SURVEY ON BASIC DATA / INFORMATION COLLECTION AND CONFIRMATION ON WATER RESOURCE MANAGEMENT IN NORTHEAST REGION OF THAILAND

FINAL REPORT

(Main Report)

SEPTEMBER 2010

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

SANYU CONSULTANTS INC.

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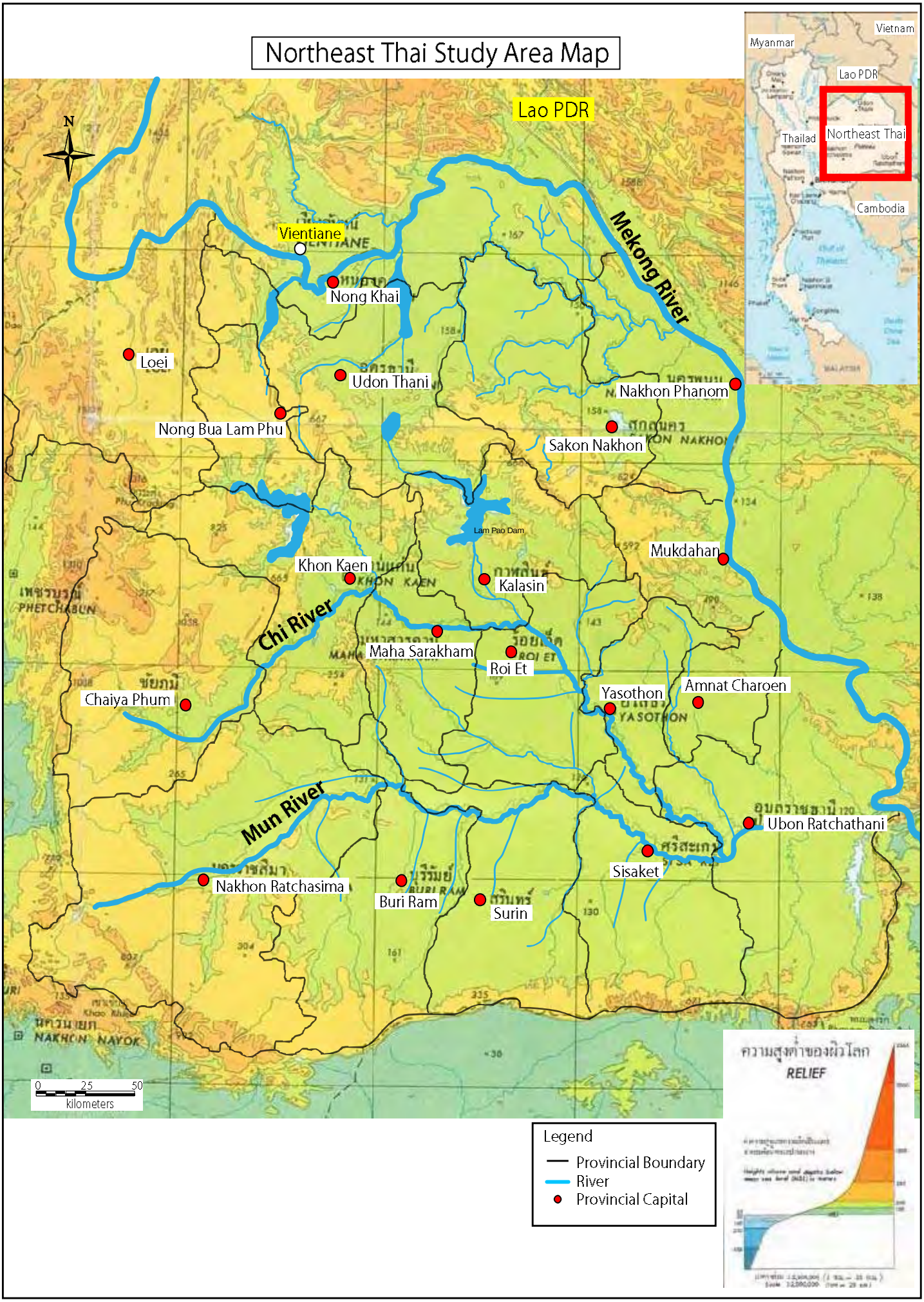
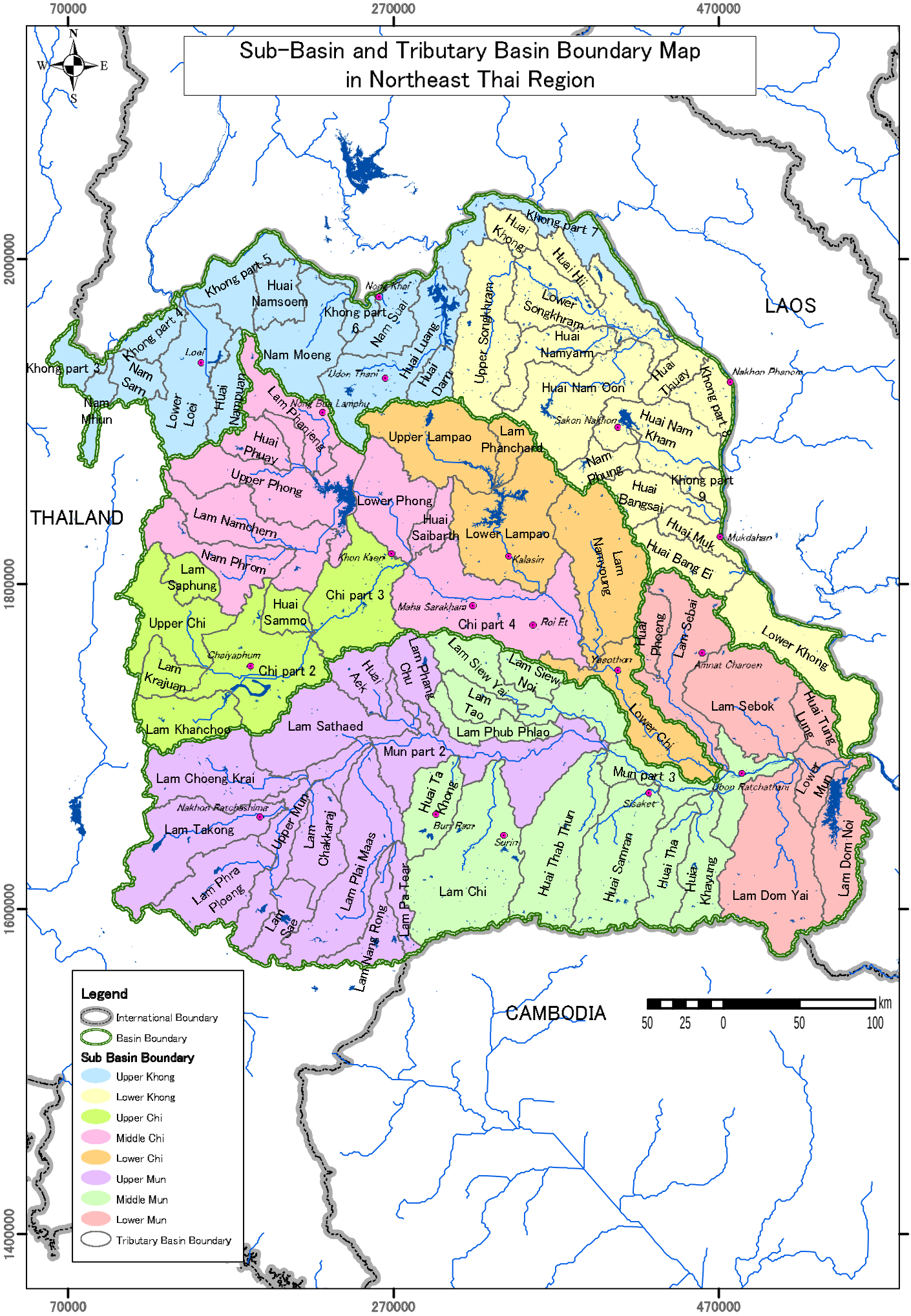

Northeast Thai Study Area Map
Lao PDR
Vientiane
Nong Khai
Loei
Udon Thani
Nong Bua Lam Phu
Mekong River
Nakhon Phanom
Sakon Nakhon
Lam Pao Dam
Mukdahan
Khon Kaen
Kalasin
Chi River
Maha Sarakham
Roi Et
Chaiya Phum
Yasothon
Amnat Charoen
Mun River
Ubon Ratchathani
Sisaket
Nakhon Ratchasima
Buri Ram
Surin
0 25 50
kilometers
Legend
Provincial Boundary
River
Provincial Capital
ความสูงต่ำของผิวโลก
RELIEF
Vietnam
Myanmar
Lao PDR
Thailad
Northeast Thai
Cambodia


Sub-Basin and Tributary Basin Boundary Map
in Northeast Thai Region
70000
270000
470000
2000000
1800000
1600000
1400000
N
W
E
S
LAOS
THAILAND
CAMBODIA
Khong part 5
Huai Namsoem
Khong part 4
Khong part 3
Nam Sam
Nam Mhun
Lower Loei
Huai Nampuan
Loei
Nam Moeng
Udon Thani
Nong Khai
Nam Suai
Khong part 6
Huai Luang
Huai Dam
Lam Phanieng
Nong Bua Lamphu
Huai Khong
Khong part 7
Huai Hi
Upper Songkhram
Lower Songkhram
Huai Namyam
Huai Nam Oon
Huai Thuay
Khong part 8
Nakhon Phanom
Sakon Nakhon
Huai Nam Kham
Upper Lampao
Lam Phanchard
Nam Phung
Huai Bangsai
Khong part 9
Huai Muk
Mukdahan
Huai Bang Ei
Lower Phong
Huai Saibarth
Lower Lampao
Kalasin
Lam Namyoung
Upper Phong
Huai Phuay
Lam Namchern
Khon Kaen
Nam Phrom
Lam Saphung
Upper Chi
Huai Sammo
Chi part 3
Maha Sarakham
Chi part 4
Roi Et
Chaiyaphum
Chi part 2
Lam Krajuan
Lam Khanchoo
Lam Sathaed
Huai Aek
Chu
Lam Phang
Lam Siew Yai
Lam Siew Noi
Lam Tao
Lam Phub Phlao
Yasothon
Huai Phoeng
Lam Sebai
Amnat Charoen
Lower Khong
Lam Sebok
Huai Tung Lung
Lower Chi
Mun part 2
Mun part 3
Ubon Ratchathani
Lower Mun
Lam Choeng Krai
Nakhon Ratchasima
Lam Takong
Upper Mun
Lam Chakkaraj
Huai Ta Khong
Buri Ram
Surin
Sisaket
Lam Phra Ploeng
Lam Phai Maas
Lam Pa Tear
Lam Nang Rong
Lam Sae
Lam Chi
Huai Thab Thun
Huai Samran
Huai Tha Khayung
Huai Khayung
Lam Dom Yai
Lam Dom Noi
Legend
International Boundary
Basin Boundary
Sub Basin Boundary
Upper Khong
Lower Khong
Upper Chi
Middle Chi
Lower Chi
Upper Mun
Middle Mun
Lower Mun
Tributary Basin Boundary
km
50
25
0
50
100

Photos

Agriculture

Rice is cultivated in dry season in the large-scale irrigation area. While glutinous rice for house consumption is cultivated in rainy season, ordinary rice is usually cultivated in dry season for sale（Nong Wai large-scale irrigation area in March）.

