Summary of Terminal Evaluation

1. Project Overview		
Country: Thailand		Project Title: " Integrated Study Project on Hydro-Meteorological Prediction and Adaptation to Climate Change in Thailand"
Issue/Sector: Water resource management/Climate Change		Cooperation scheme : Science and Technology Research Partnership for Sustainable Development (SATREPS: Project Type Technical Cooperation)
Issue/Sector: Water Resources and Disaster Management Group, Global Environment Department		Total cost (as of November 2013) : Total cost : 314million yen
Cooperation period	(R/D): May 2009 to March 2014 (Extension): N.A. (F/U): N.A. (E/N)(Grant Aid): N.A.	Partner Country's Implementing Organization : Kasetsart University(KU), Thai Meteorological Department(TMD), Royal Irrigation Department(RID)
		Supporting Organization in Japan : University of Tokyo
		Related Cooperation : JICA's "Project for Flood Management in the Chao Phraya river basin"

1-1. Background of the Project

"Integrated Study Project on Hydro-Meteorological Prediction and Adaptation to Climate Change in Thailand (IMPAC-T (hereafter "the Project")) "is a Science and Technology Research Partnership for Sustainable Development (SATREPS: Project Type Technical Cooperation) technical cooperation and joint research project for Thailand, supported by the Government of Japan. The Project was formulated with a view to proposing a prototype of a comprehensive hydrological information system to support the decision-making by the Government of Thailand on water-related climate change (see 1.2 Project Outline for detailed activities).

As an emerging nation whose economy consists primarily of agriculture and rapidly growing industries, Thailand is dependent on water resources and vulnerable to the impacts of climate change. The fluctuation of climate conditions has affected its water availability and agricultural production, and has threatened human security and economy in the form of natural disasters.

Thailand's National Strategy for Climate Change Management (2008-12) recognizes the risks that climate change causes to its water resources, and suggests measures for water sector as a key component of its adaptation strategy. These include, among others, the development of climatological database and forecast system; the creation and development of numerical model for evaluation of climate change impacts to hydrological condition and water resources; the development of models for natural disaster risk evaluation; and studying climate change impacts on the risks of flood and drought in Thailand. Against this backdrop, the Project was requested by Government of Thailand in 2008, to fill the knowledge gap of Thai government officers and researchers in implementing adaptation measures, with the assistance from an international institution of academic excellence in water-related climate change research.

The Project is one of the first projects implemented under the framework of Science and Technology Research Partnership for Sustainable Development (SATREPS), a program executed jointly by Japan International Cooperation Agency (JICA) and Japan Science and Technology Agency (JST) to promote international joint scientific research to address global issues. Established in 2008, total 78 projects have been implemented so far under the SATREPS scheme.

1-2. Outline of the Project

(1) Project Purpose : "A prototype of the Integrated System to help decision-making on the adaptation for water-related risks under climate change impact is established".

(2) Outputs

Output 1: "Monitoring capacity in the field of hydro-meteorology for climate change impact is enhanced".

Indicator 1.1 The roles of Thai research group in the promotion of the continuous monitoring for climate change impact are defined.

Indicator 1.2 Tutorials/academic papers for the continuous monitoring system are prepared/submitted.

Indicator 1.3 More than 20 That research group members are trained and obtain necessary knowledge and skills in developing, implementing, and managing the continuous monitoring of climate change impact.

Indicator 1.4 The quasi-real-time hydro-meteorological data transfer systems are installed at observation stations by Thai Meteorological Department and Royal Irrigation Department in the Chao Phraya river basin.

Output 2: "An integrated model is developed in consistence with natural hydrological cycle and anthropogenic activities are enhanced".

Indicator 2.1 The hydrological models for the Chao Phraya river basin are established.

Indicator 2.2 The models of anthropogenic activities are established and incorporated in hydrological models.

Indicator 2.3 Tutorials /academic papers for the integrated modelling system are prepared/submitted.

Indicator 2.4 Precision of discharge estimation (annual discharge, peak discharge on monthly basis) by the integrated model is no more than ±20% difference than measured volume.

Output 3: "Methodology of water-related risk assessment incorporating climate change impact with anthropogenic activities are developed".

