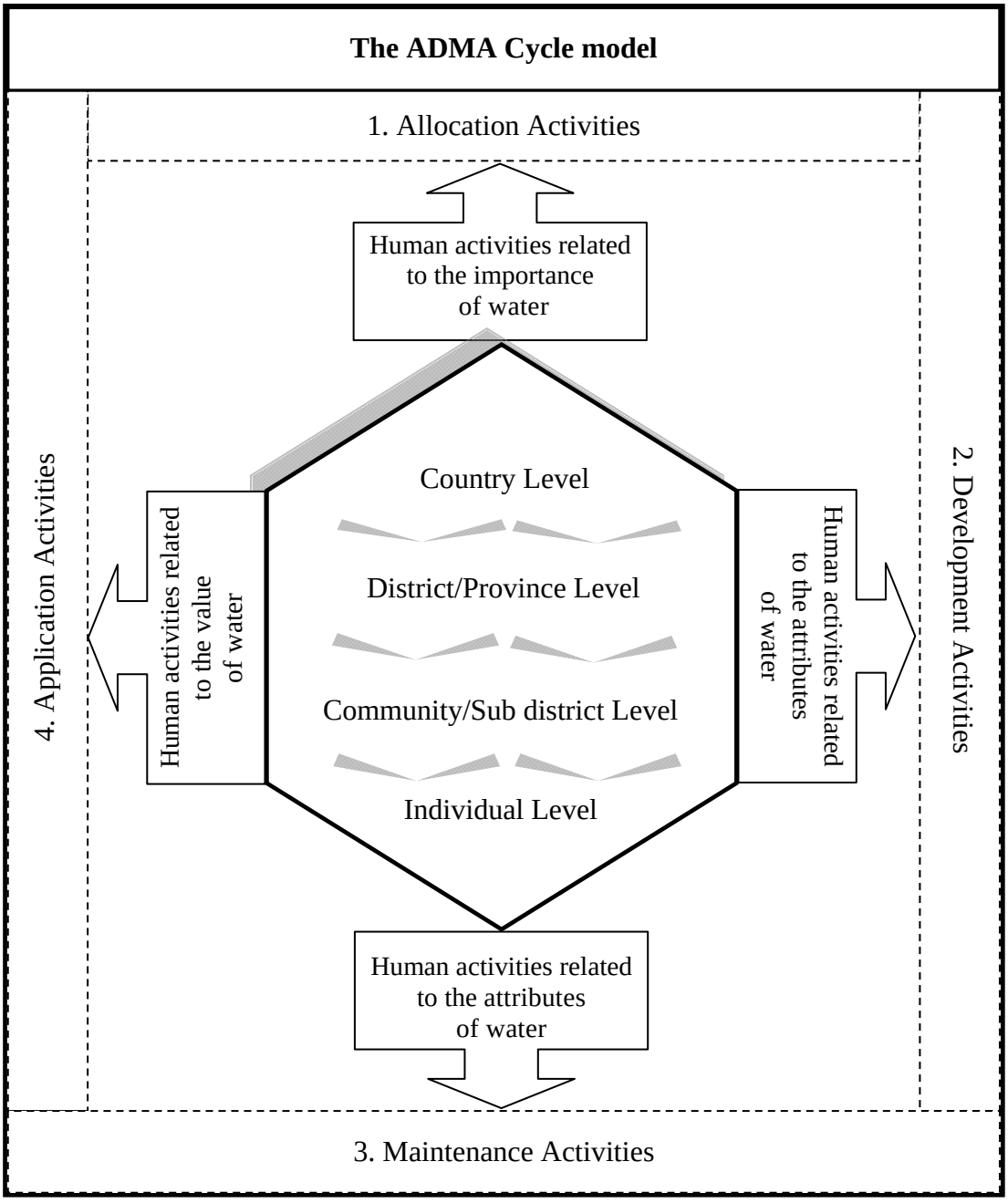


Figure 5.2 The ADMA Cycle model covers all human activities related to the water

As for the individual level, if people want to get water for drinking, they have to take water from streams or use the tap water in their houses. This is called allocation activity because people have to use their power before getting water. After that people have to boil water for killing disease. This is called development activity. Then, people put boiled water in the bottles. This is called maintenance activity. Finally, people drink water contained in bottles. This is called application activity. As for individual group level, Operation of the Artificial Rain Project is called allocation activity because people have to buy chemicals to make artificial rain and use an airplane for this operation every time. The Waterworks Authority puts chlorine in the raw water or use ultraviolet to kill disease. This is called development activity. The government builds dams for irrigation, being called maintenance activity. Electricity Generating Authority of Thailand releases water from dams for producing electricity, being called application activity. Also, discarding water is called application activity but is wasteful use.

5.2 Water resource management in rural communities

Step 1. Environmental study

As for this step, the researcher studied problems of water resource and community condition. After that, the researcher analyzed research results for the understanding of opportunities and obstacles so that people in the community are able to be interested, make decision, and do anything for jointly managing water resource.

Step 2. Stimulation of inspiration

The analysis results were synthesized to stimulate inspiration of people to jointly manage water resource.

Step 3. Knowledge development

As for this step, the researcher aimed to develop people's knowledge by persuading people willingly participating in water resource management to study

duties of all activities according to ADMA Cycle. After that, the researcher divided people group into four groups consisting of allocation activity group, development activity group, maintenance activity group, and application activity group. Each group had to find knowledge of working by reading the printed materials, listening to lecture of academicians and local experts, and carrying out study tour until they really knew their duties both in theory and practice, plan operation, and simultaneously comply with the plan.

As the researcher wanted all activity groups to happily work, the researcher used the theory “Human Values” consisting of moral behavior, peace, truth, love, kindness while working.

CHAPTER VI
CONCLUSION AND RECOMMENDATIONS

The objectives of the research were to 1. study the water resource situation and management in rural communities, 2. create a water resource management model, 3. study the possibility of a created model and the possibility of participation in solving water shortage problems of people in rural communities.

6.1 Conclusion of research results

Unit of analysis of this research is the household. Research populations consist of 26,478 households in 17 sub-districts of Chai Badan District, Lop Buri Province except the Municipality. The researcher found the sample size by calculating 26,478 households according to Yamane's formula and obtaining the sampling size by 394 households increased to 400 households for preventing statistical errors. After that, the researcher found the sample group consisting of 400 people to be representatives of populations of 26,478 households by simple random sampling according to proportion of number of household in each sub-district and village, respectively.

The household leaders who have to be mature and have lived in the community not less than three years were inquired.

The research tool was questionnaire divided into six parts with 106 articles. The questionnaire has been created and developed according to the objectives research, principles, theories, and related researches. Three experts examined validity, clearness, and accuracy of language use. The questionnaire was examined after trying out with 20 people who were not the sample group for testing tool quality and examining language used.

Data were collected by individually inquiring. 15 upper-secondary students of Sattayasai School helped the researcher inquire for four days on the 4th, 5th, 11th, 12th September, 2010. Data could be collected by 100%.