Rainfed paddy field (non-irrigation area) in dry season. Red-brown land without any crops is extended in Roi Et Province in March.

Agriculture

Rice nursery in rain fed area (non irrigation area). Villagers who do not have irrigation facilities take water from communal ponds for preparation of paddy seedling (in June).

Farmers take water from the river by using power of tillers (in June). Even though the paddy field is rainfed area, it is possible to irrigate the field located near water resources at the expense of farmers. When the rice price is high, farmers cultivate rice even in dry season.

Vegetable farming is thriving in the suburb of Khong Kaen City, Nong Wai large scale irrigation area in dry season. Farm household income was increased by good access to markets and diversification of crops through stable water supply.

Vegetable cultivation in Nong Wai large-scale irrigation area which is located adjacent to city areas (in June). A sprinkler is used for the cultivation.

Agriculture

Complex (mixed) farming including cultivation of vegetables, herbs, fruits and so on and aquaculture in ponds is promoted by Japanese ODA Loan in the Agricultural Land Reform area, which is rainfed farmland.

Since water requirement for vegetable farming is relatively small, it is possible to irrigate the vegetable field in area which has high potential of salt damage on condition of adequate water drawing. Organic vegetables are cultivated in the communal garden near communities and middle men come here to purchase vegetables every day. Irrigation system from groundwater was constructed by the support of NGO and the electric cost for pump is shouldered by the beneficiaries.

A green market by ALRO farmers in the Borabu District hospital in Maha Sarakham Province. Such organic vegetable markets with face to face sale were recently opened by supports of governmental organizations, NGO and universities in many places.

A wholesale vegetable and fruit market in Khong Kaen City. Various vegetables are supplied to the market from Loei Province which is located in western part of Northeast and relatively high altitude, and the Northern part of Thailand. In addition, imported goods such as garlic from China are also sold here.

Agriculture

Harvest of cassava in ALRO area in June. It usually takes from 10 months to 14 months for cassava cultivation. Currently, sale price of cassava is high and immature cassavas are also harvested. Mechanization for paddy and sugar cane production is in progress, however, cassava cultivation is done mainly by hand labor even now, since it is possible to diversify the harvest timing. The wage of harvest is one of income sources for neighboring farm households.

Tillage in land consolidation area. Recently, agricultural machines are rapidly increasing, especially, the number of four-wheel tractors/harvesters is remarkably increasing in the Northeast. The tractors are not owned by individuals but mainly rented with operators.

Test farming by using micro irrigation (sprinkler and drip irrigation) for cassava cultivation is operated responding to the increase of demand for bio-ethanol. Current yield is around 3 tones /rai and it is expected to be increased up to 2 to 3 times of present one by irrigation. The limiting factors of increment are difficulties of water resource assurance and production cost.

Cultivation of sugar cane, which is one of main agricultural products in rainfed area. It is an important crop in terms of harvesting work and provision of job opportunity to seasonal labors.

Agriculture

An ethanol for fuel production factory by using cassava in the suburb of Khong Kaen city. Daily ethanol production at the factory is 100,000 little by consuming 700 tons cassava per day. The operation was started in 2005 and the number of workers is around 100. The purchase price of cassava is determined based on the international market value and it is same as the market price of pellet and starch.

A processing plant of agricultural products constructed by FAO project in the village (Maha Sarakham Province). The project provided ovens, dryers, packing facilities no cost. A women group produces rice crackers in this plant as an OTOP (One Tambon One Product) for income generation.

Most of farmers in the Northeast have cattle for savings. FAO poverty alleviation project provides loan for purchase of calf to facilitate revolving fund. One of main reasons to have cattle for farmers is to get cow dung for organic fertilizer production.

Piggery has not been thriving so far in the Northeast, however, small-scale piggery is becoming popular to obtain organic materials recently. Farmers make composts by mixture of rice husk, paved rice straw for pigs, dung and micro organic materials in the livestock barn. In these days, large-scale piggery has been initiated in the suburb of Khong Kaen City.

A sales store of fish fingerings for aquaculture, which is located next to Department of Fishery, Khong Kaen Provincial Office. The office distributes young fish to farmers. Tilapia and snakehead are important cash income source for farmers. Small-scale aquaculture in ponds is common in Northeast.

Tilapia is known as an improved species, which was presented by the current Japanese Emperor and it is cultured widely at present. The fish in the photo are tilapia which on sale in the market in Udon Thani Province. Pink color fish are the ones further improved in Thailand.

Discussion with the people

Discussion with people and NGO staff in Nong Han village on 18th July. The people and NGO staff gave comments on the environmental impacts caused by projects implemented in Northeast in the past . The participants exchanged their opinions and experiences frankly.

Inspection of the Nong Han Kumpawaphi Wetland on 18th July. A researcher from Rajapat University (in Udon Thani Province) explained the impacts on the wetland by KCM project to the participants.

Water Facilities

A hydropower plant in the Huai Sam Mo watershed in Chaiya Phum Province. The plant generates electric power by using water of Huai Prathow Dam constructed by DEDP in 1992 and irrigates around 3,000 rai farmlands by trans-basin water diversion.

One main canal from the hydro power is shown in the photo above. The estimated discharge of the canal is around 2.5m^3/s taking flow of the hydro power. There are three irrigation canals, however, most of water is ineffective outflow. Therefore, DWR diverts ineffective water to six ponds to make use of water as one of watershed management pilot projects.

50 rai area-pond for drinking water, which was rehabilitated in 2008 due to water shortage in six villages in the Huai Sam Mo watershed, Chaiya Phum Province. DWR funded 8 million Baht for this rehabilitation works.

Huai Luang Estuary Barrage located in Udon Thani Province. It was constructed at the river mouth of Huai Luang, which is one of tributaries of Mekong River. Main functions of the barrage are to prevent back water from Mekong River in rainy season and to store discharge from Huai Luang in dry season. Watershed area and whole length of Huai Luang is 4,340km^2 and 100km,

Water Facilities

Pipeline inside of the 710m-length tunnel (diameter 3m) from Huai Phai reservoir in Mukdahan Province. The diameter of this pipeline is 1.2 to 0.8m. This is one of components of water diversion project, namely, Lam Phayang Pumipat Project. It is possible to divert 6MCM water to Huai Phai irrigation area (12,000ha) in Kalasin Province.

Rasi Salai weir in Sisaket Province, which irrigates 5,500ha farmland. Timing of gate opening is decided based on the gate operation committee consisting of farmers in upper and down stream, RID, TAO staff. The gate is opened for around 4 months period per year.

Yasothon Weir in Yasothon Province, which irrigates 9,760ha. This photo shows the scene from upper right bank.

Nong Wai weir in Khong Kaen Province. It was constructed to irrigate 48,320ha farmland in Khong Kaen Province and Maha Sarakham Province.

Water Facilities

Lam Takhong Dam spillway in Nakhon Ratchasima Province. It has radial gates.

Construction of Lam Pao Dam spillway in Kalasin Province. It has 4 radial gates, their height and width are 7.70m and 12.5m, respectively. The maximum discharge of this spill way is 2,216m^3/s.

The Maha Sarakham layer containing rock salt in the underground is extended widely in the Northeast, which causes salt damage in various places. The groundwater level is shallow and salinity of groundwater is high around the Nongbo Lake in Maha Sarakham Province, therefore, salt is crystallized at the surface of the land as shown in the photo above.

Salt is one of important natural resources in the Northeast since old days and traditional food processing using local salt and fish has been popular. The photo above shows the fermented foods made from fish and salt.

Summary

1. Positioning of Northeast Region of Thailand: Growth in Macro Economy and Regional Disparity

1.1 Background and Objectives

Background

The existing economic disparity between urban areas like Bangkok and the most of rural areas is a big issue for Thailand to rectify in the process of becoming a middle income country. Technical Cooperation focusing on reduction of the disparity and environmental consideration is important for the purpose of fostering good partnership between Japan and Thailand from now on. Since it is a necessity too for any development projects to take due consideration on natural and social environment conservation in Thailand today, it is necessary to examine the future direction and scenario for Japanese technical cooperation in agriculture and water resource sectors based on lessons learnt and good practices of the projects implemented in the past.

Under this background, this survey was conducted to collect and consolidate information/data concerning following matters: 1) poverty situation in whole Thailand and regional disparities, 2) position of the Northeast Region in Thailand, 3) role of agriculture in the Northeast Region, and 4) issues in water resource management in the Northeast region. The collected information/data serve as foundation for examination of direction, strategy and approach for future cooperation to be extended to Thailand by the Government of Japan.

Objectives: Consolidating all necessary information/data for fixing a framework of cooperation by the government of Japan in a long term perspective in the agriculture/water resource sector.

Study Area: Northeast of Thailand (19 Provinces) (Poverty profile and macro-economy : whole country)

Study Period:

Field survey: March to April in 2010, May to August in 2010
Final Report Submission: September, 2010

1.2 Thailand Emerging to be a Middle Income Country and Importance of Agricultural Sector

Since the NESDB Plan was first launched, Thai economy attained good growth in general for quite a long period and moving forward to become a middle income country, except the two years period of 1997-1998 when the country suffered an enormous damage and negative growth due to the currency and economic crisis as originated from Thailand. It was the manufacturing sector which exerted a pull to the national economy leading a way for Thailand to become a middle income country. The percentage of manufacturing sector in total GDP was increased while the share of agriculture/fishery sector decreased to around 10% during the period.

