Part III: Database of Water Quality

1. The Data Structure of Water Quality Management Database System

The results from participatory process were applied to construct database of water quality. The database structure was incorporated with required knowledge such as information on natural resources and environment, environmental management, watershed information, water quality indicators, water quality sampling, water quality management, and water quality sampling manual as appeared in Figure 18.

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┌─────────────────────────────────────────────────────┐
│   Water quality management database system for SAOs  │
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         │
         ├──▶ ┌──────────────────┐
         │    │   Introduction   │
         │    └──────────────────┘
         │
         ├──▶ ┌──────────────────────────────────────────────┐
         │    │ Natural resources and environment            │
         │    │ - importance of natural resources and        │
         │    │   environment                                │
         │    │ - man and environment                        │
         │    │ - causes of environmental problems           │
         │    │ - impact of environmental problems           │        ◇ From SLP
         │    │ - environmental management by local people   │
         │    │   (video)                                    │
         │    │ - local wisdom (video)                       │
         │    └──────────────────────────────────────────────┘
         │
         ├──▶ ┌──────────────────────────────────────────────┐
         │    │ Watershed management                         │
         │    │ - definition of watershed management and     │
         │    │   vedio                                      │        ◇ From SLP
         │    │ - watershed classification and vedio         │
         │    │ - watershed management organization          │
         │    └──────────────────────────────────────────────┘
         │
         ├──▶ ┌──────────────────────────────────────────────┐
         │    │ Water resource                               │
         │    │ - importance of water resource               │
         │    │ - water characteristics and water quality    │
         │    │   indicators                                 │
         │    │ - water quality standard                     │
         │    │ - water quality problems and management      │
         │    └──────────────────────────────────────────────┘
         │
         └──▶ ┌──────────────────────────────────────────────┐
              │ Mae Taeng Watershed                          │
              │ - physiography of Mae Taeng watershed        │
              │ - Chiang Mai province and water source       │
              │   (vedio)                                    │        ◇ From SLP
              │ - importance of river and water resource     │
              │   (vedio)                                     │
              │ - water quality sampling manual              │
              └──────────────────────────────────────────────┘
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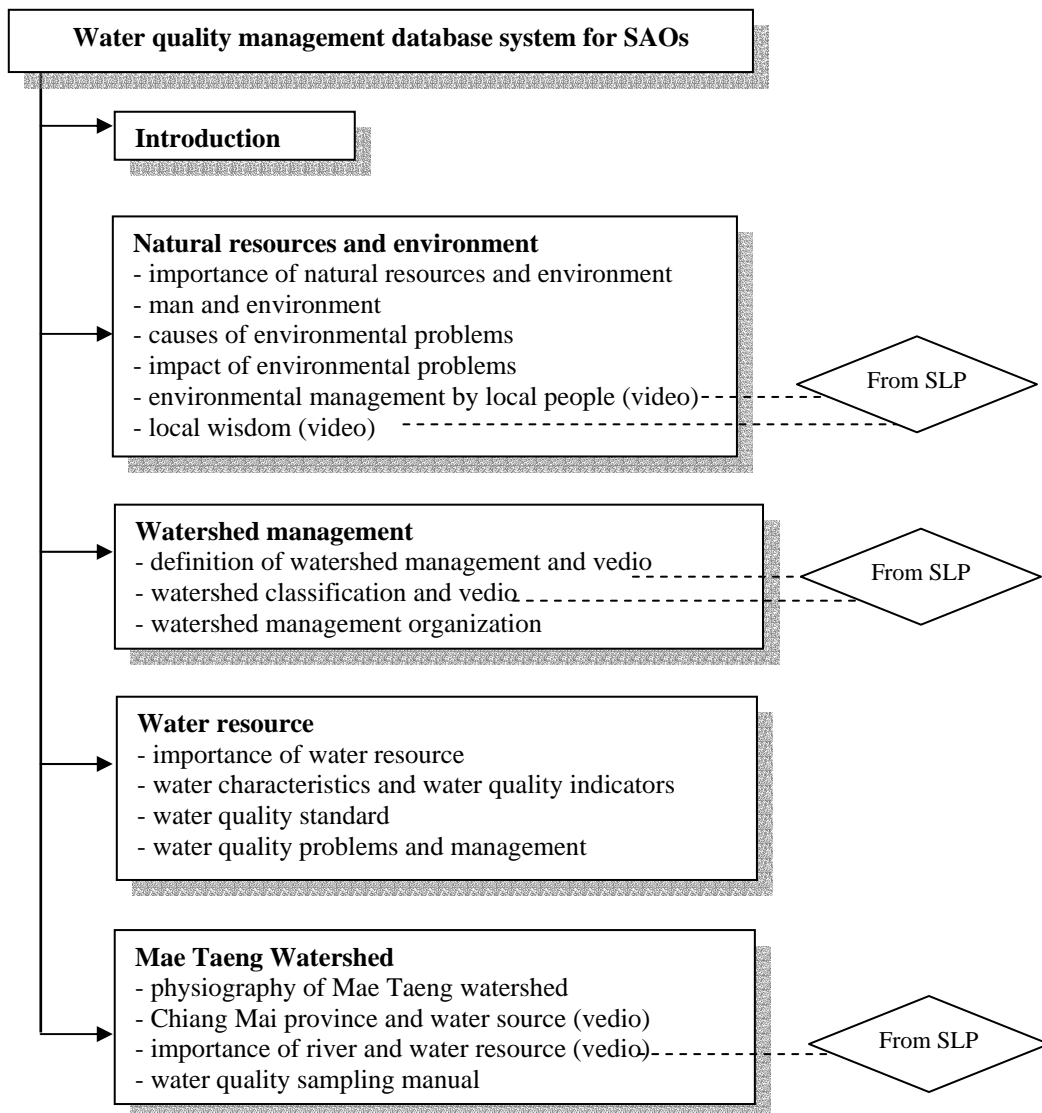
Figure 18 The proposed data structure of water quality management database system in Mae Taeng watershed

