ENHANCING COMMUNITY CAPACITY IN WATER MANAGEMENT VIA WEB-BASED DECISION SUPPORT SYSTEM

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Abstract
In year 2005, Thailand faced with drought crisis when cumulative rainfalls were lower than average rainfall and storage water in reservoirs was going down to the critical level, so allocated water were limited which supply was less than water consumptive use rate. Map Ta Phut Industrial Estate, promoted industrial area by the government in Eastern Seaboard Development Programme, seemed to be the most suffered area because it is located with Petrochemical and Power Supply plants which need a lot of water and gave impact to Thailand's economic growth. Many actions from government sectors had been implemented to supply more water, though, actions made the conflicts among industrial and other stakeholders because the policy favored industrial sector rather than others, inequitably allocated water, lacked the public participation, and missed data from regional and community sources.

The web-based decision support system, aimed to share water information to have more effective water management between regional and community arena, was developed as an information management system which can link regional water data sources and community data sources, and develop data updating process. The collected data, which covers water use computed from population, agriculture area, factory, water use rate, and water resources related information such as rainfall, surface water, well, secondary storage, were verified in small meeting group and additional survey data by local people to build the learning process in the community which they can update data in the future. The system was recognized as an innovative tool to bring new knowledge to community based water management system via new technology.

In this phase, the developed web based decision support system was further developed to (1) upgrade the drought warning system, (2) to modify the information system to fit with various level of user demand, (3) to enhance community capacity in water management and (4) promote the system for public use in Rayong Province. At present, each community is required to produce the community plan on infrastructure development to be submitted to the Province for approval to use their own annual budget. In order to enhance community capacity, the survey on community needs on water planning and operation especially during the drought period was conducted and the survey found that community needed more information and knowledge on water supply & small scaled irrigation facility planning and operation to help community members to solve or lessen water shortage.

To cope with this situation and demand, the project helped facilitate knowledge sharing area via workshops and the developed web based system. From this type of knowledge sharing workshops, concerned personnel became more familiar and more capable to solve water issue in their area, and also the project used the information from workshops to upgrade the DSS. A workshop was organized to present the developed web based DSS and transfer general and specific knowledge on water supply and small scaled irrigation scheme. The workshop was proved to be useful as the knowledge and experiences sharing among community representatives and concerned authorities. The project also knew to what extent the DSS can facilitate to the community water management system.

Through this participating process among communities and concerned authorities via workshops and the web based DSS of the project, the necessary information and knowledge were equipped to enhance the community capacity and the developed system becomes a foundation for community water planning and to the Province who can also oversee the overall water situation. The developed web based DSS can then help enhancing community water management and gaining mutual understanding and recognition among stakeholders for water problem solving for the area in the future.

Keywords: capacity building, web based, community, water management.

1) Introduction

In year 2005, Thailand faced with drought crisis when cumulative rainfalls were lower than average rainfall and storage water in reservoirs was going down to the critical level, so allocated water were limited which supply was less than water consumptive use rate. Map Ta Phut Industrial Estate, promoted industrial area by the government in Eastern Seaboard Development Programme, seemed to be the most suffered area because it is located with Petrochemical and Power Supply plants which need a lot of water and gave impacts to Thailand's economic growth. The decision makers decided to cut domestic supply down so people can use water in time schedule, closed the supply irrigation gate, and diverted water from the downstream of main river to supply water to Map Ta Phut. Moreover, the government decided immediately to build the pipe network project linking among inner and outer reservoirs, and develop groundwater wells. The results of these actions made the conflicts among industrial and other stakeholders because the policy favored industrial sector rather than others, inequitably allocated water, lacked the public participation, and missed data from regional and community sources.

The research project was initiated to gap down the community participation in the water management in the region and the principle concept was to disseminate the water information through web based system [2]. The decision support system was also developed to provide information, warning system and management tools to both community and the Province.