Indicator 3.1 Hydro-meteorological data and simulation outputs are integrated to incorporate in impact assessment.

Indicator 3.2 Disaster potential in present and future are estimated and risk indices are identified.

Indicator 3.3 Tutorials/academic papers for risk and impact assessment are prepared/submitted

Indicator 3.4 The quasi-real-time risk indices are developed as for an adaptation measure to water-related disasters under climate change, and utilized for early warning system.

Output 4: "The methodologies and outputs are promoted in order to be applied or incorporated into coping strategy to the climate change impact in Thailand".

Indicator 4.1 Recognition of IMPAC-T among water related policy makers is enhanced

Indicator 4.2 Cooperation arrangement will be signed.

(3) Inputs (as of November 2013)

Inputs by the Japanese side:

Dispatch of Japanese experts	Total 17 experts for 99.33 person-months
Provision of Equipment	Provision of equipment worth of approx. 51,330,000 Bahts, including Flux measurement system, data- and simulation servers for RID, KU, and TMD
Operation cost borne by Japanese side	Approx. 35,660,000 Baths including the purchase of small equipment, travel cost for counterparts, and the honorarium for research assistants
Training	1 member trained in Japan under JICA's training scheme. Numerous other training was implemented both in Thailand and in Japan, according to the proposals from 19 research groups.
Workshops and seminars	Key events hosted by the Project include 8 internal workshops in Japan, 4 Thai domestic research meetings, Seminars on 2011 flood, participation to the 2nd Asia-Pacific Water Summit.

Inputs by the Thai side:

Assignment of counterpart personnel	51 counterparts participating from 5 universities including Kasetsart University(KU), Chulalongkorn University, and King Mongkut's University of Technology Thonburi(KMUTT), and from 6 government institutions including Thai Meteorological Department(TMD) and Royal Irrigation Department(RID).
Operation cost borne by Thai side	Approx. 2,470,000 Bahts borne by KU
Others	Provision of office, as well as the electricity and communication cost for Japanese experts; provision of data necessary for the Project activities

2. Evaluation Team

Members of Evaluation Team	**1. Thai Evaluation Team** Ms. Attaya Memanvit Development Cooperation Officer of the Planning and Monitoring Branch, Thailand International Cooperation Agency (TICA) **2. Japanese Evaluation Team** (1) Mr. Eiji IWASAKI, Team Leader/ Deputy Director General and Group Director for Water Resources and Disaster Management, Global Environment Department -JICA (2) Mr. Hidetake AOKI, Evaluation Planning/ Deputy Director for Water Resources Management Division 1, Water Resources and Disaster Management Group, Global Environment Department –JICA (3) Dr. Kotaro INOUE, SATREPS Evaluator/Senior Fellow, Japan Science and Technology Agency(JST) (4) Ms. Misato UNOSE, SATREPS Evaluator/ Assistant Programme Officer, Research Partnership for Sustainable Development Division-JST (5) Ms. Emi YOSHINAGA, Evaluation Analysis, Japan Development Service Co. Ltd	
Period of Evaluation	November 18th-29th , 2013	Type of Evaluation: Terminal Evaluation

3. Results of Evaluation

3-1. Project Performance

Output 1: "Monitoring capacity in the field of hydro-meteorology for climate change impact is enhanced"

The four performance indicators for Output 1 are all attained.

1-1. "The roles of Thai research group in the promotion of the continuous monitoring for climate change impact are defined": the formation of 19 research groups, as well as the identification of the overall direction of research and of the roles of each group, are complete by May 2011.

1-2. "Tutorials/academic papers for the continuous monitoring system are prepared/submitted": the preparation of tutorials on flux- and telemetry observation is complete by February 2011. According to the information obtained during the evaluation, 25 academic papers were submitted to journals by October 2013.

1-3. "More than 20 Thai research group members are trained and obtain necessary knowledge and skills in developing, implementing, and managing the continuous monitoring of climate change impact": total 28 members of the "Earth Observation Group (research group #1-10) " received the training through lectures, workshops and joint research, in such areas of rainfall estimation and flux observation. The level of knowledge acquisition by Thai researchers was also found satisfactory in meeting this target indicator.