The information gained from the study was developed into information system program in the form of the multi-media system such as Photoshop and Macromedia-Director program. Details of the development of program and manual

were included the data exploration of the relevant information, the study on relationship of modules, the development of performance input data, and the preparation of manual.

2. Results of Database System Evaluation

After completing the development of the prototype of water quality database for the SAOs in the Mae Taeng watershed, the researcher evaluated the use of such database system by requesting feedback from users on the multi media program. The detail appeared in Table 11.

Table 11 Feedback from the users on the satisfaction of water quality database of Mae Taeng watershed

(Unit: %)

Satisfaction of participants on	Mae Taeng Watershed			Total
	Upper	Middle	Lower	
I Content of the multi media program				
Part I Natural resources and environment				
1) Importance of natural resources and environment				
Man and environment				
Low	0	0	0	0
Medium	26.0	12.0	25.0	21.0
High	74.0	88.0	75.0	79.0
General information on environment				
Low	0	0	0	0
Medium	17.0	12.0	14.0	14.3
High	83.0	88.0	86.0	85.7
Causes of environmental problem				
Low	0	0	0	0
Medium	26.0	12.0	25.0	21.0
High	74.0	88.0	75.0	79.0
2) Watershed management				
Watershed classification				
Low	0	0	0	0
Medium	14.0	14.0	12.0	13.3
High	86.0	86.0	88.0	86.7
Watershed management organization				
Low	0	0	0	0
Medium	25.0	22.0	17.0	21.3
High	75.0	78.0	83.0	78.7

Table 11 (cont.)

(Unit: %)

Satisfaction of participants on	Mae Taeng Watershed			Total
	Upper	**Middle**	**Lower**	
3) Water resource				
Importance of water resource				
Low	0	0	0	0
Medium	22.0	12.0	17.0	17.0
High	78.0	88.0	83.0	83.0
Water characteristics				
Low	0	0	0	0
Medium	14.0	12.0	17.0	14.3
High	86.0	88.0	83.0	85.7
Water quality standard				
Low	0	0	0	0
Medium	10.0	2.0	8.0	6.7
High	90.0	98.0	92.0	93.3
Water quality sampling				
Low	0	0	0	0
Medium	11.0	2.0	12.0	8.3
High	89.0	98.0	88.0	91.7
Water quality problem management				
Low	0	0	0	0
Medium	22.0	12.0	17.0	17.0
High	78.0	88.0	83.0	83.0
Part II Mae Taeng Watershed				
1) Mae Taeng watershed physiography				
Low	0	0	0	0
Medium	10.0	2.0	11.0	7.7
High	90.0	98.0	89.0	92.3
2) Water quality sampling manual				
Low	0	0	0	0
Medium	11.0	2.0	12.0	8.3
High	89.0	98.0	88.0	91.7
II Multi media				
Graphic and video				
Low	0	0	0	0
Medium	11.0	2.0	12.0	8.6
High	89.0	98.0	88.0	91.4
III Program assessment				
Low	0	0	0	0
Medium	8.0	2.0	10.0	6.7
High	92.0	98.0	90.0	93.3