The concept of water information through ICT technology and capacity building through knowledge sharing had been discussed and implemented in various region of the world. The water information distribution via web communication had been mentioned from the Sixth Water information Summit (2003) [9] and WHYCOS Project (World Hydrological Cycle Observing System, 2006) [6] had been implemented, focused on Africa region with GeoPortal Website, to disseminate the spatial information related to water and developed nine modules about water insitu observations. The concept of KM via knowledge sharing had been implemented under the links and web based articles with the applications in the organizations, e.g., CIDA, CGIAR, Center for Reflective Community Practice, MIT (2006) [7]. The knowledge warehouse concept with the application to aquaculture community had been initiated with website creation to disseminate the knowledge and foster capacity building via web site (2007) [4]. Besides, the capacity building via web based had also implemented through Coastlearn Program (Lessons learnt from a web-based capacity building in Integrated Coastal Zone Management (ICZM), 2008) [1].

This paper introduced the methods for community capacity enhancing via knowledge management concept and web based decision support system developed. The system had been implemented the selected communities in the Rayong area, Thailand and found to be useful and effective approach for the community water management and can link to the provincial water management scheme.

2) Web based Decision Support System developed

In the phase 1, the web-based decision support system (DSS) was designed and developed as an area-based water resources management system which can monitor and report the status of the water supply and water demand to system users that divided into 4 parties; policy user, regional users, community users, and general users as shown in Fig. 1 [2, 8]. The DSS system linked with the Provincial Operation Center (POC), the core database center of Rayong Province, to retrieve data from government agencies and then to check the data consistency from community sources.

In addition, the study developed various analysis tools as build-in functions in the DSS system to report the present situation and to forecast water situation in the region and communities. Analysis tools were consisted of 7 analytical techniques/processes, i.e., (1) monthly rainfall was estimated based on the percentile of cumulative rainfalls from April to the precedent month; (2) monthly runoff was generated by the Thomas-Fiering Model depending on runoff in the previous month; (3) artificial neural network (ANN), a black-box model which is popular for finding input-output relationship function, was developed for forecasting daily and monthly reservoir inflows; (4) domestic demand was estimated by the number of population multiplied by the consumptive use unit; (5) irrigation demand was estimated based on crop coefficient, potential evaporation, crop duration, crop calendar, and effective rainfall; (6) industrial demand was estimated based on horsepower and consumptive use unit; and (7) the simulation model computed the balance between demand and supply, and allocated water to water user nodes by their priorities.

The main web page of DSS system is available at http://project-wre.eng.chula.ac.th and www.cuwater.org. Hydrology data, such as rainfall for each station, can be displayed with reference points on GIS to compare

the rainfall distribution in the basin. The status of water use, balancing water supplies and water demand, in communities and regional level as analyzed data from DSS was described in details to give the information to water manager. The result of forecasting model following the management operation of government agency in multi-reservoir system for one year in advance can be displayed.

In the Phase 2, the focus is on the community capacity enhancing to utilize the developed DSS in their water management activities. The system was then added with the knowledge management system package to keep the training materials, relevant document and best practices of the water operation at community level [3].