Data were statistically analyzed by SPSS/FW. Statistics used were percentage, mean, standard deviation, min., max., and Pearson Product Moment Correlation Coefficient.

The research results could be concluded as follows;

6.1.1 Creation of the model of water resource management

There are three steps of creating the model of water resource management as follows;

Step 1. The researcher determined the concept of model attributes consisting of accuracy and completeness. After that, the researcher began doing Environmental Education process by studying environments on water resource situation and management and additionally collecting data in the research area.

Step 2. The model had been created by the researcher.

Step 3. The model had been developed by the researcher.

After the model of water resource management had been created, the researcher obtained the model of water resource management called ADMA Cycle consisting of four activities: allocation, development, maintenance, and application. Apart from the rural communities, the ADMA Cycle can be used in every size and place of the community.

6.1.2 Possibility study of created model

According to Table 4.38, respondents' opinion levels of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province on the ADMA Cycle are in the high level with the mean ($\overline{X}$) = 2.65 from the highest mean of 3 and standard deviation of 0.48. Most of respondents have similar opinions on the topic of Development with the mean ($\overline{X}$) = 2.76 and standard deviation of 0.45, followed by the topic of Allocation with the mean ($\overline{X}$) = 2.74 and standard deviation of 0.39.

In conclusion, people in the community agree on water resources management model in the high level.

6.1.3 The study of possibility of participation in solving the problems of water shortage of people in rural communities

According to Table 4.50, as for 400 respondents' opinion levels on participation in solving the problem of water shortage of people in the community living outside the Municipality, Chai Badan District, Lop Buri Province, 397 respondents agree in the high level (99.25%). Three respondents agree in the medium level (0.75%). Nobody disagrees.

In conclusion, it is high possible for people in the research community to participate in solving the problem of water shortage.

6.1.4 Problems, obstacles, and recommendations of people in the research community.

The research results show problems, obstacles, and recommendations of people in the research community as follows;

1) The community is not able to successfully solve the problem of water shortage due to the following reasons;

- Lack of leaders to solve problems.
- No participation in solving the problems
- Different opinions and lack of solidarity

2) Recommendations of people in the research community

(1) To sufficiently provide water for drinking.

- People concerned should make rainwater-storing places by making big jars for every household.

(2) To sufficiently provide household-based water.

- People should store rainwater for use.

(3) To sufficiently provide cultivation-based water.

- People should provide water-storing sources such as digging ponds, drilling the artesian well, digging canals, building weirs, irrigation canals, and reservoir.

(4) Methods of building cultivation-based water-storing sources suitable for the community condition

- People should build weirs.

(5) To prevent the pond-based water to least seep.

- People should tightly press soil at the bottom of the pond.

(6) To prevent the pond-based water to least evaporate.

- People should grow trees around the pond.

(7) To prevent the pond-based water to be free from insecticide.

- People should avoid use of insecticide.

(8) To economically use cultivation-based water.

- People should use the drip system.

6.2 Recommendations

The objective of the National Water Policy is to simultaneously and systematically manage water in every aspect. The word “systematically” can be analyzed in two meanings as follows; as for the first meaning, activities in general have to be consistent and systematically connect. Operation of each activity of ADMA Cycle has to be systematically done. For example, water-retaining places for the maintenance activity have to be built according to the global gravity. As for the second meaning, people doing the activities must come from every sector of the society and simultaneously do those activities. After considering the Constitution of Thailand B.E. 2550, Section 66 to Section 68 stipulating participation of people as mentioned in Chapter 2 “Related Law”, the researcher could divide people group into two parts: people in the civil society and people in the government sector. These people have to simultaneously and systematically do the activities as follows;

6.2.1 People in the civil society

1) Problems

According to statistics of drought situation in Thailand from 1989 to 2007 as shown in Table 2.1, agricultural areas in Thailand faced the problem of cultivation

water shortage throughout the past 20 years. According to this research, said drought situation is caused by human action and El Nino Phenomenon. As for the first cause, humans decrease fertility of forests, causing “too less water”. As the situation of insufficient water has occurred for a long time, it is called “repetitive drought”. Moreover, human action decreases fertility of forests, causing “too much water’. As the situation of excessive water has continuously occurred for a long time, it is called “repetitive flood”. Humans are able to use measures to solve these problems as shown in Chart 2. As for the second cause, El Nino Phenomenon causes “drought” which cannot be solved by any measures.

In conclusion, the civil society should cooperate to solve the problems of repetitive drought and repetitive flood. As these are the problems of agricultural society, they should be solved by agricultural society for benefits of agricultural society as shown in Figure 4.

2) Concept

In the past, Thai agricultural society is the self-reliance society. People in the society helped each other by cooperating to help neighbors harvest rice, jointly building churches, schools, public rest-house, cooperating to develop environments by jointly digging canal, marsh, swamp. As for cultivation, people grew plants for consumption in their households and selling so they did not face the problem of low price. In the past, Thai agricultural society relied on them on economic, social, and environmental aspect. They relied on the government sector in safety in life and property only. However, Thai agricultural society has to presently rely on the government sector in every aspect. As for economic reliance on the government sector, people request guarantee of crop price by closing roads until they receive satisfactory answers. This situation will make Thai agricultural society weak and good traditions will be ignored. An efficient way to help Thai agricultural society become good and strong society is to enable the rural communities to solve the environmental problems on water resource because water is an important variable of cultivation which directly impacts on way of life of agriculturists. This is consistent with Buddhist teaching “People have to rely on themselves” and the royal speech of His Majesty the King “People who give something for the public receive something from the public in return”.

3) Research results

The research results of occupations and water resource are as follows;

According to Table 4.5, the researcher found that occupation of 81out of 400 respondents is agriculture (45.25%).

According to Table 4.11, the researcher found that, during the dry season in the past three years, 232 respondents did not use to face the problems of cultivation water shortage (58.00%). 168 respondents used to face the problems of cultivation water shortage (42.00%).

According to Table 4.12, the researcher found that, during the excessive water season in the past three years, 96 respondents used to face the flood problems (24.00%).

According to Table 4.22, the researcher found that 395 respondents have considerably perceived Environmental Education for water resource management (98.75%).

According to Table 4.37, the researcher found that 383 respondents considerably agree with opinion on the model of water resource management (95.75%).

According to Table 4.50, the researcher found that 397 respondents considerably agree with the opinion on participation in solving the problems of water shortage (99.25%).

According to Table 4.51, the researcher found that respondents' opinion level on participation in solving the problems of water shortage is in the high level with the mean ($\overline{X}$) = 2.86 from the highest mean of 3.

According to Table 4.52, the researcher found that respondents' opinion level in general on participation in solving the problems of water shortage on attitudes toward participation is in the high level with the mean ($\overline{X}$) = 2.80 from the highest mean of 3.