1) Evaluation of database content

Part I Natural resources and environment

(1) Importance of natural resources and environment information

Man and environment: It was found that the feedback from users for such topic as at a high level (79.07 %). Considering the level of feedback of users by areas, the middle watershed got the highest level (98.0 %), followed by the upper watershed (89.0 %), and the lower watershed (88.0 %), respectively.

General information on environment: It was found that the feedback from users for such topic as at a high level (85.7 %). Considering the level of feedback of users by areas, the middle watershed got the highest level (88.0 %), followed by the lower watershed (86.0 %), and the upper watershed (83.0 %), respectively.

Causes of environmental problem: It was found that the feedback from users for such topic as at a high level (79.0 %). Considering the level of feedback of users by areas, the middle watershed the highest level (88.0 %), followed by the lower watershed (75.0 %), and the upper watershed (74.0 %), respectively.

Most users were satisfied with content of information. Results found that the program development was the actual learning process; they could adjust the information that suitable for them.

(2) Watershed management

The meaning and the important of watershed management: It found that the feedback from users for such topic as at a high level (86.7 %). Considering the level of feedback of users by areas, the lower watershed the highest level (88.0 %), followed by the upper and middle watershed (86.0 %), respectively.

Watershed management organization: It was found that the total high feedback was 78.7 % followed by Medium level (21.3 %). Considering the levels of feedback by users by areas, the highest was found in the lower area (83.0 %), second by areas in the middle (78.0 %), and third by areas in the upper (75.0 %), respectively.

(3) Water resource

The importance of water resource: It was found that the total high feedback was 83.0 % followed by Medium level (17.0 %). Considering the levels of feedback by users by areas, the highest was found in the middle area (88.0 %),

second by areas in the lower area (78.0 %), and third by areas in the upper area (78.0 %), respectively.

Characteristics of water: It was found that the total high feedback was 85.7 % followed by Medium level (14.3 %). Considering the levels of feedback by users by areas, the highest was found in the middle area (88.0 %), second by areas in the upper area (86.0 %), and third by areas in the lower area (83.0 %), respectively.

Water quality standard: It was found that the total high feedback was 93.3 % followed by Medium level (6.7 %). Considering the levels of feedback by users by areas, the highest was found in the middle area (98.0 %), second by areas in the lower area (92.0 %), and third by areas in the upper area (90.0 %), respectively.

Water quality sampling technique: It was found that the total high feedback was 91.7 % followed by Medium level (8.3 %). Considering the levels of feedback by users by areas, the highest was found in the middle area (98.0 %), second by areas in the upper area (89.0 %), and third by areas in the lower area (88.0 %), respectively.

Water quality problem management: It was found that the total high feedback was 83.0 % followed by Medium level (17.0 %). Considering the levels of feedback by users by areas, the highest was found in the middle area (88.0 %), second by areas in the lower area (83.0 %), and third by areas in the upper area (78.0 %), respectively.

Part II Mae Taeng Watershed

(1) Mae Taeng watershed physiography: It was found that the total high feedback was 92.3 % followed by Medium level (7.7 %). Considering the levels of feedback by users by areas, the highest was found in the middle area (98.0 %), second by areas in the upper area (90.0 %), and third by areas in the lower area (89.0 %), respectively.

(2) Water quality sampling manual: It was found that the total high feedback was 91.7 % followed by Medium (8.3 %). Considering the levels of feedback by users by areas, the highest was found in the middle area (98.0 %), second by areas in the upper area (89.0 %), and third by areas in the lower area (88.0 %), respectively.

Most users were rather satisfied with the content of this information. They could understand very well in this part because it had a learning process about water quality sampling that they could do by themselves.

2) Evaluation of multi media and program assessment

The level of feedback by users related to graphic and Video were at the high level (91.4 %). Considering by areas, the middle watershed got the highest level (98.0 %), followed by the upper watershed (89.0 %), and the lower watershed (88.0 %), respectively.

Most users were satisfied with graphic and vedio because the graphic and VOD were easy to understand.