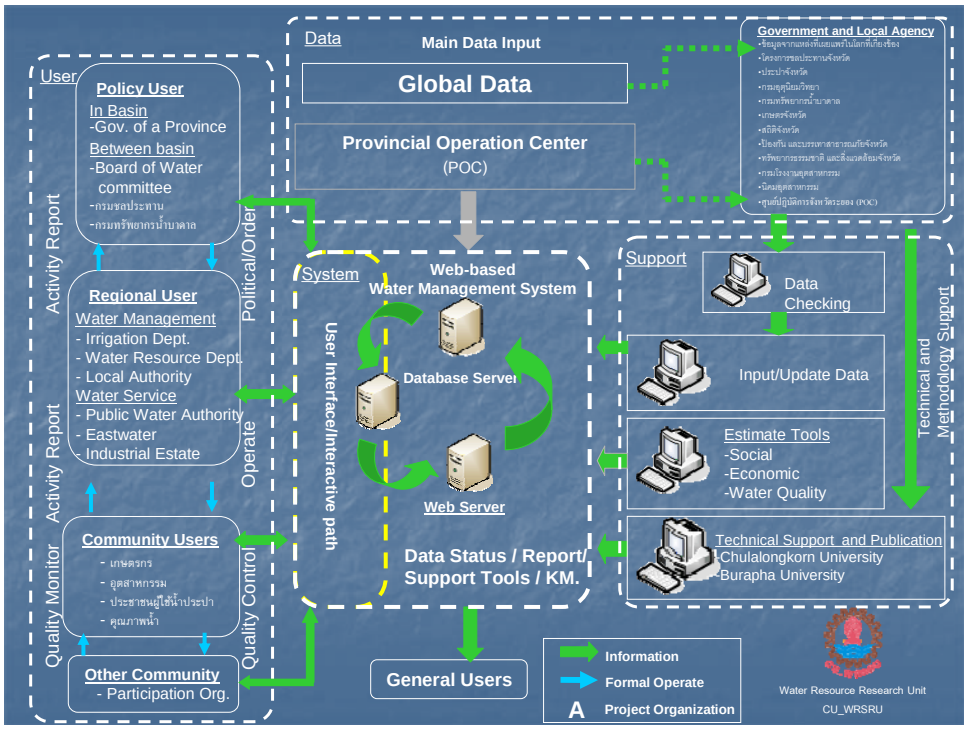


Fig 1 Developed DSS with KM support tools

3) Community capacity building and knowledge management concept

To enhance community capacity in water management, information and knowledge is necessary. The project designed the water management related content and trained facilitators as a core person to disseminate among communities. In order to localize knowledge and create facilitator in the community, knowledge cycle (so called SECI Model [5]) concept was applied (as in Fig 2). First, the facilitators were trained via lecture with the necessary knowledge. Workshops were conducted to discuss with the past experiences to combine new knowledge and past experiences. New issues raised from workshops were then practiced in the field via local research activities, e.g., water storage measurement, water requirement calculation etc. Lastly, the facilitators publicized their knowledge to other community as local lecturers.

To support the capacity building activities, knowledge management system was also developed in web based. Relevant information (such as law/regulation, water quality standards etc.) were input in the system for the facilitators and community to be used for their water operation during emergency or water planning. Lecture notes during the training and workshop sessions (such as irrigation water requirement, water supply system design guidelines etc.) were also input in the system. FAQ bog was created for basic problem solving guide. Lastly, suggestions and best practices from community were also added in the DSS for public.