According to Table 4.53, the researcher found that respondents' opinion level in general on participation in solving the problems of water shortage on opinion about solving the problems of water shortage is in the high level with the mean ($\overline{X}$) = 2.92 from the highest mean of 3.

According to Table 4.61, the researcher found that there are five problems and obstacles making people in the villages unable to solve the problems of water shortage. The topic with the highest frequency of the problem is the topic of lack of leaders to solve the problems, followed by the topic of no participation in solving the problems.

The research results of water resource can be concluded as follows; Rural society is agricultural society. Almost half of agriculturists used to face the problems of water shortage in the dry season in the past three years. Almost ¼ of agriculturists used to face the flood problems in the excessive water season in the past three years. All agriculturists considerably perceive Environmental Education for water resource management. As for opinion level on the model of water resource management, most of agriculturists considerably agree on said issue. As for opinion level on participation in solving the problems of water shortage, most of agriculturists considerably agree on said issue. As for opinion level in general on participation in solving the problems of water shortage, agriculturists' attitudes toward participation are in the high level. As for opinion level in general on participation in solving the problems of water shortage, agriculturists' opinion on solving the problems of water shortage is in the high level. The problem and obstacle making people in the villages unable to participate in solving the problems of water shortage is lack of leaders to solve the problems. Agriculturists in rural communities are ready to cooperate to solve the problems of water resource and agree to use the ADMA Cycle to do activities but they do not have leaders to solve said problems.

4) Recommendations

As for solution to the problems of water resource in the civil society, people concerned should do a project such as One District One Community Project for Solving the Problems of Water Resource. People in the community have to select a leader and use a model of water resource management called ADMA Cycle with implementation steps as follows;

Step 1. Environmental study

This step aims to study problems of water resource and community condition. After that, people concerned have to analyze the research results for the

understanding of opportunities and obstacles which enable people in the community to be interested, make decision, and do activities for joint management of water resource.

Step 2. Stimulation of inspiration

People concerned have to synthesize analysis results to stimulate inspiration of people to jointly manage water resource.

Step 3. Knowledge development

This step aims to give knowledge to people by persuading people willingly participating in water resource management to study duties of all activities according to the ADMA Cycle. People have to be divided into four groups according to their interest and willingness, consisting of allocation activity group, development activity roup, maintenance activity group, and application activity group. Each group has to find knowledge of working by reading the printed materials, listening to the lecture of academicians and local experts. Finally, they have to carry out study tour and really know their duties both on theory and practice. After that, they have to plan working and simultaneously comply with the plan.

6.2.2 The government sector

1) Problems

Results of the flood disaster in the end of 2011 causing a lot of damage to every sector of the country indicate the followings;

(1) Water resource management of the government sector still lacks unity. After the flood situation, no agency is directly responsible for water resource management. Therefore, the government sector has to establish a Specific Flood Prevention and Solution Operation Center for the unity of solution to the problems and order.

(2) The government sector does not have preventive measures as indicated by a lot of damages.

(3) The government sector does not have systematic knowledge of water so it is not able to immediately solve the flood problems. For example, while water was being polluted due to flood for several days, there was discussion that whether E.M. ball discarded in water was efficient to solve the problems of polluted water.

2) Recommendations

(1) The problem of work unity

All agencies related to water management have to be combined in the same ministry such as establishment of Ministry of Water Resource.

(2) The problem of lack of preventive measures.

This problem can be solved by establishing an agency responsible for all water-related activities of humans in a new ministry so that all problems of water resource can be directly managed by the responsible agency. For example, if the ADMA Cycle is used for agency establishment, there are four agencies responsible for working as follows; 1. Water Resource Allocation Agency is responsible for providing water to replace the missing part. Examples of responsible agencies consist of Artificial Rain Project, Ground Water Project, and Desalination Project. 2. Water Quality Development Agency is responsible for improving quality of water to be suitable for use type such as treating polluted water in canals, improving quality of ground water, recycling polluted water. 3. Water Quantity Control and Maintenance Agency is responsible for building water-retaining places and draining. This important agency has to use preventive measures to reduce damage caused by drought and flood. 4. Water Application Agency is responsible for instilling conscience of value of water resource to enable people in the country to find and disseminate efficient ways to economically use water for the highest benefits.

(3) The problem of lack of systematic knowledge of water

This problem can be solved by doing a research on water resource allocation, development, maintenance, and application to enable agencies responsible for each aspect to elaborately and really know how to do.

In conclusion, the problems of repetitive drought and repetitive flood caused by human action can be solved by the civil society acting as the center of using solution measures. The problems of drought and flood caused by natural phenomenon can be solved by the government sector acting as the center of using preventive measures for systematic and simultaneous management.

6.3 Future research

6.3.1 Creation of the model of natural resource management

As for country development, it is necessary to simultaneously develop four dimensions: economic dimension, social dimension, political dimension, and environmental dimension because all dimensions mutually impact. However, economic dimension and environmental dimension require moderation while social dimension and political dimension require the highest virtue as shown in Figure 6.1

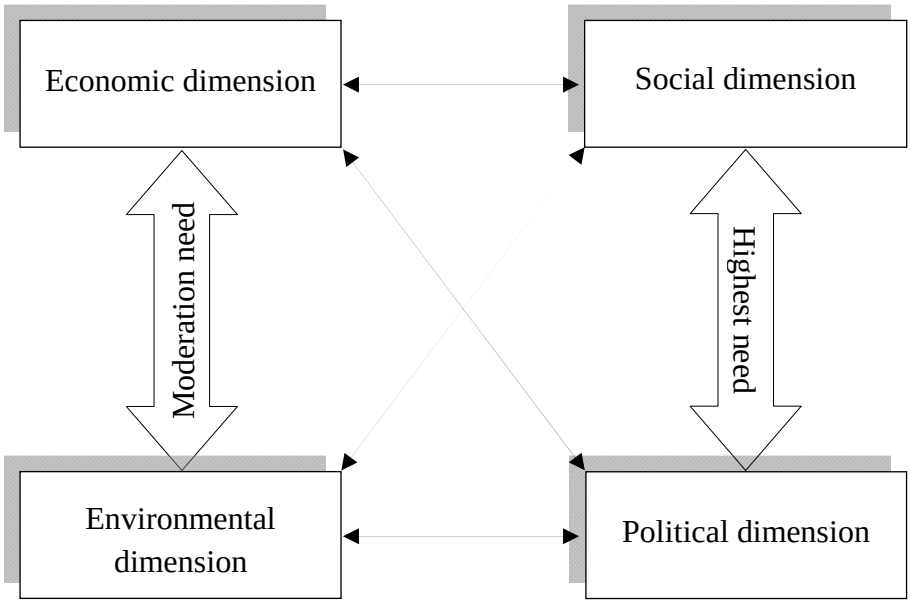


Figure 6.1 Four dimensions of country development mutually impact

Examples of impacts are as follows; Progress in economic dimension and social dimension is the cause of greenhouse gas emission which impacts on environmental dimension by causing global warming. Global warning causes decrease in snow which is the source of rivers. For example, decrease in snow in Tibetan Plateau which is a source of the Khong River causes decrease in water in the Khong River.