3) Evaluation of program assessment

It was found that the total high feedback was 93.3 % followed by Medium level (6.7 %). Considering the levels of feedback by users by areas, the highest was found in middle area (98.0 %), second by areas in the upper area (92.0 %), and third by areas in the lower area (90.0 %), respectively.

Most users were satisfied with the program assessment because the multi media program was easy to assess, not complicated and more interesting. However, there were done difficulties for the users due to the limitation of computer hardware.

3. Water quality database system program

The program of water quality management database system for SAOs was made from Macromedia-Director program. This program appeared in DVD and Figures 19-41.

The database intended to be an object learning media as well as a water quality database system.

Figure 19 The first page of the water quality management database system for SAOs in Mae Taeng watershed

Figure 20 The introduction page of the water quality database

Figure 21 The main page of the database providing information about natural
resources and environment

Figure 22 The main page of the database containing information about the importance
of natural resources and environment

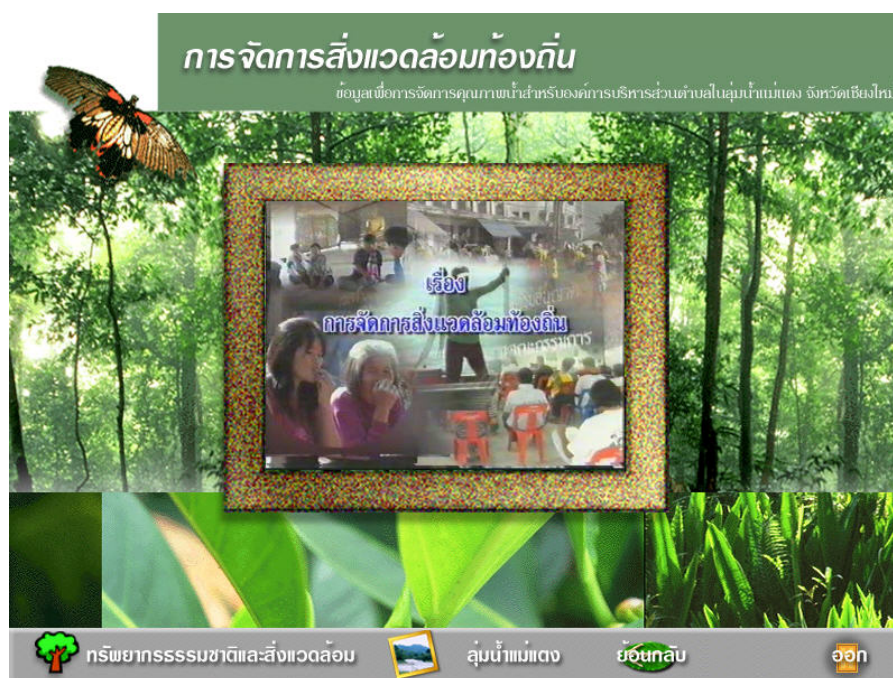Figure 23 The page in the database showing information about man and environment

Figure 24 The page of the database providing information about environmental
management by local people (video)

Figure 25 The main page of the database providing information about watershed
management

Figure 26 The page in database providing definition of watershed management

Figure 27 The page in database providing information about watershed
classification

Figure 28 The page in database providing information about watershed management
organization