1-4. The quasi-real-time hydro-meteorological data transfer systems are installed at observation stations by Thai Meteorological Department and Royal Irrigation Department in the Chao Phraya river basin: the quasi-real-time hydro-meteorological data transfer system ("telemetry system") was installed at total 32 observation stations in and around the Chao Phraya river basin. These are at 24 stations

managed by RID, 4 stations by TMD, and 4 flux observation towers constructed with the support from the Project.

Output 2: "An integrated model in consistent with natural hydrological cycle and anthropogenic activities is developed"

All four performance indicators for Output 2 are achieved.

2-1. The hydrological models for the Chao Phraya river basin are established. Two hydrological models were developed by revising the models originally created by Japanese researchers. One is a 5-minute resolution model covering the Chao Phraya river basin, developed by revising "H08"model originally proposed by National Institute for Environment Studies of Japan. The other is a model for the Chao Phraya river basin developed by revising the Simple Biosphere including Urban Canopy (SiBUC) model originally proposed by Kyoto University.

2-2. The models of anthropogenic activities are established and incorporated in hydrological models: a model of anthropogenic activities (reservoir operations in Bhumibol and Sirikit, to be precise) was developed in 2011 and was incorporated into the hydrological model developed under the Indicator 2-1.

2-3. Tutorials /academic papers for the integrated modelling system are prepared/submitted: the "H08 Manual User's Edition" was compiled as a tutorial for the integrated hydrological model developed under Indicator 2-1. According to the information collected during the evaluation, total 6 journal publications relating to Output 2 were produced by November 2013.

2-4. Precision of discharge estimation (annual discharge, peak discharge on monthly basis) by the integrated model is no more than ±20% difference than measured volume.: The average precision (or error) of discharge estimation of Chao Phraya river basin between 1981-2004, undertaken using the H08 model developed under Indicator 2-2, proved less than ±20%. The error of the estimation using the SiBUC model proved average 17.5% for annual discharge, and 20.8% for peak discharge on a monthly basis. The accuracy of estimation for "C2" observation station, the most important station for decision-making on the runoff in the Chao Phraya river, recorded 98%, and for Y.6 station, 100 %. For these results, the evaluation team evaluated this target as being successfully met.

Output 3 : "Methodology of water-related risk assessment incorporating climate change impact with anthropogenic activities are developed."

3-1. Hydro-meteorological data and simulation outputs are integrated to incorporate in impact assessment : the intention of this Indicator is to prepare a set of the data, information, and tools necessary for assessing the impacts of climate change-induced disasters in the mountains, oceans and rivers. Through the activities under Output 1 and 2, hydro-meteorological data and simulation results were already prepared and have been utilized for various impact assessment shown in Indicator 3-2 below.

3-2. Disaster potential in present and future is estimated and risk indices are identified: with the data and information prepared under Indicator 3-1, the Project identified the areas potentially at risk of slope failures and coastal erosion, as well as the extent of the damage they may cause. Likewise, the indices for flood and drought risk assessment were selected and the extent of the risk was specified by the Project.

As a result of these work, landslides risk potentials were identified in northern- and central-west mountain areas as well as in the west and central Malay Peninsula. The identified risks were then summarised in a hazard map and has been distributed to landslide-prone areas. For the coastal erosion, the areas at risk and the extent of potential damage were identified. On the flood and drought risks in tropical rainfall, the risk indices were identified and the impact assessment was conducted in 22 provinces, using the risk indices.

3-3. Tutorials/academic papers for risk and impact assessment are prepared/submitted: the JCC meeting in May 2011 agreed that tutorials on risk and impact assessment would not be prepared under this Indicator. The decision was due to the recognition among members that the number of risk/impact assessment would be more important than the creation of tutorials. According to the information collected during the evaluation, total 14 academic papers were submitted to journals relating to the Output 3 activities.