To decrease the global warming, it is necessary to comply with Figure 8. When four dimensions mutually impact, it is necessary to simultaneously and systematically improve four dimensions as follows;

1. Economic dimension: As for demand of consumption, it is necessary to depend on moderation which will enable people to decreasingly consume natural resources, causing decrease in supply according to the balance theory of Demand and Supply. Moreover, production process should use green energy instead of fossil energy.

2. Social dimension: People should use the principle of the highest virtue by being good people of the country. In daily life, people should use less energy as much as possible.

3. Political dimension: People should use the principle of the highest virtue such as being moral executives of the country, strictly enforcing law against people who destroy forests or international agreement beneficial to people such as Tokyo Protocol with the main objective to reduce greenhouse gas emission.

4. Environmental dimension: It is necessary for people to hastily develop themselves to keep up with other dimensions. If every dimension equally progresses, severity of impacts will decrease. Other dimensions rapidly progress due to diversified models or theories. Examples of the theory on economic dimension are Sufficiency Economy of His Majesty the King, Division of Work Theory of Adam Smith. Examples of the theory on social dimension are five-hierarchy of need theory of Dr. Abraham H. Maslow, Participation Theory. Examples of the theory on political dimension consist of parliament system, presidential system, central administration, local administration. As for environmental dimension, there are few theories and models of environmental management. Therefore, it is necessary to do a research to create environmental theories and several models of natural resource management.

The world of environment is oneness. No environment is far from humans. For example, smog caused by forest fire in Borneo Island, Indonesia has impacted on health of people living in Singapore, Malaysia, and the southern provinces of Thailand.

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APPENDICES

APPENDIX A
RESEARCH QUESTIONNAIRE

A MODEL OF ENVIRONMENTAL EDUCATION FOR WATER RESOURCE MANAGEMENT IN RURAL COMMUNUTIES

Clarification: To read messages for respondents before beginning the question.

1. The objective of this question is to study the possibility of the model of water resource management and implementation according to community's water resource management model.

2. You have the right to allow or not allow a questioner to question you. You are able to answer or not answer any questions. And you are able to cancel the question anytime.

3. Data on the question are kept confidential and used for the research only. The research results do not specifically mention anybody's name. Data derived from the respondents are concluded.

4. This questionnaire consists of 14 pages, six parts, and 106 articles as follows;

Part 1. Personal data (7 articles)

Part 2. Data on environments in the community (36 articles)

Part 3. Knowledge of Environmental Education for water resource management of people in the community (20 articles)

Part 4. Opinions on the water resource management model (20 articles)

Part 5. Opinions on participation in solving the water shortage problem of people in the community (14 articles)

Part 6. Problems and obstacles making people in the community unable to solve the problem of water shortage and recommendations (9 open-ended questions)

FOR THE QUSTIONER

1. Please read above clarification for the respondent before beginning the question.

2. Please mark ✓ □ in front of messages, answered by the respondent and fill messages in ……, answered by the respondent.

I, (Questioner's name) Mr./Miss ……..…… do confirm that I have read the above clarification for the respondent who is □ household leaders □ representatives of house no…… Mu …..…..., ……Sub-district, Chai Badan District, Lop Buri Province

PART 1: Personal data

1.1 Sex □ Male □ Female

1.2 Age (counted as a year if exceeding six months)

□ 1. Below 20 years old

□ 2. 20 years old

□ 1. Aged 25-34

□ 2. Aged 35-44

□ 3. Aged over 45

1.3 Religion

□ 1. Buddhism

□ 2. Christianity

□ 3. Islam

□ 4. Other (please specify) ……

1.4 Education

□ 1. Primary education (P. 1- P. 6)

□ 2. Secondary education (M. 1-M. 6)

□ 3. Vocational education/higher vocational education/diploma

□ 4. Bachelor degree

□ 5. Higher than bachelor degree

□ 6. Other (please specify) ……

1.5 Main occupation

□ 1. Agriculture (such as cultivation, raising animals, fishing)

□ 2. Trading/operating private business

□ 3. Civil servants/employees in state enterprise

□ 4. Hirelings

□ 5. Other (please specify) ……..

1.6 How long have you lived in this community?

□ 1. I have lived in this community from birth.

□ 2. I move to live here. (counted as a year if exceeding six months)

□ 1. Less than three years □ 2. More than three years

1.7 Social position

□ 1. No.

□ 2. Yes. (such as sub-district head, village head, committee of Sub-district Administrative Organization, religious leaders)

PART 2: Data on environments in the community

Natural environments:

2.1 Soil

1) How does your family own the land?

□ 1. Being his ownership □ 2. Renting □ 3. Other (please specify)……..…

2) Your family mostly uses the land for

□ 1. Agriculture □ 3. Industry

□ 2. Dwellings □ 4. Other (please specify)….

3) Does your family face the problem of soil quality?

□ 1. No.

□ 2. Yes. □ 1. Saline soil

□ 2. Acid soil

□ 3. Other (please specify) ……

2.2 Water

1) Does your family have his own water resources?

□ 1. No.

□ 2. Yes. □ 1. Ponds □ 2. Artesian wells □ 3. Other (please specify)…..

2) Where does your family get drinking water? (please put number in □ in order)

□ 1. Rainwater □ 3. Ground water

□ 2. Tap water □ 4. Other (please specify)…….

3) Did your family use to face the problem of drinking water shortage during the dry season in the past three years?

□ 1. No.

□ 2. Yes. □ 1. Once □ 2. Twice □ 3. Three consecutive years

4) How do you solve the problem when your family used to face the problem of drinking water shortage?

□ 1. State agencies give out water. (please specify names of state agencies.)

□ 2. Other (please specify)……..……

5) Where does your family get household water? (please put number in order.)

□ 1. Rainwater □ 3. Ground water

□ 2. Tap water □ 4. Other (please specify)….

6) Did your family use to face the problem of household water shortage during the dry season in the past three years?

□ 1. No.

□ 2. Yes. □ 1. Once □ 2. Twice □ 3. Three consecutive years

7) How do you solve the problem when your family used to face the problem of household water shortage?

□ 1. State agencies gives out water (please specify names of state agencies)……..

□ 2. Other (please specify)……..

8) Where does your family get cultivation water? (please put number in order)

□ 1. Rainwater □ 3. Ground water

□ 2. Tap water □ 4. Other (please specify)…….

9) Did your family use to face the problem of cultivation water shortage during the dry season in the past three years?

□ 1. No.

□ 2. Yes. □ 1. Once □ 2. Twice □ 3. Three consecutive years

10) How do you solve the problem when your family used to face the problem of cultivation water shortage?

□ 1. State agencies give assistance. (please specify names of state agencies.)