Figure 29 The page of the database containing the video about watershed
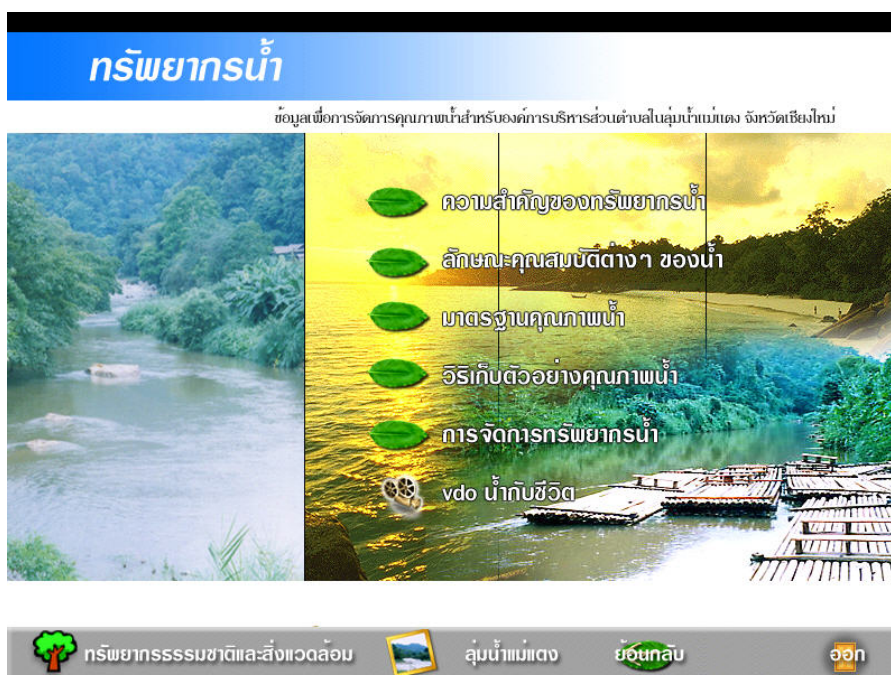
Figure 30 The main page of the database providing information about water resource
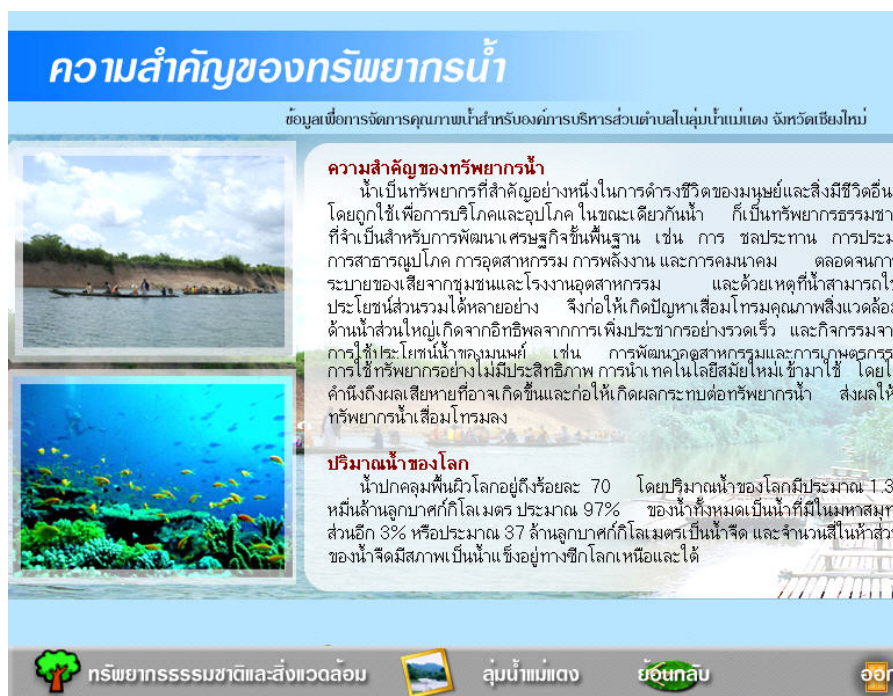
Figure 31 The page in database providing information about the importance of water
resource

Figure 32 The page in database providing information about water characteristics

Figure 33 The page in database providing information about water problems and
management

Figure 34 The page of the database providing information about water and human
(vedio)

Figure 35 The page of the database providing information about water quality
sampling technique

Figure 36 The main page of the database providing information about Mae Taeng
watershed

Figure 37 The page in database providing information about the physiography of
Mae Taeng watershed

Figure 38 The main page of the database proving information on water quality
sampling manual

Figure 39 The page in database providing information on water quality sampling form