However, the sector is still important industry for the nation given that 1) it provides 34.9% of whole population with job opportunities, 2) it contributes food security and 3) agricultural products are main export items. The Royal Government of Thailand (RTG) aims Thailand to be the Kitchen of the World through promoting agricultural production and related food industries as well as export expansion. In fact, the country is the second largest agricultural produce and food exporting country in Asia next to China.

While the national economy continued favorable growth as a whole, the Northeast Region ranked at the lowest at all times in terms of GDP per capita and the disparities in GRP (Gross Regional Product) amount with the other Regions expanded as well. The regional share in the national GDP has been maintained at around 10 % though it shares around 1/4 of overall national total of agricultural production, while it is to be noted that some years in the recent past the regional growth rates were higher than the national average. Such growing sectors which caused higher regional growth were agriculture as supported by higher price level, whole sale-retailing as supported by the increased purchasing power, manufacturing consisting mainly of small-medium food industries, transportation and education. This implies that in order to attain higher economic growth rate in the Northeast Region, development of agriculture and manufacturing sectors is inevitably important and it is necessary to consider the sizable market sharing as big as 1/3 of the overall domestic market.

The reasons why the Northeast Region ranked economically at the lowest at all times are not only low percentage in manufacturing industry in the Northeast, but also low productivity in the agricultural sector. While the planted area of more profitable and productive crops such as fruit tree and natural rubber harvesting accounts for 84% of total arable land in the Southern Region, the climate and soil conditions are more favorable, fruit and vegetable production are actively undertaken and the shares of paddy field and upland crops are equal in the Northern Region. On the other hand, two-thirds of area is paddy field in the Northeast Region and around 90% of the land is low productivity rain-fed area. As a result, the land productivity in the Northeast Region is quite low, causing the least GDP per capita as derived mainly from the rain-fed paddy farming. In view of the above, it can be concluded that it is necessary to facilitate crop diversification and possible value adding in addition to the improvement of agricultural productivity for the growth of agricultural sector in the Northeast Region.

1.3 Economic Disparity and Poverty Issues in Thailand

Main reason why the Northeast Region is considered as a poor area is in the fact that the per capita GDP is very low as compared with the others. As per the statistics in 2007, the per capita GDP in the Region is mere 40,144 Baht, which is only 1/8 of the level representing Bangkok Metropolitan area and East Region. The very basic factor causing such difference is that the Northeast Region having as many as 21 Million people sharing 1/3 of the national total of 63 Million (Notified data in 2008), but most of them depend their lives upon small-medium enterprises and agriculture which usually suffer from comparatively low productivity. Aside from per capita GDP which shows productivity, household income also shows regional economic disparity and the Northeast is the lowest at 12,995 Baht/month and followed by the North at 13,568 Baht/month in 2007. The household income in Northeast Region accounts for 37 % of the

same at 35,514 Baht/month in Bangkok Metropolitan and vicinity showing lower disparity than GDP per capita as it includes the income derived from remittance by immigrant workers. In the aspect of expenditure, the disparity become even smaller at 46 % of Bangkok Metropolitan and vicinity, but the ratio of expenditure against income is calculated at 84 %, the highest in the country. For the households in debt situation too, the Northeast Region is the highest at 75.6 %.

Thailand has a problem of considerable high income inequality when comparing with the other Asian countries by Gini Coefficient. Income inequality in Thailand has a trend to get worse with economic growth. In spite of recent improvement in Gini coefficient, yet situation has not changed from the status that richest 20% enjoys half of the wealth.

Population under poverty line was over 40% in 1998 and has been decreased to 8.48% in 2007. Looking into regional difference, half of population under poverty line resides in the Northeast. Accordingly poverty incidence is always highest in the Northeast, and that of 1988 was more than 50%. Situation has been rapidly improved after year 2000, and the latest poverty incidence of the Northeast in 2007 is 13% only. About 80-90 percent of Poor people live in rural area, which suggest that target of poverty reduction shall be focused on rural poor in the region. However, due to the fact that poverty population are concentrated mainly in such households as landless, very small scale farming operation and high ages without working forces, then it is necessary to provide in-direct support through community and direct support of welfare to the target poverty people rather than the improvement in income through raising up of agricultural productivity.

UNDP Thailand assessed all region by using Human Achievement Index (HAI), which measures all the provinces by Health index, Education index, Employment index, Income index, Housing and living environment index, Family and Community life index, Transportation and Communication Index, and Participation Index. Northeast HAI shows that the Northeast is better than national average and other regions in Family and Community Index and Participation Index but lagged behind in other indices. Community life and mutual help is still important in people's life in the Northeast, and participation in social activity and group activity is strong point of communities in the Region, which shall be taken into account when one considers about poverty reduction.

1.4 Positioning of Northeast Region and Development Issues

For Thailand who is going to be a middle income country, the poverty ratio is already lower than 10 % and the development target has been shifted from poverty alleviation to income disparity, while in order to attain narrowing the gap/disparity, economic development in Northeast Region is very necessary. But under the "Sufficiency Economy" concept being adopted as the core concept for the national economic and social development in the country, the development vision placing emphasis on human development but not economic development is indicated. In the Northeast Region, strengthening of agricultural sector is important both for the regional economy/industry and the living/livelihood of farmers' households. For the agricultural production, water resource is an important factor, and under this study, agricultural sector and related industries as well as water resource management shall be chiefly focused on and the

directions for development cooperation shall be studied for possible consolidation.

2. Agriculture in the Northeast Region

2.1 Socio-economic Situation of the Northeast Region

The Northeast Region of Thailand consists of 19 provinces with having the regional total land area of 169,000 km2 which shares 33 % of the national total area. In 2008 the regional population accounts for 21.4 Million people with 5.8 Million households which shares around 30% of the national total. When comparing the scale of economy of 19 provinces in the Northeast Region, Nakhon Ratchasima is the largest followed by in order Khon Kaen, Ubon Ratchathani, Udon Thani and others. These four (4) provinces including the regional core cities/urban areas shares as much as 45 % of the GRP.

2.2 Present Situation of Agriculture Sector in Northeast Region

The proportion of farm households in the Northeast Region is around half and the proportions are 58 % in wet season and 45 % in dry season, implying that agriculture sector still holds the most important position for the people in the Northeast Region. Ageing of regional population and shortage of successors in agricultural sector have been commonly discussed to date and it is predicted that in Northeast Region further ageing in farming population will be accelerated in future.

Proportion of farm income in average household income is decreasing over years in rural area (non-municipal) and non-farm income of household is increasing. However, focusing on income of farm household, 45-60% of income from agriculture depends on agriculture, which is showing farm income is major source for farm household. While average income of farm household in the Northeast is 8,500 baht per month equivalent to 2/3 of total average income of the Northeast, 13,000 baht per month.

Of the total land area in the Northeast Region, farm lands occupies as large as 57.1 Million rai (About 9,130,000 ha), about 54 % which is equivalent to 40 % of the total farm land in the country. Farmland Holding per household is 20rai (3.2ha) on average, and the holding is smaller in the central part where paddy field is predominant and it is larger in the areas upland field is predominant., Further, about 90 % is of small holders with less than 40 rai and farm land holding has been fragmented due mainly to the inheritance in general.

The land in the Northeast is classified into three categories, i.e., 1) flood and non-flood plain in Chi and Mun basin, 2) Mountain range and surrounding hilly area, and 3) undulating land between these two. In the Northeast Region, the irrigation area shares only 10.6 % of the overall farm land and the remaining is practices under rainfed condition by using rainfall and water resources available at nearby areas. Such small scale water resource development like SSIP without distribution canals and small farm ponds are considered as important means for improvement of rainfed agriculture.

In the Northeast Region, the primary and most important crop is Major Rice in wet season. Major rice is followed by some other important crops as cassava and sugarcane. These crops are important export items and also important materials produced in Northeast Region for

agro-industries. The Northeast Region is a major rice production area. 57 % of planted area for major rice in whole country is in the Northeast Region producing 45 % of the national total. Khao Dok Mali, the famous Jasmine Rice and RD6, glutinous rice are the major varieties planted. The yield is considerably lower than the national average, only 78% and 57% of those in national average and Central Region, respectively. In the dry season, however, rice farming in the Region is limited due to low irrigation rate. Cassava production as upland crop in Northeast Region accounts for around half of total production in Thailand. Sugarcane cultivation provides seasonal employment opportunity in rural area for harvesting labor. Majority farmers change their selection either cassava or sugarcane depending on the crop's price factor.

In the Northeast Region, planting of vegetables and fruit are rather limited sharing only 5.2 % of farm land by fruit and vegetables/flowers by 0.5 %. There are production areas famous for peanut, soy bean, shallot, potato, tomato and pineapple in the Region.

In agriculture in the Northeast region, livestock sector plays important role in addition to paddy and field cash crop production. Number and production of beef cattle in the Northeast region is 40% of total in Thailand. In addition, number of buffalo accounts for 80% of total one in the country. Cattle are owned by small-scale farmers and rain-fed area can be utilized as common grazing land for cattle. Cattle and buffalo also can be livestock for asset and saving for small holders and safety net in case of crop failure. Recently cow dung is valuable for raw material of organic fertilizer. Inland fish culture by using farm ponds is also the important source of income as a part of the complex farming.

Under the circumstances of increasing demands for rubber world wide as caused by the increasing car manufacturing in China, the Government of Thailand pursues policy for expansion of planted area fro rubber, and in Northeast Region too the planted area for rubber is rapidly increasing by 2.8 folds from 2005 to 2008. This increase is particularly true in the 6 provinces located along the Mekong River and Buriram and Sisaket provinces on the Cambodian border where favored with more rainfalls. In the year 2008, the production share remained at only 5 % of the national total but it is predicted that the share will jump to about 20 % in near future. As the income for farm households, rubber may be considered as better source with having sustainable cash flow and higher profitability, bringing about regular income throughout the year as compared with other cash crops like rice, sugarcane and cassava which cause harvesting just once a year. However, there is some fears that rubber plantation in mono-culture manner may cause weakening of farming households and the possible losses in bio-diversities as well.