□ 2. Other (please specify) ……..……

11) Did your family use to face the flood problem causing damage to crops during the excessive water season in the past three years?

□ 1. No.

□ 2. Yes. □ 1. Once □ 2. Twice □ 3. Three consecutive years

12) How do you solve the problem when your family used to face the flood problem causing damage to crops?

□ 1. State agencies give assistance. (please specify names of state agencies)……

□ 2. Other (please specify)……..

13) Did your family use to face the problem of polluted water which cannot be used during the past three years?

□ 1. No.

□ 2. Yes. □ 1. Once □ 2. Twice □ 3. Three consecutive years

14) How do you solve the problem when your family used to face the problem of polluted water which cannot be used?

□ 1. State agencies give assistance. (please specify names of state agencies)…..

□ 2. Other (please specify)…….

2.3 Air

1) Did your family use to face the problem of air pollution until you are not able to drink the rainwater in the past three years?

□ 1. No.

□ 2. Yes. □ 1. Once □ 2. Twice □ 3. Three consecutive years

2) How do you solve the problem when your family used to face the problem of air pollution until you are not able to drink the rainwater?

□ 1. State agencies give assistance. (please specify names of state agencies.)…..

3) What causes the problem of air pollution which impacts on the rainwater used for drinking ? (You can answer more than an article.)

□ 1. Smoke from industry □ 3. Smoke caused by burning unwanted plants

□ 2. Smoke from vehicles □ 4. Other (please specify)…….....

2.4 Energy

1) Does your family use wind energy for water-related benefits?

□ 1. No.

□ 2. Yes. (please specify) ……..

2) Does your family use solar energy for water-related benefits?

□ 1. No.

□ 2. Yes. (please specify) ……..

3) Does your family produce biological gas by fermenting dung or agricultural rubbish for water-related benefits?

□ 1. No.

□ 2. Yes. (please specify) …….…….

2.5 Plants

1) What economic plant does your family most grow?

□ 1. Rice □ 3. Homegrown vegetables

□ 2. Field crops □ 4. Fruits □ 5. Other (please specify)……..

2) Apart from the problems of water shortage and flood in the past three years, did your family use to face other cultivation problems (If yes, you can answer more than an article).

□ 1. No.

□ 2. Yes. □ 1. The problem of seeds caused by…….

□ 2. The problem of fertilizer caused by…..

□ 3. The problem of low price caused by….

□ 4. Other problems (please specify)…….

3) How do you solve the problem when your family used to face other cultivation problems?

□ 1. State agencies give assistance. (please specify names of state agencies)……

□ 2. Other (please specify) …….

2.6 Animals

1) Does your family raise animals for consumption in the household?

□ 1. No.

□ 2. Yes. (please put number in order)

□ 1. Hens □ 3. Pigs □ 5. Cows

□ 2. Ducks □ 4. Fish □ 6. Other (please specify)……..

2) If your family raises animals, did you use to face the problem of shortage of water used for raising animals?

□ 1. No.

□ 2. Yes. You solve the problem by …….

Cultural environments:

2.7 Concept : Culture on belief, rituals

1) Does your family or your village have belief in water rituals such as Hae Nang Maew?

□ 1. No.

□ 2. Yes. □ 1. …….

□ 2. ……

□ 3. ……

2) Does your family or your village have expertise in the following crafts (If yes, you can answer more than an article).

□ 1. No.

□ 2. Yes. □ 1. Weaving □ 4. Banana-leaf inventions

□ 2. Basketry □ 5. Carving (please specify) ……..…

□ 3. Pottery □ 6. Other (please specify) ……..…

3) Does your family or your village have folk medicinal textbooks? (If yes, you can answer more than an article).

□ 1. No.

□ 2. Yes. □ 1. Medicinal textbooks on……...

□ 2. Medicinal textbooks on……...

□ 3. Medicinal textbooks on ……...

□ 4. Medicinal textbooks on…….

2.8 Organization: Group culture

1) Do people in your village group to jointly do activities? (If yes, you can answer more than an article.)

□ 1. No.

□ 2. Yes. □ 1. ……Club with the objective to……...

□ 2. ……Cooperatives with the objective to…….

□ 3. Other (please specify)…..with the objective to …….

2.9 Ceremony: local traditions

1) Does your family or your village have folk songs? (If yes, you can answer more than an article.)

□ 1. No.

□ 2. Yes. □ 1. Phleng Yao

□ 2. Phleng Ram Thone

□ 3. Other (please specify) ……...…

2) Does your family or your village have folk tales (If yes, you can answer more than an article).

□ 1. No.

□ 2. Yes. (Names of tales) □ 1. ……..……..

□ 2. ……

3) Does your family or your village have kid plays? (If yes, you can answer more than an article.)

□ 1. No.

□ 2. Yes. □ 1. ……...

□ 2. ……..

□ 3. ……

2.10 Materials: material culture

1) Does your village have any constructions which should be conserved? (If yes, you can answer more than an article.)

□ 1. No.

□ 2. Yes. □ 1. ……..……

□ 2. …….

□ 3. …….

PART 3: Knowledge of Environmental Education for water resource management of people in the community

Questions	Knowledge level		
	Agree		
	Considerably	Slightly	Disagree
As for Awareness: 1. "*It is important to have water for consumption, use, and cultivation because life is there. Humans cannot live without water*". 2. "As there is a lot of water, it is not necessary to economically use water". 3. "Rain generally falls above forests because air above the forest is more humid than air above the ground".			
As for Knowledge: 4. "The first living thing in the world occurs in water". 5. "Water is a single resource which can be found in 3 statuses: solid, liquid, and vapor". 6. "Distilled water is most suitable for drinking because it is free from disease although it does not have any minerals".			
As for Attitude: 7. *"Progress becomes true if everybody and every party in the country fully perform his duties with consciousness, intellect, and honesty by thinking of public benefits rather than other benefits".* 8. "The problems of water shortage and flood are the problems of community and should be solved by the community for benefits of the community". 9. "Water has less value than gold".			

Questions	Knowledge level		
	Agree		
	Considerably	Slightly	Disagree
As for Skill: 10. "We should practice consciousness by correctly using water according to use type". 11. "We should practice thinking by efficiently using water". 12. "We should correctly practice by economically using water". 13. "We should practice sharing so that everybody is able to use water".			
As for Participation: 14. "We should have preparedness of thought (Head) by thinking to jointly solve environmental problems with other people such as jointly growing the forests or jointly digging canals, marsh, swamp". 15. "We should have preparedness of mind (Heart) by being ready to jointly solve environmental problems with other people". 16. "We should have physical preparedness (Hand) by being ready to jointly solve environmental problems with other people". 17. "We should have preparedness of social humanities by being ready to persuade neighbors to jointly solve environmental problems".			

Questions	Knowledge level		
	Agree		
	Considerably	Slightly	Disagree
As for Ability on Evaluation: 18. "As Thailand is a breadbasket country, it is not necessary to solve the problem of water shortage". 19. "Deforestation lessens the rainfall". 20. "In the future, people will not vie for water although there is increase in populations in every country in every year because our world has excessive water".			