Figure 40 The page of the database proving information about water conservation in Chiang Mai province (video)
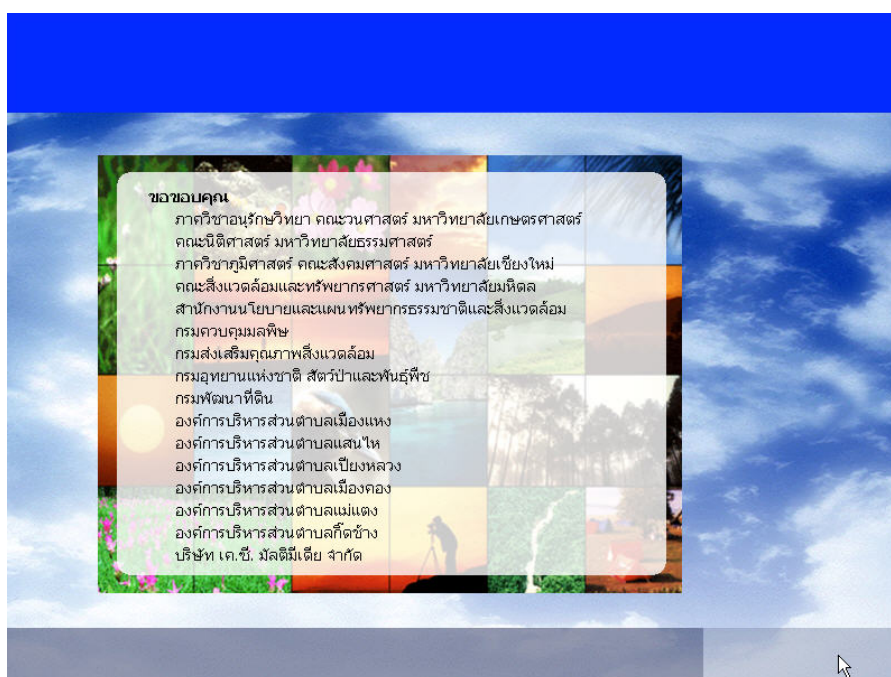
Figure 41 The last page of program for Mae Taeng watershed database

Part IV: Proposed Participatory Process and Guideline

As a result from the study of participatory process, the participatory model of water quality database development process was introduced as illustrated in Figure 42.

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                    │    Building up relationship   │
              ┌ ─ ─ ┘ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ └ ─ ─ ┐
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Researcher
√ specialists
√ facilitators
√ NGOs
√ community development official

Responsibility
● **To collaboratively study particular problems of water quality for the community,**
● **To adopt the participatory process**
 - to enhance of the group potential
 - to promote and useful activities to solve water quality problems continuously

Community
√ Formal leading group of community.
√ Informal leading group of community
√ SAO members

1. Collection of secondary data related to community:

 to make understanding on the overall nature of community

2. Analysis of stakeholders
 ● Group meeting.
 ● Understanding on participatory method and induce the involvement of water quality problems management

3. Analysis of water quality problems
 ● Problems exploration
  - to identify problems by stakeholders
  - to pioritise problems by its serioness
 ● Analysis of qualitative and quantitative problems of the community
  - to conduct research related to problematic issues via the involvement of community.
  - to educate community to be aware of serious, continuing, and widely affected problems.
  - to select serious, continuing, and directly affected community and do further analysis.
 ● Analysis the causes of problems via brainstorming.
  - to make better understanding on problems and causes.

AIC

Figure 42 Proposed model of participatory process in water quality database
            development for Mae Taeng watershed

4. Structural analysis of water quality problems:
    1) To integrate process combine with the community and research's viewpoint on problems
      2) To educate the community regarding the linkage of causes and problem
         • Exploring causes and solution for the problem
           - to integrate problems and causes collected from stage 3 and look back to other causes (use mind map)
           - to design the learning process of the community regarding root of the problems and linkage
        • To survey and analyze factors related to problems
           - to study indepth of the problems