2.3 Value Chain: Present Situation of Marketing and agro-processing

Of the overall production of rice in the country, about half is for domestic consumption and the rest is for exporting and stored in stock. Thailand shares 30-35 % of the world's international rice export, being the first ranked in the world. The amount of parboiled rice for export to be shipped to African countries is increasing. In Thailand the Jasmine rice is produced mainly in the Northeast Region. It is considered necessary with this concern to further pursue improvement of the quality and higher value adding with the Jasmine rice.

Cassava has been processed to be tapioca starch and chips/pellets for livestock feed. Recently,

there is high demand of cassava as a raw material for bio-ethanol production. Sugarcane is a major export product of Thailand and a by-product of sugar process, namely, molasses plays an important role as a raw material for bio-ethanol production.

In case of rubber, the processing from latex to rubber sheet is handled by producer farmers and further processed by processor shipper. 90 % of the products are for export and China is ranked 1st in importing rubber from Thailand, though in the past Japan was the 1st ranked. Currently, there is a tendency that domestic demand for rubber is also increasing due to the intensified production capacity of tire producing factories in Thailand too.

Vegetables and fruits production in the Northeast Region is limited and they are supplied from other regions. Recently, direct market, organic farming and contract farming are becoming popular. Especially in the recent years, food safety and organic farming are the important factors in considering the possible value adding on the agricultural produces.

In addition to the export of agricultural produces, the food industries (including beverages) shares as big as 15.6 % of the overall manufacturing sector in terms of GDP value adding amount, being so important in the agro-industries in Thailand. Of the food processing enterprises, 6 % is with having foreign investment of which the investment from Japan shares the most. Thailand has long been one of the major food exporting countries in the world and ranked at 7th sharing 2.4 % of the world total, playing a role of food processing center in Asia. Out of the overall food processing factories in the country, as many as 59.6 % is in Northeast Region though of which 90 % are of small/medium scale enterprises. In the aspect of employment, the food industries are of labor intensive nature and contribute considerably to the regional economy as the local industry. The Northeast Region itself is a large market holding as many as 1/3 of the national population and the Region is favored with good logistic location in exporting the products to the neighboring countries and China.

2.4 Institutional Aspect of Agricultural/ Rural Development

Government agencies involving in the agriculture sector development and community development are many including all the project executing Departments under the MOAC, Community Development Department under the Ministry of Interior, Industrial Promotion Department under the Ministry of Industry and the Bank for Agriculture and Agricultural Cooperatives etc. It is pointed out that Governmental projects do not meet to people's demands adequately by the vertical administrative system. In addition, effects and sustainability after the project completion are not sufficiently secured. Not only the related government agencies but also NGOs and Foundations involve in the development activities, it is recommended to form a partnership with NGOs to study and grasp the needs and conduct extension services at the field to secure sustainability of the development project even after the termination of the project.

The MOAC promotes establishment of Learning Center, aiming at possible extension of agricultural technologies as well as providing opportunities of learning for farmers. This is to nominate and register the advanced farmers and their farm lands as "Learning Center" and share the learning among the participants with having the advanced farmer functioning as the lecturer. In the Northeast region, the numbers of the cooperatives are rather limited. After the Royal

Decree effected in 2004, the farmers' group (Only registration at Amphoe office) can access to various funds provided by the government even without the status of juristic person without establishing a cooperatives. This provided good opportunities for development for such community enterprises and farmers' group as having no juristic person status.

Various project facilities have been transferred to TAOs in accordance with the Decentralization Act and the budget allocated for TAOs has been in increasing trend. After this, TAO will have to play a greater role in the promotion of agriculture and varieties of activities in seeking off-farm incomes (including OTOP promotion) in Tambon. It is necessary to pay due attention not only in leveling up of the TAO's administrative capability but also in plan formulation with due participation by the local residents and civil society as well as in the allocation of adequate budget.

In the Northeast region, there are many higher educational institutions. With having due collaboration with the educational and research institutions in the region, it seems possible to improve the agricultural productivity and value-adding through raising up the standard, step by step, of agricultural technology, research and development, agro-processing and improved value-chain.

When pursuing the raise-up of standard of living of farm families by means of agriculture/rural development, the roles of safety net become very important. The RTG fixed a policy to implement a new price insurance scheme for 3 major crops of rice, cassava and maize from the crop year 2009/10 in order to mitigate shock to farmers from rapid decrease of those prices. There are systems to pay compensation money or extension of loan repayment period or subsidy for interest payment as well in case of the crop damages due to floods, drought and insects. The climate insurance is newly introduced safety net by derivative with rainfall index, and started test operation in this year as handled by BAAC. Irrespective to the degree of damages, insured money be paid or not paid depending on the rainfall amount fixed for each locality in a fixed period

2.5 Higher-priorities-given Policies/Development Plans for Agriculture and Future Trend

The 10th Plan (2007-2011) describes that the "Sufficiency Economy Concept" is a basic principle while there is an understanding that globalization will be further accelerated. It sets the "Green and Happiness Society" as a vision and emphasizes human resource development, promotion of effective, sustainable and equitable economy, ultimate balance between development and environment and good governance. The 11th Plan (2012-2016) which is under the preparation shows the same direction for the road ahead.

The Agricultural Development Plan put an emphasis on the country's advantage and suitability in further production increase and expansion of investment through re-confirming the favored natural conditions and abundant bio-diversities by varieties of ecological systems in the country, in addition to the geographical/logistic advantages. The prevailing globalization will bring about chances for Thailand. The Plan also indicates the necessities for reinforcing the country's capability to respond to changes and to strengthen the competitiveness and the resultant possibility for further export expansion.

Such trends and changing contexts with which the Northeast Region encountered, encountering or will encounter in relation with the regional development will be the following five (5) items.

1) Regional basis economic integration will be further enhanced and among others the regional economy of Asian countries will have fast-growing trend.
2) Aged population will rapidly increase and younger generation will move from agriculture sector in rural area to non-agricultural industrial sector in urban area. This will lead to further ageing of farming labor.
3) The government promotes the use of bio-fuel and in Northeast Region more sugarcane and cassava will be produced as the material for ethanol production.
4) Global warming and climate changes will cause threats in the form of flooding and drought, damage on farm production.
5) Through expansion of FTAs, farm produces in the Northeast Region such as rice, cassava rubber and fruits will find more demands for export expansion.

Concerning food demands and supplies trend for 50 years from now on, it is predicted that population increase, middle class increase, change of consumption trend and so on will boost the necessity to respond to as much as 50-70 % food demand increase. However, there is a possibility of decrease in farmland area due to urbanization and shortage of irrigation water source.

Under the trend, roles to be accomplished by the Northeast Region are noted as follows.

i) To be the major production base for food and energy crops in Thailand
ii) To be the leading production base for processed foods and ethanol
iii) To be the gateway for facilitating tourism and trade among Indo-china countries
iv) To be one of the major tourist sites in the country

Especially, the basic development direction of the Northeast is that the region will be a production base in terms of agriculture (production of food and fuel plants) and agro-industry (food processing and ethanol production)**.**

2.6 Current Problem and Future Issues on Agriculture/ Food Sector in the Northeast

Through undertaking the subject survey/studies, the following problem areas and future issues to be challenged are pointed out in the agriculture and agro-industry sectors in the Northeast Region.

(1) Low agricultural productivity: In particular the rice productivity is low in the Northeast Region as compared with the other Asian countries too. It is particularly true in the Northeast Region in Thailand. To cope with this, RTG tries to solve the problem through promoting varieties improvement, distribution of good seeds, improvement in cultivation technique and farm management, soil improvement and provision of irrigation facilities. It is, however, necessary not only to examine the manner for incentive generation for farmers and focusing only on cropping but also to select adequate problem solution method in the overall agriculture system.

(2) Excessive response to price fluctuation by farmers and problems on land and water: Selection of cash crops to be planted for by farmers largely depends on the sale price fluctuation. This often causes the following problems.

-Too rapid conversion of land use
-Planting on the land not suitable for the crop
-Negative effect on water allocation
-Competition between food crop and energy crop
-Unstable supply of material for agro-industry

For this concern, policies to consolidate a land use plan/cropping schedule and stabilization of agricultural produces in basin by basin is to be enhanced.

(3) Soil deterioration by consecutive cultivation of single crop and weakness of mono-culture: Consecutive cultivation of mono-crop in an area will cause the soil deteriorated and crops to be weak against disease/insect, which in turn offer higher risks for the farmers' farm economy. This implies the necessity for risk dispersing through promoting maintenance of bio-diversity, crop diversification and complex farming. At the same time, issues on market and labor shortage problems are to be overcome.

(4) Importance of crop diversification and markets: In order to challenge for the above-stated issues and also to gain income from the limited water resources, it is necessary to promote crop diversification. However, without stable markets for the produces, production beyond self-sufficiency is deemed difficult. In this concern, contract farming with private business is being promoted, while there are reports that too much input of fertilizers/insecticides cause residual chemicals and damages on human health.

(5) Grade-up of food industries and reinforcing the collaboration with agriculture and quality control: The Northeast Region local food industries have a potential for export to neighboring countries if the product quality could be improved. However, the most of the food processing factories in the Region are of small/medium scale and the prevailing production control and the quality control are not sufficiently developed. The market within the Northeast Region itself is considered substantially large already and it is considered necessary to have due supports by public bodies in addition to the due efforts by private sector to develop local products by using the locally available resources and possible value-chain through industrial integration so as to expand the vitalized regional economy in wider areas.

(6) Ageing and shortages in farm labor and successors: The proportion of aged person older than 60 years will share 15-20 % in 10 years time in the Northeast Region to encounter the aged society. Of the farming household, the proportion of workers older than 55 years is in increasing trend and with having less number of successors, the pace of ageing will be further accelerated. The shortage of farming labor will cause increased production cost of farm produces and lowered competitiveness, requiring some countermeasures.

(7) Inviting potential industries for competitiveness reinforcement: As affected by the AFTA, the

agriculture in the Northeast Region will face severe competition with the neighboring countries which would be supported by lower labor cost. Price competitiveness is the key even in the case of material products for bio-fuel and food processing too. This requires firstly attaining higher productivity but to avail this, promotion of farm mechanization and inviting related industries like farm machineries and pipes/sprinklers for upland irrigation into Northeast Region are to be positively considered.