Chai Pattana Aerator

PART 4: Opinions on the water resource management model

Questions	Opinions		
	agree		
	Considerably	Slightly	Disagree
As for Allocation: 1. "Water Allocation is to sufficiently provide water for use in the household and cultivation and to retain water provided". 2. "Growing forests is sustainable solution to the problem of water shortage because forests are the source of streams".			

Questions	Opinions		
	agree		
	Considerably	Slightly	Disagree
3. "People's self-reliance by sufficiently storing the rainwater for use in the household throughout the year is not necessary because the government will give out water every time when people do not have enough water for use in their households". 4. "Apart from the rainwater used for cultivation, people should also use water from natural water resources such as marsh, swamp when there is rainwater shortage".			
As for Development: 5. "If there are not any natural water resources in the villages or there are not enough water resources, we should build water-retaining places in the villages". 6. "Development of water quality means making water have better quality". 7. "There are two methods of developing water quality: limitation and treatment. As for limitation, people have to limit use when they want to develop quality of household water. As for treatment, people have to treat water when they want to develop quality of surface water resources". 8. "A method of treating water in polluted canals is aeration such as using Chai Pattana Aerator" (as shown in the above picture). 9. "To preserve environments of the community, wastewater from industry and households has to be treated before being released canals".			

Questions	Opinions		
	agree		
	Considerably	Slightly	Disagree
10. "Wastewater from agriculture caused by contamination of chemicals such as insecticides does not have to be treated before being released into canals".			
As for Maintenance: 11. "Water Maintenance is divided into two aspects: 1) maintenance of water quantity by preventing seepage and evaporation, 2) maintenance of water quality is to prevent water from dirtiness and contamination". 12. "The objective of maintaining quantity of water in the pond is to find methods of preventing water to least seep or evaporate". 13. "A method to prevent seepage is to raise buffaloes at the bottom of the pond and let buffalo dung tightly treaded. After that, release water into the pond". 14. "Growing Vetiver Grass around the pond helps prevent the edge of the pond from collapse". 15. "Growing floating plants in the pond does not help reduce evaporation of water".			
As for Application: 16. "Efficient use of water means 1) economical use of water to have more water to use and 2) use of water according to type use to have more quality water to use". 17. "Economic use of water means use less water without reducing benefits".			

Questions	Opinions		
	agree		
	Considerably	Slightly	Disagree
18. "Use of water according to use type means use of water with quality suitable for the activity without using better quality water which has the same benefit as lower quality water". 19. "Use of the rainwater used for drinking to water trees is suitable for use type". 20. "Change of behavior of using water by economically using water and using water according to use type is not necessary".			

PART 5: Opinions on participation in solving the problem of water shortage of people in the community

Questions	Opinions		
	Agree		
	Considerably	Slightly	Disagree
Attitudes toward participation: 1. *"People who give various things for the public receive various things in return".* 2. "Humans are not social animals so they are able to live alone". 3. "People in the community help each other by jointly doing activities such as harvesting which is a good tradition which should be preserved". 4. "Jointly doing public activities such as jointly building churches, schools, public rest- house should be promoted".			

Questions	Opinions		
	Agree		
	Considerably	Slightly	Disagree
5. "Jointly developing natural environments such as jointly digging canals, marsh, swamp or helping remove rubbish should be strictly campaigned".			
Opinions on solving the problem of water shortage: 6. "It is time for the community to solve the problem of water shortage". 7. "People in the villages should not wait for the government to solve the problem of cultivation water shortage but they should first try to solve the problem as much as possible". 8. "Solving the problem of drinking-water shortage is easier than solving the problem of cultivation water shortage. If people find ways to store more rainwater, they are able to solve the problem of water shortage". 9. "People in the community jointly solve the problem of water shortage as follows; They jointly think to find ways to jointly solve the problem of water shortage. They jointly make decision to be jointly responsible. They jointly do any activities so that they are able to quickly and successfully solve the problem. And they jointly receive benefits after jointly solving the problem of water shortage" 10. "As for the principle of solving the problem of water shortage, people in the community have to jointly find solution method".			

Questions	Opinions		
	Agree		
	Considerably	Slightly	Disagree
11. "Efficient water management methods should be done in the form of projects". 12. "When your village makes the project of solving the problem of water shortage, how much do you agree that your family should send a representative to participate in the project?" 13. "When your village makes the project of solving the problem of water shortage, how much do you agree that you should persuade other people to participate in the project?" 14. "Do you agree that you should follow results of solution to the problem of water shortage?"			

PART 6: Problems and obstacles making people in the community unable to solve the problem of water shortage and recommendations

1. What problems and obstacles make people in the community unable to successfully solve the problem of water shortage?

1)…….

2)……

3)……..

2. Recommendations on solving the problem of water shortage

2.1 What methods should be used for sufficiently providing drinking water?

1)…….

2)……

3)……..

2.2 What methods should be used for sufficiently providing household water?

1)…….…….

2)……

3)……..

2.3 What methods should be used for sufficiently providing cultivation water?

1)…….…….

2)……

3)……..

2.4 How should water-storing places be built in your village?

They should be built ……..…….

Due to the following reasons;…….

2.5 What methods should be used for preventing water in the pond to least seep?

1)…….…….

2)……

3)……..

2.6 What methods should be used for preventing water in the pond to least evaporate?

1)…….…….

2)……

3)……..

2.7 What methods should be used for preventing water in the pond from pesticide?

1)…….…….

2)……

3)……..

2.8 What methods should be used for economically using cultivation water?

1)…….…….

2)……

3)……..

APPENDIX B
REMARKS DERIVED FROM THE RESEARCH

As for the issues on water and forests

- Flood itself is not disaster but humans cause disaster.
- Drought and flood are caused by natural phenomena.
- Repetitive drought and repetitive flood occur because humans decrease fertility of forests.
- Water- retaining places should be built according to the global gravity.
- Forests are living dams so forests should be first built. If repetitive drought and repetitive flood still occur, dams have to be built afterwards.

The issue on doing alternative rice farming

Rice Terrace, alternative way, can be used for solving the problems of flood and drought situations in the rice field.

Structure: Rice Terrace is a pond by keeping water at the bottom of the pond. Above the water level, farmers have to make the Rice Terrace to the edge of the pond for use in growing rice. A wall has to be built above the edge of the pond. Water gate is opened for receiving water in the excessive water season and it is closed when there is enough water. Vetiver Grass is planted above the wall for strengthening the wall.

Benefits: Farmers are able to grow rice during drought or flood.