3-4. The quasi-real-time risk indices are developed as for an adaptation measure to water-related disasters under climate change, and utilized for early warning system: the Project uploads, near real-time on its webpage, the results of water-related risk assessment worked out with the risk indices identified under Indicator 3-2. The quasi-real time risk indices were utilized for early warning through 1) the Project's cooperation to JICA's Project for Flood Management in the Chao Phraya river basin, to establish RID's early flood warning system; 2) the dissemination of quasi-real time information on hydro-meteorological condition in Chao Phyraya basin, as an early warning for the public; and 3) the development of an early slope failure risk warning system in the landslide-prone province of Krabi province. The system sensors the landslide risks upstream, and delivers the risk information to the communities downstream through wireless network.

Output 4: "The Methodologies and outputs are promoted in order to be applied or incorporated into coping strategy to the climate change impact in Thailand*"*

Of two indicators for Output 4, 4.1 was attained while 4.2 was met only in part.

4-1. Recognition of IMPAC-T among water related policy makers is enhanced: the evaluation team concluded this indicator as being achieved. The bases of this conclusion are the followings. First, as a response to the Chao Phraya river flood in 2011, the Project undertook various assistance including the dispatch of expert team to assess the flood situation, the contribution to the revision of the Chao Phraya river basin master plan and to the development of RID's flood warning system, and the dissemination of flood-related information and predictions. Owing to such efforts, the Project's 2nd Flood Seminar received participation from Deputy Prime Minister His Excellency Kittiratt. His participation is deemed as an example of how the Project is recognized in Thailand. Second, the Project was invited to present its outcomes at a technical session on water-related disaster management, at the Asia-Pacific Water Summit in May 2013. The Project stakeholders considered that the role assigned to the Project at this technical session as a credit to the Project from policy makers. Third, the Project has increasingly received attentions and participation from senior management of the counterpart organizations (such as RID and TMD), as compared to at the beginning of the Project where there were only the middle-management taking part.

4-2. Cooperation arrangement will be signed: this Indicator was added upon the recommendation from the Mid-term review, to provide a cooperation framework so that members participating as an individual with limited support from their organizations would stay engaged in the Project activities. During this Project, a sizable number of individual cooperation agreements were signed between certain member organizations. They, however, do not fully correspond to the original intension of this indicator, as it rather aimed at a more comprehensive cooperation framework encompassing larger number of participating organizations. For this reason, the evaluation team concluded that the indicator 4-2 is met only in part.

Project Purpose: **"A prototype of the Integrated System to help decision-making on the adaptation for water-related risks under climate change impact is established"**:
the development of the software component of this system is mostly complete by March 2013. The preparation of the Project's website is also underway for official opening by the end of 2013, thereby achieving the indicator of "recommendations and integrated information from the system are published on web pages".

3-2. Evaluation Results

(1) ***Relevance***

- Relevance of the Project is high. The Integrated Information System developed by the Project contributes to realizing the international agreements[4] on climate change, and is consistent with both Thailand's national- and climate change policies[5] and Japan's development assistance

[4] Such as the Fourth Assessment Report of the Inter-governmental Panel on Climate Change, and the decisions adopted at the 16th Conference of Parties of the United Nations Framework Convention on Climate Change ("the Cancun Agreements").

[5] Such as National Strategy on Climate Change Management (2008-2012), and the Climate Change Master Plan (2013-2050) whose preparation is currently underway.

policy for Thailand[6]. In particular, the Project is relevant and timely as a response to Thailand's capacity needs as expressed in Thailand's National Strategy on Climate Change Management (2008-2012), where the country recognizes its own lack of knowledge base and information for decision-making on climate change.

- Being on one hand a research project that pursues an excellence in an advanced research, the Project also put emphasis on the capacity development of Thai researchers. This combination of research and technical cooperation aspects is deemed highly appropriate for Thailand to strengthen its research-base, and for Thai counterparts to enhance the ownership in carrying out the research activities.
- Having stated that the Project is relevant to climate change strategies, the evaluation team also recognized the need to share the Project information more widely with the authorities in charge of climate change management.