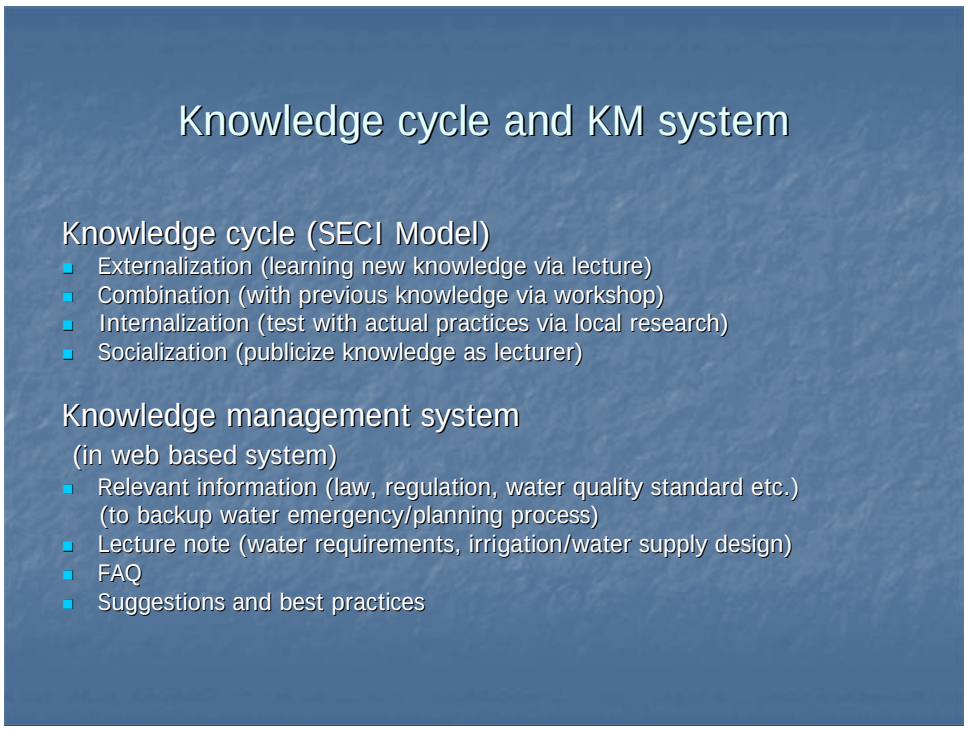


Fig. 2 Knowledge Cycle and KM System

4) Implementations

The enhancement implementation process comprised of training need assessment, knowledge and information provision (as needed), knowledge sharing via workshops and web site, knowledge dissemination by local lecturers and monitoring. The training need assessment was conducted through field interviews and the review of community development plan (which included the development needed collected from villages in the community). The seminar was then designed to deliver the knowledge and information needed for community water management. Many meetings, participatory forum were conducted to deliver the necessary knowledge and information. Issues from the seminar were gathered and workshops were conducted to share experiences of problem solving among local officers and facilitators such as how to design or choose water supply system in their own community, how to plan for small scaled irrigation system etc. The materials developed and used were then added in the knowledge management session in the DSS. The seminar for the nearby communities was then organized to disseminate the water management knowledge and DSS and the lectures were then conducted by local agencies and facilitators at community. The enhancing process were evaluated into stages and at each community participated i.e., be able to collect data, input in the system, monitor the water status via the system, make a water report from the system, conduct a case study for water solving, plan water system for community, provide water solution via the system. The DSS was also improved to add FAQ and best practices from the training, forum and workshops into the system.

4) Results

From the need assessment, the communities need the knowledge of small scale water supply and irrigation system to help solve water problem in the area. The training on water requirement calculation for water supply and irrigation was then conducted by utilizing knowledge and information from the authorities concerned, e.g., Provincial Water Works and Royal Irrigation Department. The participatory forums were organized to engage the authorities to present their plan framework or activities and in the same time, targeted local communities also could present their plan/activities with the support of web based system (Fig 4). The discussions of both authorities and communities brought the improvement of both plan and DSS. The target communities then presented their framework, adjustment of the water plan, the utilization of the DSS to other communities to share experiences of both water management and system application.

The evaluation of the target local community was conducted and shown in Fig. 5. It can be seen that communities from the project phase 1 ended up with the reporting via the system, though, targeted community in the project phase 2 were developed to use the system for water planning stage.