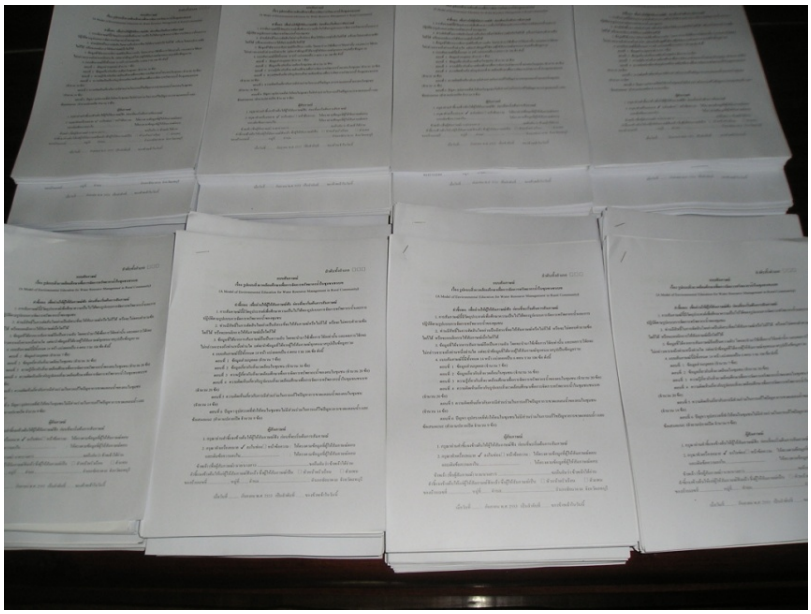
Objectives: To make sure that farmers are able to; consume rice in their households throughout the year and use for produce rice in the next year.

Location: The rice field should be situated near farmers' own house.