(2) ***Effectiveness***

- Effectiveness of the Project is high, judging from the level of attainment of the Project Purpose: "a prototype of the Integrated System is established to help decision-making on the adaptation for water-related risks under climate change impact". As explained earlier, the software component of the system is complete by March 2013, and the Project's website is being prepared by the KU and the University of Tokyo for official opening by the end of 2013.
- One factor that contributed to Effectiveness is the partnership that the Project fostered, between government officials and researchers who had limited opportunity for cooperation. This partnership helped facilitate the sharing of opinions, information and data among them. Likewise, the contribution of the Project activities with 3 Outputs and the development of the Integrated Information System is evaluated as significant. The system has contributed to a stable supply of hydro-meteorological data, and of flux data in particular which is one of few initiatives in the monsoon Asia; the development of high-resolution hydrological models for Chao Phraya river basin, long-term simulations of water discharge with consideration to human activities is now available for decision-making; the Project provided one of few examples of impact assessment such as on slope failure, and the method of the assessment was made available and accessible to the public.
- During the evaluation, the evaluation team noted that the basic information (what functions are installed in whose servers, how they are linked, which data are transferred to whom via whom, etc.) was not sufficiently documented. While this issue per se does not affect the team's conclusion on Effectiveness, the need was recognized to summarize and share basic information on the system as a reference for the future management and utilization of this Integrated Information System.

(3) ***Efficiency***

- Efficiency of the Project is relatively high. On the attainment of Output Indicators, all the indicators related to the research were satisfied regardless of the interruption of the Project activities during the 2011 flood. On the academic outputs, total 63 academic papers (52 Thai- or international journals, and 11 Japanese) were accepted by the Project by September 2013, which can be viewed as a significant academic achievement.
- For a project of this size (with total 67 members including 51 Thai counterparts and 16 Japanese), the Project is efficiently managed. The progress was limited for the first one and half year, due to the management style of the then Project Manager. After the change in the management, however, the activities are advancing smoothly and all the recommendations for improvement from the Mid-term Review have been put to action.
- The Project is one of the projects that commenced at the early stage of SATREPS scheme. This

[6] Of 3 priority areas of Japan's development assistance to Thailand, this Project falls under the "Sustainable Economic Growth and Responses to Aging Society". The actions under this priority area include flood prevention program, and the strengthening of research capacity and network, to which this Project strongly contributes to. Refer to: http://www.jica.go.jp/thailand/english/activities/activity04.html (although the content needs updating).

implies that the Project implementation process involved many learning-by-doings, without any predecessor examples to refer to. What appears to have been especially challenges for the project administration were: 1) to foster understanding of its members on the differences between a pure research project that requires academic outputs, and a capacity development project under JICA's technical cooperation that requires the achievement of development objectives, among others; and 2) to incorporate the different viewpoints and requirements into project activities (such as planning and realizing the requirement for practical social application of the research outputs).

- On the provision of equipment and financial cost, the provision of several servers experienced delay, partly because of the stagnancy that the Project experienced during the previous Project Manager, and of the flood in 2011. The equipment, training cost, and other budget requested by research groups were provided by the Project on time.

(4) ***Impact***

- Impact of the Project is high. The evaluation of Impact was based on 1) the likelihood for the Project's Integrated Information System to be utilized for decision-making (as a "social application"), and 2) the examples of other research outputs applied for real practices, or the cooperation agreements signed to utilize the outputs.
- On the social application of Integrated Information System, RID as a key Project counterpart utilizes the Project's hydrological model to predict the river discharge for next year, as one of several models if not a mainstream. By so doing it wishes to monitor the performance and credibility of the system, and to use it as a future decision-making tool to predict long-term climate change impacts (when constructing a new dam, for example). RID also sends its officer to Tokyo to foster a specialist in the operation of H08 model, which demonstrates a long-term commitment by RID to utilize the system. The models and skills learned are also being utilized by TMD, to carry out the simulations in their routine work.
- In addition to the examples shown above, the Project's outputs have been utilized in establishing a flood warning system for RID, and for the community-based early landslide warning system in Krabi province developed by the Group #16. Cooperation agreement between KU and the Department of Royal Rainmaking and Agricultural Aviation (DRRAA) is also to be signed, to utilize the results of rainfall observation and prediction by satellite for the work of the Department.
- For many other outcomes not mentioned above, the demand for their practical application is potentially high, given the recent and frequent fluctuation of the climate conditions and the damages it has caused in Thailand. The challenges that the Project faced in realizing their social application include the difficulty to plan how to apply the outcomes for the society, before any concrete research result is obtained; the lack of roadmap to connect the outcomes to real practices; and the difficulty to gain broad understanding on the advanced scientific research it is undertaking.