3. Existing Water Resources Management

3.1 General Feature of Northeast Region

Northeast Region is located at the Central Area[1] in the lower Mekong basin. The basin area is 165,000 km^2, which is divided into three large basins, namely, Khong basin (46,500 km^2), Chi basin (49,500 km^2) and Mun basin (69,700 km^2). Moreover, they are sub-divided into upper, middle and lower sub-basins and eighty (80) tributary basins. Water resource volume, land use and water use of these three (3) river basins are as follows:

General Description of Watershed in the Northeast Region

Sub-basign	Basin Area (km^2)	Popula-tion (10^3)	Annual Rainfall (mm.)	Land Use (km^2)				Potential Water (MCM)	Water Uses (MCM)	Reservoir Capacity (MCM)
				Forest	Farm	Others	Total			
1.Khong Basin										
(1) Upper	20,500	2,180	1,442	4,784	8,880	8,688	22,352	8,470	1,080	310
(2) Lower	25,960	2,990	1,712	4,544	10,640	10,880	26,064	12,170	1,380	1,110
(3) Sub-total	46,460	5,170	1,593	9,328	19,520	19,568	48,416	20,640	2,460	1,420
2.Chi Basin				0	0	0	0			
(1) Upper	13,550	1,440	1,126	5,312	5,312	4,384	15,008	2,680	570	320
(2) Middle	21,030	2,880	1,253	1,760	12,544	7,376	21,680	4,760	2,190	2,340
(3) Lower	14,900	2,120	1,448	1,312	7,408	5,264	13,984	4,510	1,780	1,790
(4) Sub-total	49,480	6,440	1,277	6,704	25,264	17,024	48,992	11,950	4,540	4,450
3.Mun Basin						0				
(1) Upper	29,170	3,630	1,110	3,728	17,600	9,488	30,816	4,510	3,080	1,560
(2) Middle	24,390	4,470	1,369	2,064	14,864	5,744	22,672	5,540	1,760	890
(3) Lower	16,140	1,880	1,601	2,720	7,648	7,584	17,952	8,920	940	1,760
(4) Sub-total	69,700	9,980	1,314	8,512	40,112	22,816	71,440	18,970	5,780	4,210
4. Total NER	165,640	21,590	1,381	24,544	84,896	59,408	168,848	51,560	12,780	10,080

Note: The areas indicated as land use are the accumulation of river basin-wise provincial areas based on the "Agricultural Statistics of Thailand 2008" which includes some parts of Pasak river basin by 3,200 km2 located in Loei and Chaiyaphum provinces. Therefore, the total land use area is not equivalent to the total basin area of Khong, Chi and Mun.

The data collected from main observing stations of TMD and RID were analyzed. The results imply that the clear change in annul rainfall is not found out, however, a periodical change at 10 to 15 years' interval is obscurely recognized in these 60 years. In last 30 years, early 80's to late 90's is correlative to dry period while the wet period is early 2000 to 2008. Conversely, in last two years, dry climate again took place until the dry season of 2010. Evaporation value is 1,500 to 1,600 mm per annum, of which 600 to 700 mm is lost during the dry season, December to February due to reservoir's characteristics with shallow water depth and wide surface area.

[1] 'Central Area of lower Mekong basin' lies along Mekong river with the length of 850 km between Chiang Khan and Pakse where covering 277,000 km^2 of watershed area, The left bank belongs to Lao territory and the right bank is

3.2 Existing Infrastructure of Water Resources and Irrigation

As for the irrigation rate which is the rate of the irrigation area against the farm land, northeast region has the lowest one in the whole country as shown in the table 3.4.2 which implies that the rainfed paddy is dominant.

Irrigation Rate by Regions in Thailand

As of 2007 (Unit : Million rai)

Region	①Farm Land	②Irrigable Area	③Beneficial Area	④Irrigated Area = (②Irrigable + ③Beneficial)	⑤Irrigation Rate = [④/ ①×100] (%)
Northeastern	57.1	3.74	2.31	6.05	10.6
Northern	27.8	4.49	4.17	8.66	31.2
Central	25.7	13.11	1.75	14.86	57.8
Southern	19.8	2.39	1.19	3.58	18.1
Whole Thailand	130.4	23.73	9.42	33.15	25.4

Data Source : Agricultural Statistics of Thailand 2008

Note

Irrigable Areas : mean the areas under the services of large and medium - scale irrigation projects of the Royal Irrigation Department, where thereare the systems to provide water for agriculture, consumption, industry, tourism, etc. and to control flood as well as water quality.

Beneficial Areas : mean the areas that cannot get direct services from large and medium - scale irrigation projects but people can get benefit from such projects indirectly through small scale irrigation project initiated by government or farmer agencies.

General descriptions on existing water resources and irrigation facilities are shown in the following table:

Existing Water Resources Project in the Northeastern Region of Thailand

Basin	Large Scale			Medium Scale			Small Scale		
	No. of Project	Water Storage (MCM)	Irrigable Area (rai)	No. of Project	Water Storage (MCM)	Irrigable Area (rai)	No. of Project	Water Storage (MCM)	Irrigable Area[2] (rai)
Khong	5	819	395,495	102	310	404,375	1,678	422	241,000
Chi	7	1,662	1,130,496	82	451	305,358	1,318	242	138,000
Mun	9	1,269	928,285	172	910	775,363	2,458	327	186,000
Total	21	3,750	2,454,276	356	1,671	1,485,096	5,454	991	565,000

Basin	Pumping			EGAT's Power Plant			Total		
	No. of Project	Water Storage (MCM)	Irrigable Area (rai)	No. of Project	Water Storage (MCM)	Irrigable Area (rai)	No. of Project	Water Storage (MCM)	Irrigable Area (rai)
Khong	297	-	479,412	1	165	-	2,083	1,716	1,520,282
Chi	447	-	725,536	3	2,452	-	1,857	4,807	2,299,390
Mun	252	-	339,391	3	1,966	-	2,894	4,472	2,229,039
Total	996	-	1,544,339	7	4,583	-	6,834	10,995	6,048,711

Northeastern Thailand with 165,000 km^2

[2] Since it is considered to be possible to irrigate approximately 660 thousands rai by the storage volume of 991 MCM of the small scale project, the actual irrigation area is estimated as mach as 565 thousands rai by the study team which is correspond to 20% of the summarized irrigation area.

3.3 Operation & Maintenance and Water Cost

In case of large scale project[3], O & M project Offices under the RID are organized. Activities for O & M of the reservoir, the main canals and lateral canals of the large scale project are secured by the said O & M office. In addition, the O & M for tertiary canals is to be carried out by the WUGs which have been organized for a tertiary canal. Independent offices, budget and staff are provided for the large scale projects for O&M in considerably good conditions. While in case of medium scale project[4], one responsible officer from the O & M division of the provincial office of RID is assigned. The officer takes responsibility to operate 4 to 5 projects of the medium scale. There are many projects being poorly maintained due to insufficient man power, deterioration of the facilities and malfunction of WUG as caused by insufficient budget allocation for maintenance.

In case of the small scale project[5], maintenance works of the facilities has been transferred to TAO, and most of the projects have no maintenance at all. On the other hand, the pump irrigation projects[6] are maintained in comparatively favorable conditions with subsidy of pump electric cost by Tambon. While no charge is imposed on water in case of irrigation by gravity flow, the charge is required for farmer in case of pump irrigation. The following electric cost sharing methods are applied in the Northeast at present.

- Sharing rate and payment method of pump electric cost are discussed and agreed between RID and WUG in the Project constructed by RID. 100% of pump operation cost in rainy season is shouldered by RID and 100% of that in dry season is shouldered by farmers.
- In case of Pump Irrigation Project transferred from the DEDP and presently managed by RID, farmers share 0.6 baht / kWh and RID shares the rest out of total electric cost of 2.6 baht / kWh based on the original agreement at the time of construction.
- In case of pump irrigation project transferred to TAOs or constructed by Tambon, eclectic cost sharing method depends on TAO.

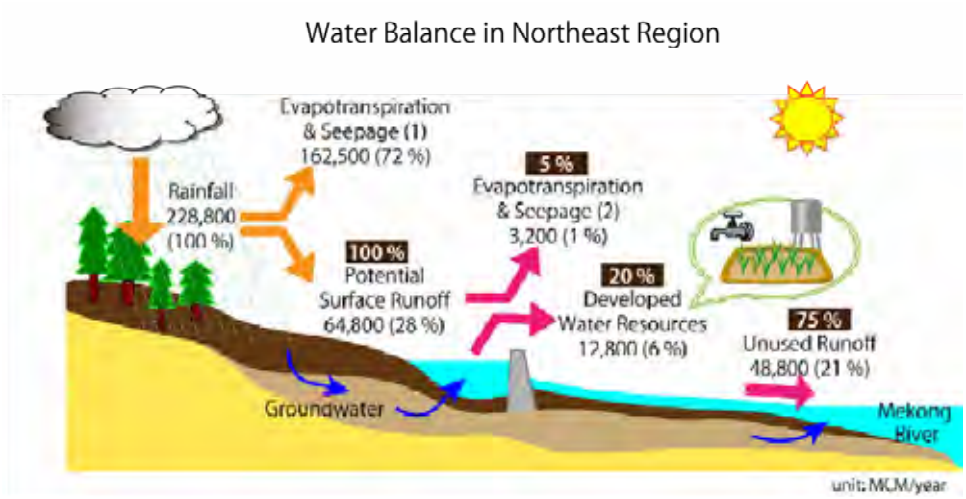
[3] Large scale project shall be defined as a project which has storage capacity more than 100 MCM or has the surface water area of the reservoir more than 15 sq.km., or has the irrigable area more than 80,000 rai (12,800 ha).

[4] Medium scale project shall be defined as a project which has storage capacity less than 100 MCM, or has the surface water area of the reservoir less than 15 sq.km., or has the irrigable area less than 80,000 rai (12,800 hectares).

[5] Small scale project shall be defined as a project which has storage capacity less than 100 MCM, and construction period is less than one year.

[6] Pump irrigation project shall be defined as a project without the storage capacity because this type of project is to pump water from the main river or its branches and distribute the pumped water into farmland.