APPENDIX C
PHOTOES

Indoor training

Outdoor training



Questionnaires

Assistant researchers are ready to work

Research area

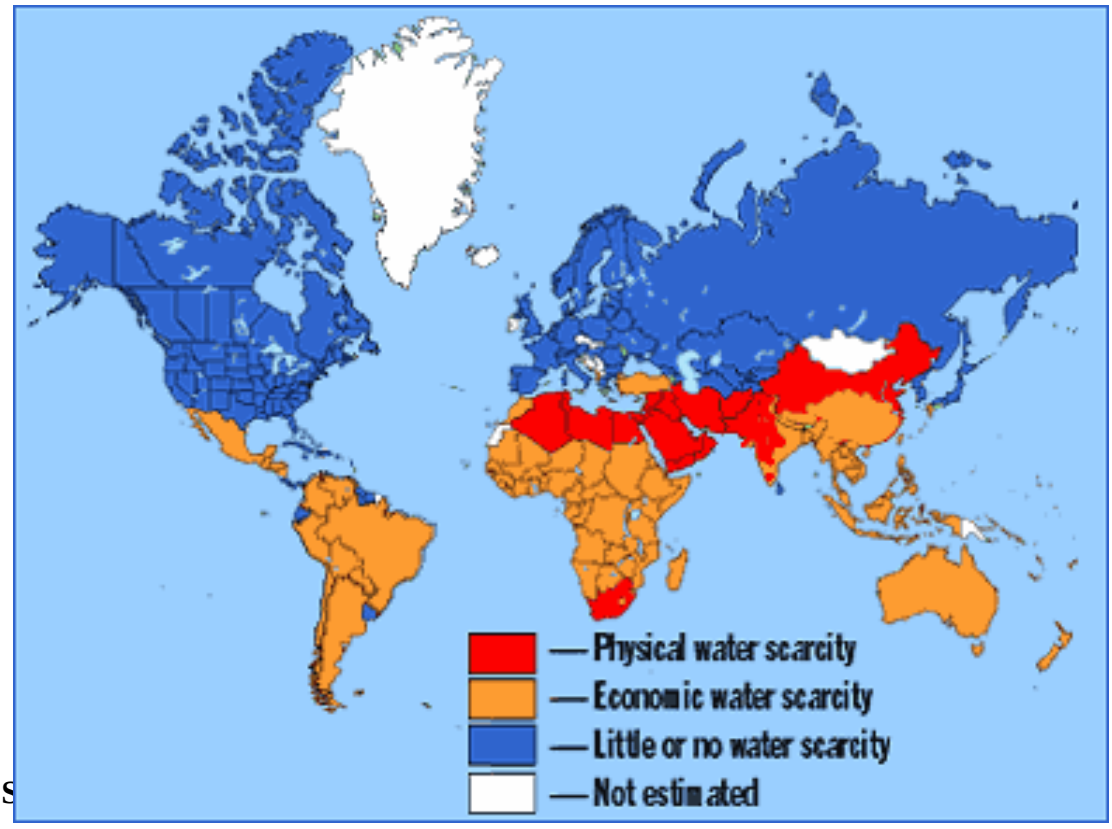

Drinking – water

Agriculture - water

APPENDIX D

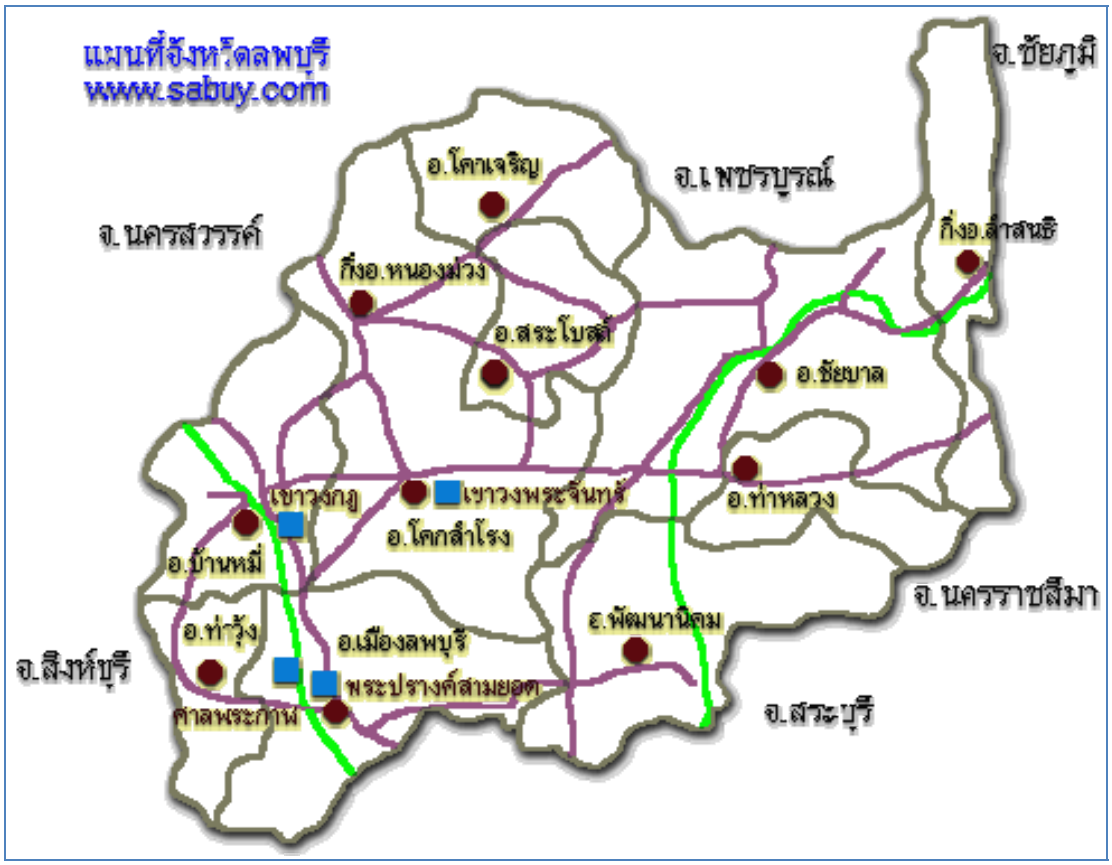
MAPS

Water scarcity of the world

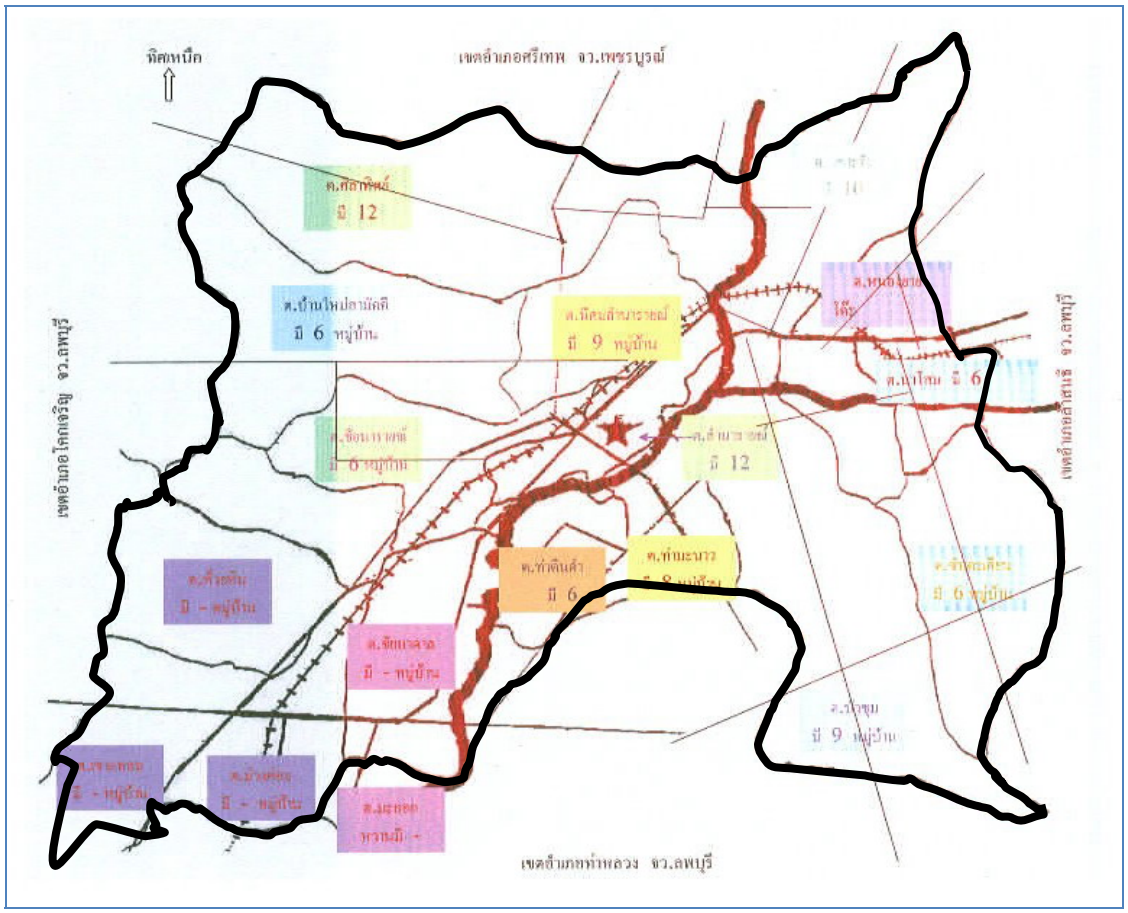


S

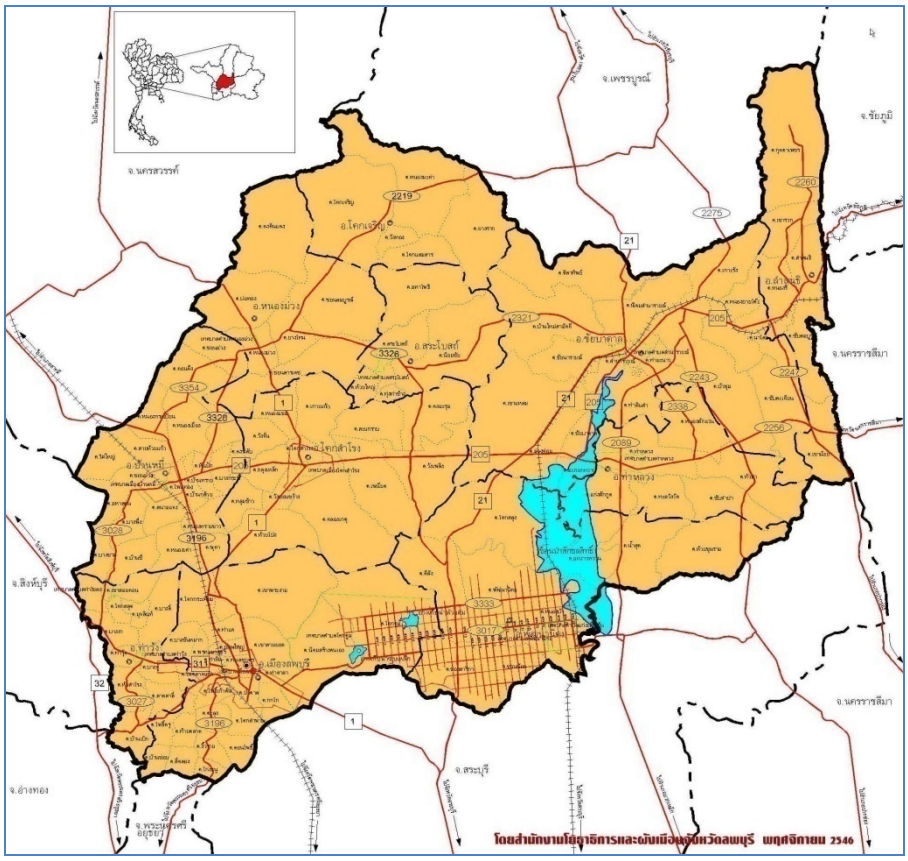
Lop Buri province



Chai Badan district, Lop Buri province



Pasak Cholsit dam



BIOGRAPHY

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