SLP

5. Selection and analysis of solution:
    1) To take findings found in stage 4 into account to find concrete solution for the community
    2)To integrate lessons and constraints confronted by the community and the relevant agencies together with local experiences to get the solutions
        • Review and analyze problem by community
          - to select the methodology
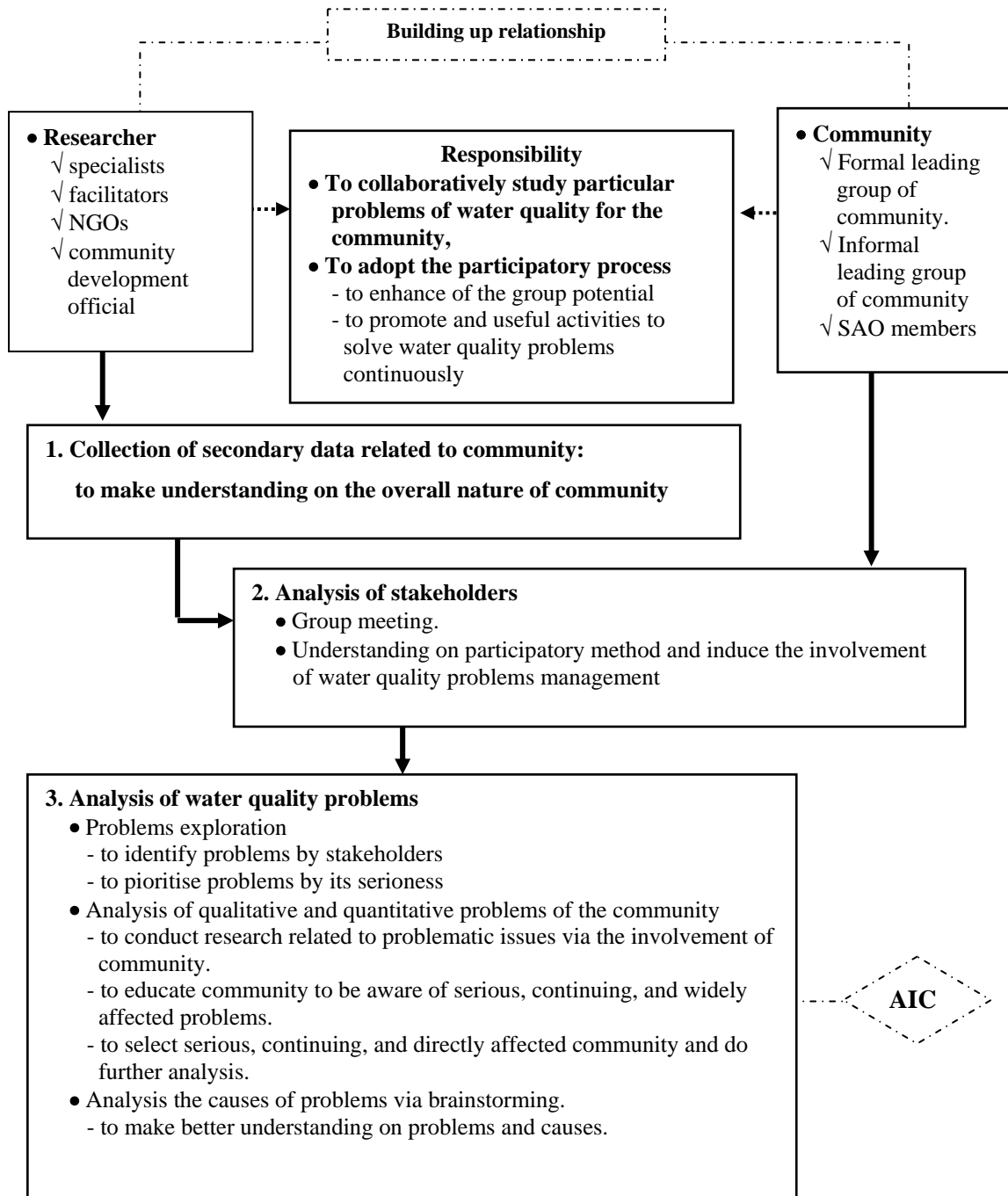   - to analyze the causes of misfunctioning (or constraints)
          - to analyze the factors associated with the success, that is the analysis of potential of community to deal with problems
          - to introduce new methods for the community
          - to analyze problems, constraints, and potential of new solution
       • Analysis of the water quality solution
          - to induce the community to consider the possibility of the solution
          - to integrate local wisdom and understanding on the conditions with techniques and experiences of the researcher and specialist
       • Analysis of procedures in actual practice
          - to apply the solution to identify the responsible person, material procedure, technique, resource, budget, method, and coordination guideline.
          - to explain in details about the practical guideline to the solution
          - to make community commitment

SLP

6. Transforming the solution into database:
    To simplify the results from stage 5 to be the input for database
    To sum up the main content and use it as database for water quality management