Fig. 3 System training and workshop activities for capacity building

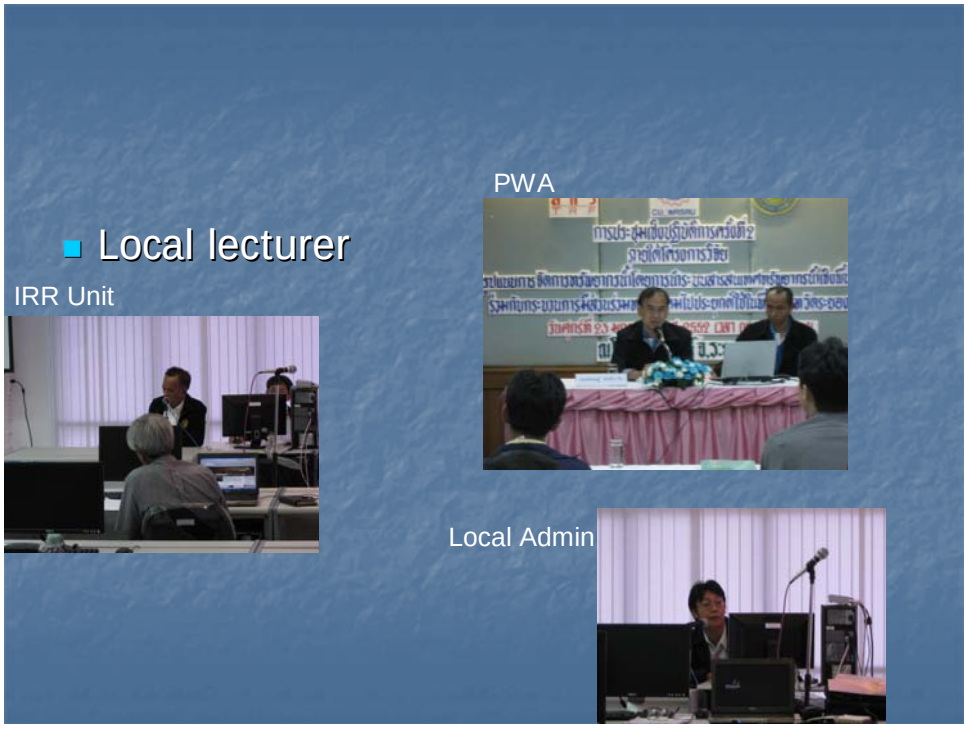
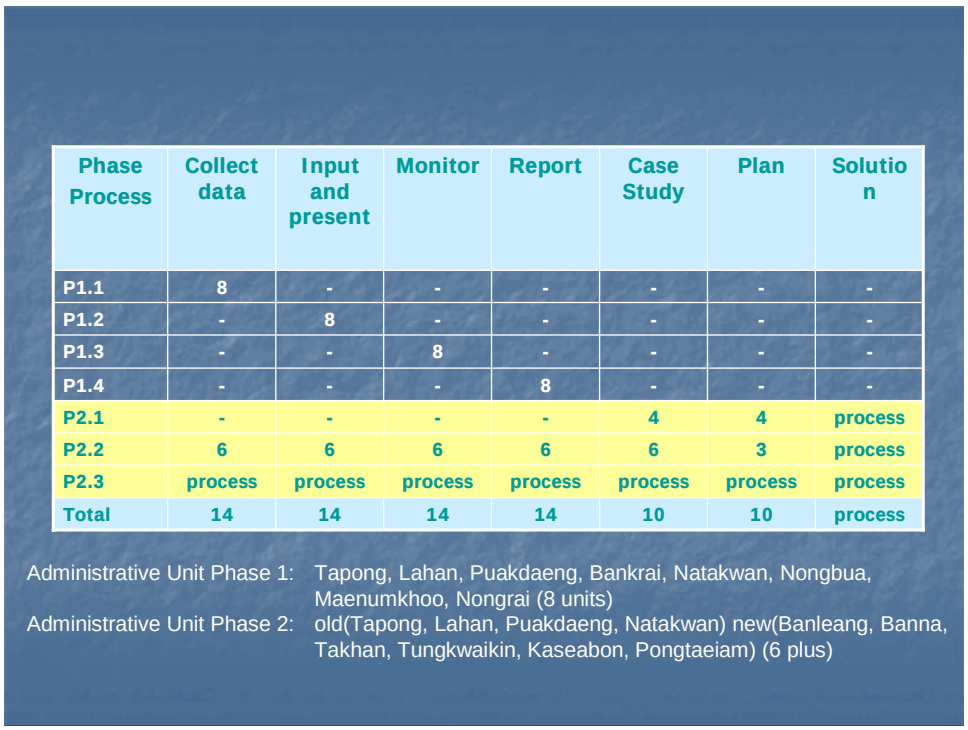


Fig. 4 Community knowledge sharing session



Phase Process	Collect data	Input and present	Monitor	Report	Case Study	Plan	Solution
P1.1	8	-	-	-	-	-	-
P1.2	-	8	-	-	-	-	-
P1.3	-	-	8	-	-	-	-
P1.4	-	-	-	8	-	-	-
P2.1	-	-	-	-	4	4	process
P2.2	6	6	6	6	6	3	process
P2.3	process	process	process	process	process	process	process
Total	14	14	14	14	10	10	process

Fig. 5 Evaluation Results

5) Conclusions

The research project enhanced the capacity building via the concept of knowledge management cycle and it is learned that proper preparation for capacity enhancement plan is needed (such as needs assessment /course design & lecturer selection, besides role and participation of concerned water authorities is necessary to help solve local water problem. For project implementation, follow up/ promotional activities arrangement is crucial to promote the system and lastly the establishment of KM forum within web based system is useful for knowledge and system dissemination.

Water problem solving/planning were also discussed in the forum/workshops and it was found that more understanding among stakeholders on water problem solving and better water operation and planning with the help of web based system through knowledge sharing were derived and linked to the capacity enhancing evaluation.

However there are still pending issues for further research/ study such as the utilization promotions of KM system in the wider communities, the need for content/information improvement by knowledge cycle, more lecturer training as system facilitator to disseminate the system.

6) Acknowledgement

The research team would like to express sincere thanks to participating administrative units (in Rayong Province), Royal Irrigation Department officers, Provincial Water Authority officers, Rayong Provincial Authority etc. and also thanks to The Thailand Research Fund for the research fund and Chulalongkorn University for her support in the research unit.

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