3.4 Balance in Water Resource Volumes in the Northeast Region



A water resource balance study was made for the mean of 30 years period and the result is summarized as following table:

Balance of Water Resource Volume in the Northeast Region

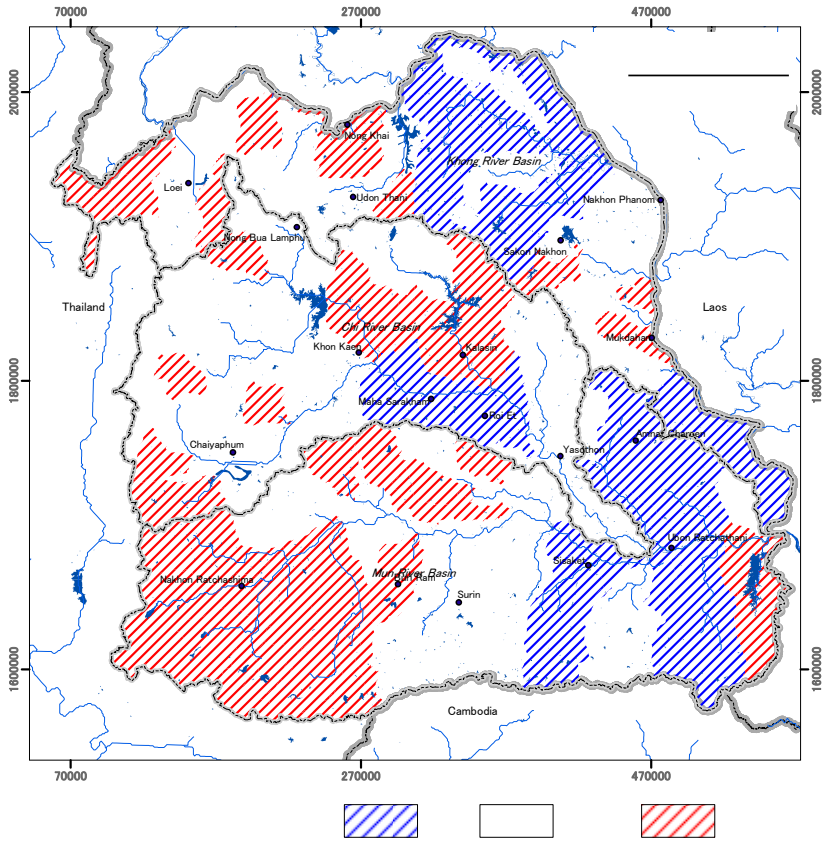
No.	Items	Water Volume MCM / year					Remarks
		Khong Basin	Chi Basin	Mun Basin	**Northeast (NE)**	**% (%)**	
-	Basin Area (km^2)	(46,460)	(49,480)	(69,700)	**(165,640)**		
-	Rainfall (mm/year)	(1,593)	(1,279)	(1,314)	**(1,381)**	-	
1	Rainfall Volume	74,000	63,200	91,600	**228,800**	**100**	
2	Evaporation & Seepage (1)	48,400	49,000	66,600	**164,000**	**72**	
3	Potential Surface Runoff	25,600	14,200	25,000	**64,800**	**28 (100)**	Runoff to the channel
4	Developed Water Resource (Present Water Demand)	2,500	4,500	5,800	**12,800**	**[6] (20)**	Irrigation, Domestic Water Use, etc.
5	Unused Runoff (Drained to Mekong river)	23,200	9,400	16,200	**48,800**	**[21] (75)**	Almost discharged during Aug., Sep., Oct. & Nov.
6	Evaporation & Seepage (2)[7]	-100	300	3,000	**3,200**	**[1] (5)**	Mainly from reservoir & river

The potential run-off to be utilized is 48.8 Billion m^3 (around 75% of No.3) and most of the run-off is lost in rainy season (August to November) and finally discharges into the Mekong River. Paddy cropping in rainy season needs supplemental irrigation in May-July, when the water level reaches the lowest level. It is necessary to construct reservoirs to store run-off water to the Mekong River for irrigation use. At present, only 20 % of surface water in the Northeast Region is utilized for irrigation, supply to cities and domestic purposes.

[7] The evaporation and seepage in Khong basin is indicated as minus 100 MCM (No.6). The minus value is due to the inclusion of Mekong water in the water level data as affected by the higher water level in Mekong River.

3.5 Potential on Water Resource/Irrigation Development

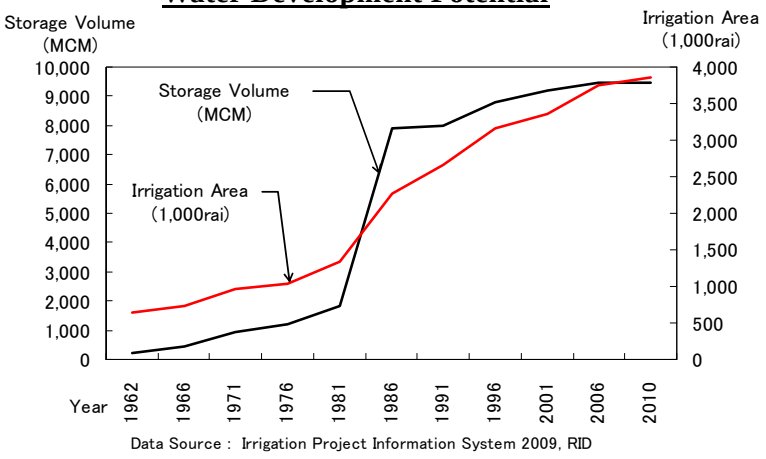
According to basin water balance as shown in the figure right, high potential area for water resources development is limited to the lower stream areas of three (3) basins, and the drought zones such as Upper Mun, known as occupied by extensive rain-fed paddy, have no sufficient potential for the development.



Water Development Potential

3.6 Water Resource and Irrigation Development in Large and Medium-scale Reservoir Projects

The chronological water resource development and expansion of irrigation area are shown in the following graph. As can be seen from the graph clearly, the tendency that the development of storage capacity has been nearing to the end or marginal area. This implies that today it is quite difficult to develop in Northeast region a large scale reservoir as the main facility for water resource development.



Changes of Water storage Volume and Irrigation area in Large and Medium Scale Project

There are no more dam sites technically suitable for large/even medium scale reservoirs, being the most of suitable sites already developed. Moreover, it is becoming difficult to find solution and consensus building regarding involuntary resettlement, land acquisition and adverse effects on fishery resources by reservoir constructions. Cost benefit ratio of the project is lowered down due to prolonged construction period and increase of compensation cost.

3.7 Institution and Regulations on Water Resource management

Under the Thai Government, there are various Departments and agencies who are engaged in the

water resource management including as many as 5 Ministries, 10 Departments, 5 State Enterprises and many numbers of local administration bodies as provinces and Tambons. Among those agencies so many in the numbers, DWR and RID are the two (2) key agencies in charge of water resource development/management and National Water Resource Committee (NWRC).

Under the governmental reform as effected in the year 2002, the DWR was newly established under the Ministry of Natural Resources and Environment. The Department's mandates were in policy formulation on the overall water administration in the country and in the promotion of policies and plans for integrated water resources management at basin levels. There are as many as 10 Regional Offices nation-wide under the DWR. In the Northeast region, three offices of Region 3, 4 and 5 are operated in Khong basin, Chi basin and Mun basin, respectively. The annual budget for DWR was 3,605 Million Baht, 71 % of the total was allocated for investment nature of project development/implementation.

RID established in 1927 is the biggest agency as an infrastructure development project implementing body under the MOAC, the share of RID budget within MOAC stands for as big as 60 % every year. The RID ever engaged in construction of facilities for as large as 27 Million rai irrigation area and be responsible for construction of new development project and O & M activities of the said existing facilities. There are as many as 17 Regional Irrigation Offices nation-wide and four (4) Regional Offices in charge of 19 provinces in the Northeast. Under regional office, there are provincial irrigation offices, one each for all the provinces and the existing projects O & M offices. The annual budget of RID was 37,132 Million Baht, of which the investment for project development shared 81 % in the amount of 29,990 Million Baht. There observed a tendency that the investment for the new irrigation development has been declined. Northeast region shared about 17-20 % out of the investment nature budget spending by RID.

NWRC is a national level committee established in 1999 and chairman of NWRC is nominated by the Prime Minister among the Deputy Prime Ministers and a substantial part of the committee members is composed of the Minister of relevant Ministries, Departments' Director Generals and the chiefs of state enterprises. Representatives from provincial government, TAO, communities as well as 9 members from the 25 RBCs nation-wide also join as members. The tasks of NWRC are solution of water issue, indication of guidelines on water resources development, Scrutinizing and approval on project plans, priority setting on water allocation and coordination on water demands and report to the Cabinet.

In parallel with the establishment of the NWRC, RBCs were organized gradually one by one. At present, there are 25 RBCs in the 25 major basins nation-wide. RBC is expected to play a key role for IWRM at basin level. The committee members are provincial governors, representatives of regional offices of line agencies, local administration bodies, agricultural association, water user group, industry water users, private companies in commercial and tourism sectors, experts and so on. DWR regional offices have a role of secretariat office of RBCs. Each year, budgets for RBC are allocated from DWR in the amount of 500,000-800,000 Baht. However the amount is just sufficient for holding regulatory meetings and some for training and preparation of meeting materials etc. only and almost none of the budget available for activities required for adequate water management.

There are two (2) major offices under RID in charge of the project O & M. They are project O & M office and the provincial irrigation office. The former is specifically organized for large scale project O & M and the scope of work include reservoir management, operation, water distribution to each main and lateral canal as well as O & M of the project facilities. The latter is in charge of middle scale irrigation project O & M and coordination of other agencies such as provincial offices. RID established the Office of Public Participation Promotion (OPPP) within the Department and fixed eleven (11) activities concerning the O & M based on the Participatory Irrigation Management (PIM) guideline prepared. The activities include key issues such as establish of WUG, formation of Integrated Water User Group (IWUG), establish of Joint Management Committee (JMC) to promote people's participation in the construction and O&M of irrigation facilities.