7. Implementation as agreed
    To abide by the commitment
    To use database for dealing with problems
    To provide knowledge for the stakeholders involved with water quality
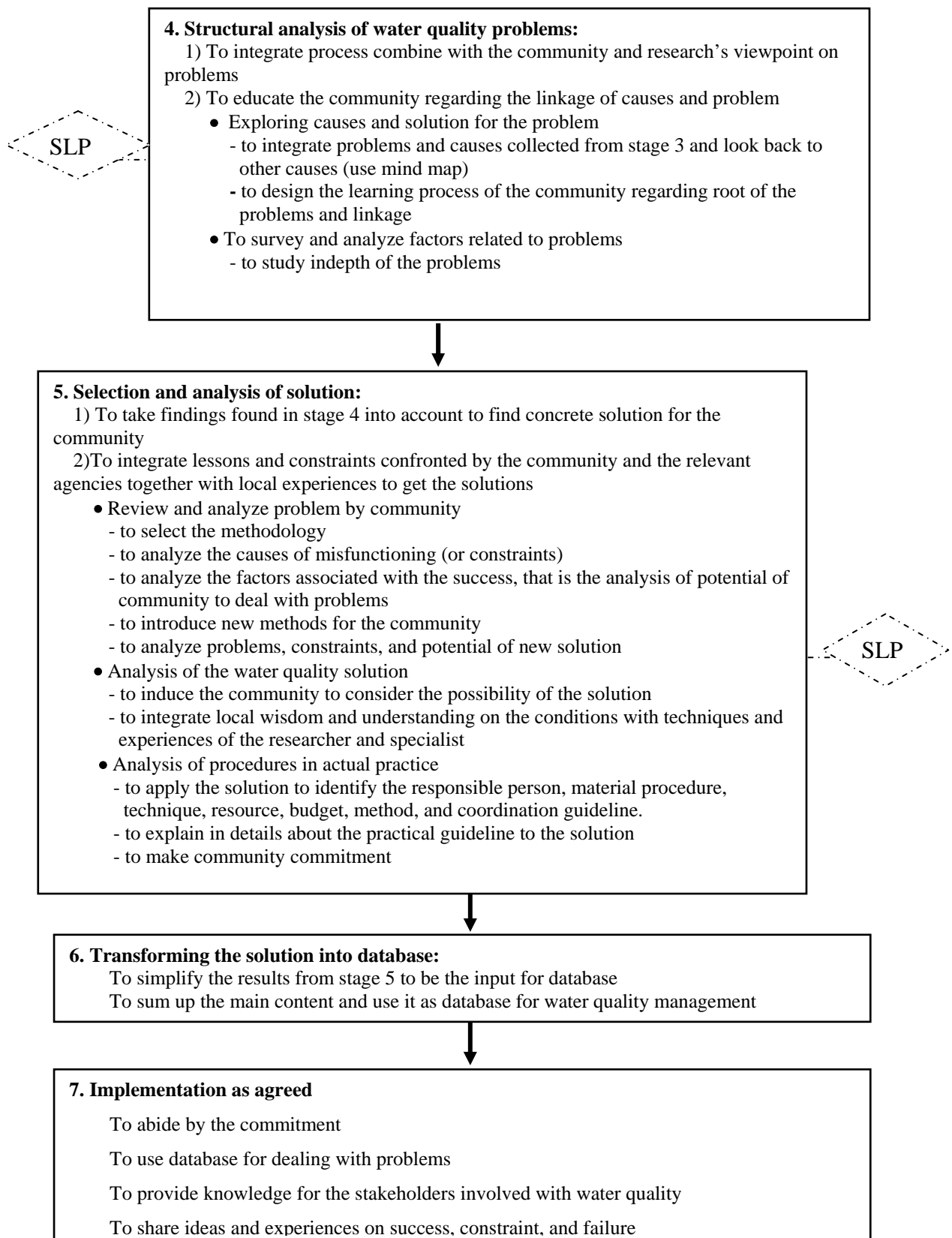   To share ideas and experiences on success, constraint, and failure

Figure 42 (cont.)

Practical guidelines on participatory process

The practical guidelines on participatory process learned from this research were as follows:

1) The selection of representatives or participants in the participatory process should take into consideration that people living closely to the existing problems should not be missed out from the process.

2) The researcher must understand background of the participants so that he/she can design appropriate participation techniques and logistics accordingly.

3) The researcher should pay attentions to the constraints of the process and/or of the participants such as timing, location, and linguistic barrier, etc.

4) The researcher must encourage participants to speak out their ideas freely without any intimidation from the researcher.

5) The researcher must encourage active participation by employing any necessary interactive technique or means such as mind map and delphi technique for instances. And he/she must ensure that there will be enough time to complete the technique.

6) The researcher should have good knowledge and background in watershed and resource management as well as water quality management.

7) The researcher should have good communication skills, open-minded and good human relations as well as analytical skills.

8) The researcher must always keep in mind that his/her role is facilitators of the process, not the implementation.