(5) ***Sustainability***

Sustainability of the Project is relatively high.

- As international level, existing agreements (such as the Cancun Agreement mentioned in "4.1 Relevance"), promote the research and capacity development in climate change. At national level, the draft Climate Change Master Plan (2013-2050) is also expected to serve a long-term support for the areas of work that this Project focused on. In light of these policies, the Project's sustainability is evaluated as high.
- It is likely that the research activities will continue, if not in the same size and structure as the Project. For the university participants, research is their profession, and the long history of partnership between KU and the University of Tokyo provides a framework for the research cooperation to continue. The government participants also have interests in continuing the research similar to the Project, yet their participation may be subject to the understanding from their supervisors to participate in such research activities. To note, the representatives from 16 out of 19 research groups expressed the their group's willingness to continue the work of the

groups, and some initiatives are already taking place to realize these willingness, in the form of cooperation agreements and the discussion on forming an emergency advisory group in emergency cases.

- For most of the Thai participants, the Project activities are related to their daily work, indicating certain prospect for the research outcomes to be utilized in their own work. Participants from universities, in particular, are already utilizing the knowledge and models from the Project in their own lectures and academic works. The participants from government agencies (mostly the TMD and RID participants) are also applying basic skills and project outputs (data and models) to their daily work. RID sends its officers to study at the University of Tokyo as a preparation to utilize the outputs of the Project on a long-term basis.
- On the management and utilization of the Integrated Information System and the equipment provided by the Project, there are several concerns that need to be addresses during the Project. For the management of the Integrated System, for example, there are currently no management policies or a framework of problem resolution. The Phayao University (PU), one of the three universities in charge of managing the flux tower provided by the Project, reported on the difficulty in securing the maintenance cost for the tower and communication cost to transfer the data. For the equipment provided to research groups –PC ,hard-disk drives and other portable equipment used for the routine research work -, there is a need for each participating organization to document a list of the equipment they received from the Project, for the purpose of future monitoring.

3-3. Factors that contributed to achievements of goals

(1) *Factors relating to Project Design:* the Project's focus on the capacity development of Thai researchers, while at the same time being a research project that pursues academic excellence. This approach helped strengthen the research-base in Thailand.

(2) *Factors relating to Implementation Process:* increased cooperation among government officers and the researchers who would otherwise have limited opportunity for communication. This facilitated the sharing of opinions, information and data among them.

3-4. Issues/factors that caused the issues

(1) *Factors relating to Project Design:*

- Although it is difficult to plan activities for social application before any concrete research outcomes are confirmed, this difficulty was given little recognition during the project preparation or at the early stage of project implementation.
- There were only a limited number of research groups that had a clear roadmap to utilize the research outputs obtained.

(2) *Factors relating to Implementation Process:*

- The stagnation of the activities for the first one and half years of the Project implementation, due to the management style of the former Project Manager. However, the management of the Project saw significant improvement after the change in the management in late 2010.
- The difficulty for the Project to gain understanding from its members on the need to fulfil the requirements as a technical cooperation project (such as the attainment of development objectives and social application), in addition to the academic outputs required for a pure research project.

3-5. Conclusion

This Project was implemented with a view to reduce risks of climate change-related water disasters. To realize this objective, the Project piloted a development of an Integrated Information System to support the policy-making on the adaptation to climate change, established a quasi-real-time flood monitoring system as an early warning, and created hazard maps using geographic information system and hydrological models. To further promote the social application of the research outcomes, several issues need to be overcome. Such challenges are the difficulties to plan social application before any research output is obtained, the lack of clear roadmap to utilize obtained research outcomes, and the difficulty to gain broad understanding on the technical research activities the Project is undertaking.