It was in 2002 that the DWR was established aiming at further promotion of water resources management as one of the core mandates of the Department. However, the special laws/regulations to allow water management to be done with due legal support are yet to be stipulated. The MoNRE drafted Draft Water Law and submitted the final Draft to the Cabinet to secure the approval on May 2007. Presently, however, the Draft is still in the position waiting for due debating at the parliament. It is thought that this situation restricts RBC's authorities and hinders embodiment of IWRM State Irrigation Act is under revision for institutionalization of WUGs to be legal entities and let WUGs manage and being responsible for O&M of irrigation facilities aiming at farmers' participation in line with decentralization.

3.8 Relationship between the Mekong River Committee and the Northeast

Mekong River flows through six (6) countries of China's Yunnan Province, Myanmar, Laos, Thailand, Cambodia and Vietnam with having the basin's total area of about 800,000 km2. Of the total runoff of Mekong River, about 10 % is derived from 3 sub-basins of the Northeast Region, Thailand. The irrigation area in the Lower Mekong Basin in which the Northeast Region is located has the tendency to increase every year by 1-4 % per annum, and as per the survey made in 2009 confirmed the existence of about 4 million ha irrigation area in total. The shares of the irrigation area among riparian countries are 510,000 ha in Cambodia, 170,000 ha in Laos, 1,420,000 ha in Thailand and 1,730,000 ha in Vietnam, where in Vietnam cropping intensity is 2.5 for paddy. The annual total irrigation area in the LMB basin reveals at as large as 6,260,000 ha as assumed with the irrigation water requirement of 50 x 10 Billion m3, implying that about 10 % of the gross water resource of 475 x 10 Billion m3 by Mekong River is used for irrigation purpose. Of the said 10 %, it is estimated that the share of water use by Thailand is about 2.6 % and that by Vietnam is 6.5 %.

In Yunnan province , China, a series of projects to construct as many as 14 cascade dams at the upstream basin of Mekong River is planned and some are completed and some currently under construction. There are concerns/worries about probable change of flow regime and time of high and low water, water quality deterioration and biodiversity degradation by the dam constructions.

Governments of the Laos, Thailand, Cambodia and Vietnam exchanged the Agreement in 1995 for sustainable development, utilization, conservation and management of the Mekong River Basin water and the Mekong Rive Commission (MRC) was established. According to the Agreement, any signatory state has the obligation to notify to the MRC about water intake in general. Moreover, it is

necessary to have a prior consultation in the following cases:

1) Water intake from main stream in dry season
2) Water diversion from Mekong River basin to non-Mekong river basin even in wet season.

The signatory states have the National Mekong Committees and necessary procedures with the MRC are taken through the National Committee. Thirty three (33) projects for development of Mekong River tributaries have been notified to the MRC in the past and no signatory states have raised claims against the notifications so far, since all projects above involved water intake from the main stream, and therefore there have been no prior consultation meeting held. Concerning the timing for notification and holding the prior consultation, the matters are yet to be concluded by MRC to date.

3.9 Water Resource and Irrigation Projects

RID plans to implement 18 large scale projects, 465 medium scale projects and 2,930 small scale projects in and after the fiscal year of 2010. If all the projects as tabulated be implemented, the total storage capacity will be increased by about 4,000 MCM and the irrigable area by about 4 Million ha (24,888,806 rai). In such case, the irrigation rate will be increased from 10.6% to 54%. Mainly, the irrigable area is increased by "Khong-Loei-Chi-Mun Water Management Diversion Project (KLCM Project) alone, which contribute to increase of irrigation rate up to 30%. Other than the above, those projects which may contribute largely to the expansion of irrigable area is firstly the medium scale irrigation project with which storage be increased by about 2,100 MCM and 261,000 ha (1,633,449 rai) of irrigable area (by 2.9% irrigation rate increase). Secondly, it is pumping irrigation project (Small scale) and increases are 1,041 pumping stations and about 286,000 ha (1,789,000 rai). The irrigation rate in addition to the small scale irrigation project can be increased by 6%.

Irrigation area can be extended by rehabilitation projects too. RID is currently implementing the improvement of Lam Pao project. The improvement will increase the storage volume by 550 MCM and new expansion of irrigation area by 225,000 rai. The existing facilities under the large scale and medium scale projects are to be deteriorated year by year and the functions could be lost finally. In order to maintain the functions, it is necessary to execute rehabilitation projects, at least 1% of existing facilities annually.

There are the possibilities to increase the water release in dry season by improving the dam/reservoir operation. By the rehabilitation of Lam Pao and Ubolrat dam, the irrigation area in the dry season can be increased by about 200,000 rai each. Apart from irrigation area expansion, land consolidation projects to improve irrigation efficiency are implemented in the large scale irrigation area.

DWR is a governmental organization for study, planning and O&M on water resource and it implements water resource conservation, construction of simple weirs at the upstream, rehabilitation of water resource facilities, small scale weir constructions and so on. The LPC is proposed by DWR. The project conveys the surplus water from Huai Luang in Khong basin to Lam Pao reservoir in Chi basin in the later wet season.

3.10 Trial for IWRM by the Government of Thailand and Implementation Programme

In Thailand preparatory works for introducing IWRM had been started at an early date and by now a road map to introduce IWRM has been prepared and implemented to date. The 3 key principles of IWRM are 1) Formation of enabling environment for legal support, 2) Institutional framework and 3) Management instrument. Out of them, Institutional framework was prepared by establish of NWRC and RBC, however, the Water Resource Act (Water Law) is yet to be formulated, as a result, legal authority has not been given. Concerning the Management instrument, communication on water resource in the pilot areas and IWRM training are implemented, on the other hand, river basin management plan is still under the preparation.

The pilot project areas which introduced IWRM are Chaophraya river basin, Yom river basin and Bang Pa Kong river basin only. Full scale IWRM has yet to be implemented in the Northeast. However, tributary base pilot projects for river basin management are in progress in the middle basin of the Chi River. These pilot projects are supported by international donors or organizations such as ADB, FAO, MRC-GTZ, WWF. The project scale is relatively small and their main activities are legal and institutional support and environmental conservation considering implementation process. Out of these projects, good practices can be disseminated and expanded to be IWRM at the level of river basin, including agricultural sector and irrigation facilities.

3.11 Challenges for Water Resource Management

(1) Challenges on water resource use: Many reservoirs were constructed by large, medium and small scale dam projects. However, the number of effectively used reservoirs is limited by the topographic limitation, and effective water storage volume remains only around 10,000MCM. That amount is equivalent to around 15% of total available water resource potential volume in the Region, namely, 65,000MCM, and as much as 85% of water resource is evaporated or discharged to the Mekong River without use. Since water resource is unevenly distributed in the Northeast, there is no much potential for water resource development in the upstream to middle stream basin of the Mun River, which has the highest water demand in the Region.

(2) Issue of flood: People along the Chi, Mun and Mekong River have been coexisting with flood, however, such system is spoiled by current river basin development and economic loss is increasing. Primarily, it is necessary to implement high-level water management in the Northeast Region based on the control points to prevent flood, however, it is not possible due to the fact that observatory setting, organization and analysis of hydrological data, and guideline preparation are not advanced, necessary information for the basic management plan could not be provided.

(3) Water quality issue: In the development planning and water use, the first priority is to be given to the river maintenance water in addition to the possible maximization of water use. In fact, the consideration of river environment is a key for a sustainable development of the basins. Deterioration of water quality is reported increasingly year by year by monitoring data. It indicates that the maintenance water is not sufficient to preserve the river water quality, so far.
As well, low water management is an essential for the river environment in dry season. But

control points have not been firmly settled yet and data processing, analyzing and planning for low water flow improvement works are still in progress.

(4) Legal and institutional issues: Various governmental agencies involve in water resource management. So far, the sharing of responsibility for each organization is not clear, which makes it difficult to implement harmonized and efficient water resource management. Data collections are also implemented by each governmental office without due collaboration depending on each necessity, therefore, there is a tendency that those collected data are not unified and cannot be used for efficient management. The roles of RID and DWR are overlapped both in central and local levels and it is necessary to formulate Water Resource Act, which stipulates authorities of NRWC, RBC and DWR. In addition to that, it is important to secure the budget and technical capacity to facilitate activities by working groups and implementation of action plans and learning process by people's participation.

(5) Promotion and control of water resource management and irrigation development by provincial offices and local administrative bodies (TAO): Small scale project was handled mainly by RID, but as per the Decentralization Act 1999, all the facilities constructed were transferred to the TAO. With the limited budget available for TAO, new construction of small scale project is seemed hardly possible, many TAO are interested in irrigation development, though. On the other hand, provincial offices have more sufficient budget for development, it is expected that provincial offices will mainly promote water resource management, irrigation development and O&M of facilities.

(6) Response to change of water resource environment: The water resource condition has been changing due to development and forest area decrease. Management of water resource and watershed are becoming more important to improve the situation for proper flood control and sustainable water use. Moreover, water quality control including salinity prevention and groundwater management are becoming increasingly important matters.

(7) Integrated O&M of irrigation facilities and improvement of water use efficiency: Attaining higher efficiency in the use of limited water resource through rehabilitation, improvement of the existing facilities such as canals and on-farm facilities, and renovation of dam is also an important task in overall water management. In addition, it is needed to implement PIM and strengthening of WUGs.

(8) Integrated river basin management: A part of area in the far upper Chi basin has not been developed, however, water resource management is implemented taking the whole watershed into consideration to a certain level. On the other hand, in Mun basin, operations of facilities in upper and middle stream are individually executed in accordance with the uncontrolled river flow. In case of drought, integrated water management is not implemented on the basis of water balance in upper and lower watershed.

(9) Integrated water resource management: Collaboration between RID being responsible for irrigation facility management and DWR responsible for IWRM policy promotion is essential for adequate river basin water management. It is also needed to provide adequate occasions for enhancing cooperation system between those two parties. Furthermore, it is important to facilitate

functioning of RBC organization by all stakeholders who are involved in watershed management under the RBCs of three river basins.

4. Natural and Social Environmental Issues in Water Resource Development and Management

4.1 Environmental and Social Consideration in Thailand

Thailand is becoming a middle income country soon. On the other hand, the development caused various problems such as water and air pollutions, increasing harmful waste, decrease of forest area, involuntary resettlment due to large-scale projects and so on. Responding to these situations, the Government of Thailand establsihed various Acts and Guidelins concerning enviornmnetal conservation and revised them occasionally based on the necessity. One of the objectives of the 10th NESDP is "to preserve natural resources and biodiversity, along with safeguarding the quality of the environment to be a secure foundation of national development and livelihood for both current and future generations; to create mechanisms to safeguard national benefit in a fair and sustainable manner." The plan emphasizes the importance of sustainable development to secure a balance between environmental conservation and economic development.