The evaluation results in recognition of the achievements and challenges above are as follows. Relevance of the Project is high, for its consistency with the international and Thai national policies and needs; effectiveness is also high, for the Project's attainment of the Project Purpose, the contribution of the Project activities and Integrated Information System to achieve effectiveness. Efficiency is relatively high, taking into consideration of both the stagnation of the Project due to the project management at the early stage of the implementation, and of the progress of the activities it made after the Mid-term Review. The evaluation of the Impact is high, judging from how the Project's Integrated Information System has been utilized and how the research outcomes are applied for social application. Although such factors as the existence of related sector policies, the level of technical skills obtained, and the likelihood for the research to be continued, likely to ensure the Project's sustainability, there are concerns on the lack of management policy for the Integrated Information System and the equipment provided. As a result, the Sustainability of the Project was evaluated as relatively high.

4. Recommendations

4.1. Recommendations of the actions to be taken by the end of the Project

(1) ***Prepare the framework to manage Integrated Information System.*** The representatives of the organizations who received the servers – KU, RID, and TMD – should initiate the following actions, in consultation with Japanese experts:

- Summarize the basic information on the Integrated Information System, in a manner that facilitates the understanding of the outside stakeholders who need explanation on the system. Such information includes the roles and functions of each server, and the route through which observation data is transferred and stored. Share this summary to the Project members and stakeholders.
- Start preparing the policy to ensure regular and continuous data transfer and information update for the Integrated Information System. The issue(s) that each organization should decide should be discussed by each organization respectively; for the cross-cutting issue(s), all the three should consult together. The schedule to finalize the policy should also be determined during this preparation process.

(2) ***Disseminate Project outputs/outcomes.*** The Project should share the outputs and outcomes of the Project widely with the stakeholders in water resources management, climate change, disaster risk reduction, and with those responsible for formulating and implementing the policies in these sectors, and promote the social application of the Project outcomes in cooperation with those stakeholders. In so doing, the Project should consider the invitation of the organizations concerned – such as Ministry of Natural Resources and Environment (MNRE) (including ONEP and Department of Water Resources) and Ministry of Science and Technology – to the symposium of the Project planned in January 2014.

(3) ***Create equipment list by Project participant organizations.*** For the purpose of future monitoring, the Project should prepare a list of equipment provided to each organization, and share it with a designated person from each organization to manage the list.

(4) ***Identify future research topics.*** To utilize the skills and outcomes of this Project for further research activities, the Thai researchers should discuss and compile a list of future research topics in the water-related climate change adaptations.

(5) ***Obtain feedbacks to the Integrated Information System.*** The Project should obtain feedbacks on the Integrated Information System from its users, and compile the results.

(6) ***Secure management cost for the flux tower.*** By the end of the Project in March 2014, PU should confirm the way to finance the maintenance cost of the provided flux tower. Both KMUTT and Naresuan University should prepare a document that clearly states the source of funding for the

maintenance of the flux towers.

4.2 Recommendations of the actions to be taken after the Project

(1) KU, RID, and TMD should finalize the draft policy discussed in 4.1(1) before March 2015, and share the final version to the Project members.
(2) Thai researchers should make their utmost efforts to realize the research presented in 4.1(4).
(3) KU should improve the Integrated Information System based on the feedbacks obtained in 4.1(5).

5. Lessons learned

Below are the lessons learned by JICA through the implementation of the Project.

(1) As mentioned in "3.2(3) Efficiency", SATREPS is on one hand a research project that requires academic outcomes, and on the other hand a capacity development project implemented under JICA's technical cooperation. The differences in the requirements from the two schemes should have been sufficiently clarified and shared among the Project stakeholders at an early stage of the Project implementation.
(2) The implementation of this Project proved it difficult to plan the activities for social application before any concrete research result is obtained. Such difficulty should be taken into consideration in the early stage of project formulation, so that the activities to realize social application can be discussed and planned once the research outcomes are clarified.
(3) The cooperation among project members and their stakeholders is essential to gain better understanding from the public on the advanced scientific research undertaken by SATREPS projects. Such cooperation could involve the holding of regular study meeting among stakeholders, networking with outside stakeholders on a more daily basis, and the compilation of project information in a manner clear to the third party.