The political and legal framework of environmental consideration have been initiated in 1975. After the several legal revision, a new notification regarding "Specification on types and sizes of projects or activities requiring the preparation of Environmental Impact Assessment (EIA) report and the criteria, procedure, practice and guideline for the preparation of the environmental impact assessmnet reports" was published in 2009. According to the notification targeting 33 types of industry, it is necessary to implement EIA for projects of construction dam, reservoirs and irrigation, whose storage volume and storage surface area, irrigated area are 100 million m^3 or more, or 15km^2 or more, and 80,000rai (12,800ha) or more, respectively. Water diversion is not listed up in the notification.

Apart from the EIA system above, governmental agencies or private individual should prepare EIA report prior to implementation of project, which may seriously affect community based on "Notification of Rule, Procedure, Method and Guidelines for Preparation of the Environmental Impact Assessment Report for the Project or Activity which may seriously affect Community with respect to Quality of Environment, Natural Resources and Health" which was announced in 2010. Large scale irrigation project is one of the projects which may seriously affect community. In addition to that, it is necessary to implement Strategic Environmental Assessment (SEA), which requires environmental assessment in the process of decision-making process, programme formulation and examination of plural alternatives. The guideline for SEA was prepared emphasizing on necessity of public participation in the all processes.

4.2 Natural Environment in the Northeast

Forest area that accounted for 40% of whole area of Northeast in early 1960s, was sharply decreased to 12% in 1998 due to development and expansion of farmland area. Fortunately, it is under the recovery thanks for people's efforts, and it reached to 16.5% of whole area. Northeast

has a unique natural condition that rock salt ranges widely and people in the Northeast have adapted themselves to this environmental condition, and salt making has been operated for hundreds of years. Fishery is the most important industry next to agriculture and fish processing by using salt is an important house industry. Before development, since this area was covered with extensive forest, it is thought that a good balance to prevent salt damage was sustained. However, loss of forest spoiled the good hydrological balance between evaporation and rainfall, consequently, salty groundwater moved up to the surface, which promoted salt accumulation and salt damage. It is needed to take various measures such as re-examination of management method of existing facilities, delinking of affected area by salt, improvement of drainage, leaching by rainwater and soil improvement against this issue.

River water in the Northeast generally satisfies the standard for irrigation purpose. However, some rivers located on unban area is deteriorated by domestic waste water and Biological Oxygen Demand (BOD) of those river waters show relatively high values, which is not appropriate for irrigation use. Moreover, there are some cases that untreated waste water discharges into rivers from factories by mistake, which gives damages to fish resources. Therefore, provincial offices of Department of Fishery (DOF) and Ministry of Natural Resources and Environment (MoNRE) collaboratively try to solve the issue. Wetlands in the Northeast are utilized for fishery, irrigation, tourism, navigation and so on and they are essential for people's lives. Water quality deterioration of some of wetlands becomes an issue.

4.3 Environmental Impacts by Water Resource Development Projects –Case Studies-

Development projects can cause impacts on surrounding environment both negatively and positively. The cases that generated negative impacts on people's livelihood more than positive impacts were reviewed, namely, (1) Rasi Salai Weir, (2) Pak Mun Dam, (3) Prong Khun Phet Dam and (4) Nong Han Kumpawapi development project.

In case of (1) Rasi Salai Weir, the project was started without assessment of impacts on the surrounding environment since it did not require EIA study. Consequently, salt damage to crops[8], loss of wetland forest which was food supply source for the people and decrease of fish resource were caused by the project. Regarding (2) Pak Mun Dam, any compensation against the loss of fishery was not provided to the fishery people prior to the project, since it was judged that there would be no damage to the fishery. However, the gates which prevent fish migration of the dam reduced fish resource significantly. The protest campaign by the fishery people was developed into a social movement. Concerning (3) Prong Khun Phet Dam, it is suspended by the protest of residents. The dam site is located in the forest where the people can access to rich forest products such as mushroom and bamboo shoot. The revenue from the forest products accounts for around half of their household income. Since the forest was classified as Conservation Forest, the loss of income from the forest products resulting from forest submersion under water will not be compensated. The people oppose the project, persisting that the proposed compensation is not enough for the loss. In case of (4) Nong Han Kumpawapi development project, embankment and

[8] Various information about the salt damage can be gotten, however, the number of documents describing quantitative data concerning salinity is very limited. A hydrological model prepared by Khong Kaen University implies that there is a relation between the weir construction and salt accumulation.

weir construction restricts the water outflow of wetland, consequently, which resulted in waterweed overgrowth, insufficient irrigation water in dry season due to sedimentation, flood in wet season, fishery resource declined in number, diversity and water quality deterioration.

4.4 Participatory Natural Resource Management

Two cases of natural resource management activities, which are initiated by the local community under the supports from governmental agencies are reviewed. They are (1) Watershed Management in Huai Sam Mo (HSM) Sub-River Basin and (2) Conservation of Bung Khon Long Non-Hunting Area.

In case of (1) Watershed Management in Huai Sam Mo (HSM) Sub-River Basin, sub-basin working group was established. A study to identify some common local knowledge/wisdom and suitable local practices in natural resource management in the HSM watershed was implemented. As a result, various cases were identified, e.g. 1) an organic research center which integrates traditional wisdom and scientific knowledge and provides organic fertilizer and pesticide which can be made easily with low cost to farmers, 2) non-fishing area establishment, 3) forestation by monks, and 4) small-scale weir construction by people and university.

(2) Bung Khon Long Non-Hunting Area is only one Ramsar site in the Northeast. The Ramsar Site project office identified the boundary of the area in collaboration with the surrounding people. Therefore, the specified Ramsar area was accepted by the people and it makes people recognize this site as their natural resource. All of eleven villages surrounding the lake have conservation zones within the Non-Hunting Area, where entry is allowed. As a result, fish seems to be increased in number, which motivates people’s awareness.

4.5 Natural Resource Management by Governmental Agencies

Various governmental agencies implement diverse activities for management of natural resource e.g. fishery resource, water and forest. Often these attempts involve public participation. Unfortunately, collaborative works among different agencies are very limited and their lessons learnt and experiences are not necessarily shared among those agencies sufficiently. Therefore, it is desirable to involve not only DWR or RID personnel but also, provincial officers of other agencies who are familiar with local situations.

4.6 Activities of Non-Governmental Organizations in the Northeast

At present, there are over 140 NGOs in the Northeast. They are divided into 8 networks dealing with different issues namely alternative agriculture, natural resource and environment, Child, HIV-AIDS, Woman, Human Right, Community Enterprise and Urban Community. NGOs actively working on natural resource management in the Northeast Region are Chi River Basin Network, Land and Forest Network, Agricultural Network, Mineral Network and Mun River Network. In addition to that, a nation wide NGO, Assembly of the Poor and an international NGO, World Wildlife Fund are also working for people in the sector of human rights and natural resource management.

4.7 Issues on Environmental Consideration

Development projects give both positive and negative impacts on natural and social environment. There are some cases which brought about negative impacts on people's livelihood more than positive impacts, even though the objectives of the projects were improvement of living condition. Furthermore, some projects are suspended due to objection by affected people. Problematic projects have something common. Those are 1) insufficient prior study and hasty project implementation, 2) inadequate examination based on scientific data to assess adverse impacts, 3) lack of understanding of social status of affected area e.g. traditional life style, and 4) lack of enough communication with people and information sharing.

There are some cases of natural resource management, which are initiated by the local community in sustainable manner. The well managed cases have common points as follows: 1) these activities satisfy people's demand, 2) the people have an idea that they own natural resources to be managed by themselves, 3) these activities are implemented in small scale with smaller budget in short period, and 4) people's opinions are reflected in the planning process.

On the other hand, the collaboration between governmental organizations which are responsible for conservation of natural resources such as soil, water and forest is very limited for integrated management. Therefore, it is desirable to establish a new system to share each lessons learned and experiences for various organizations, to formulate an action plan based on the new system above, and to accomplish their tasks.

4.8 Environmental Consideration in Water Resource Development and Management in Future

Implementation of SEA is necessary for large-scale water resource management with water diversion or trans-basin, which covers plural provinces. In case of SEA implementation, project site, scale and target area are not determined at initial stage and plural alternatives should be shown and compared in terms of not only technical matter and cost but also environmental impacts. At the same time, participation of representative people and researchers in planning process should be secured to reflect people's voices in the planning.

Even though projects are large/medium-scale which do not require SEA, Based on the lessons learnt and experiences through projects in the past, it is important to collect people's opinions from the Scoping stage and to facilitate cooperation among proponent, local communities, and researchers for project implementation.

In case of projects requiring land acquisition or involuntary resettlement, it is recommended to take measures with new twist to minimize affected area and number of people. It is recommended to consider that the affected people who depend on forest products and to provide new land which can be accessible to forest as compensation. Irrigation projects in the Northeast have potential to cause salinity. Based on data such as groundwater, topography and rainfall, it is necessary to examine the possibility of salinity issue sufficiently referring to similar cases. In addition to that, fishery is an important industry for the people in the Northeast. Therefore, even though cash income from the fishery seems to be relatively small, there is possibility that it plays

an important role as protein source. Therefore, it is proposed to take countermeasures such as fish ladder setting not to prevent fish migration from any projects.

It is not needed to implement EIA or IEE for small scale projects. However, it is desirable for people to participate in the community based water resource management. Referring the case of HSM watershed management, it is recommended to request people to prepare plan for water resource management combined with tree planting or organic farming based on their demand. It is also desirable to set rule by people themselves to be easily followed. Governmental agencies and research bodies can support community-based project financially and technically, which can lead to collaborative water resource management in the local level.

5. Review on Projects assisted by GOJ and Other Donors in Water Resource and Agriculture Sectors

5.1 Selection of Cooperation Projects by Japan and other donors

For Thailand, Japan has been extending a number of cooperation projects in water resource and agriculture sectors to date. It is necessary to learn from the lessons experienced and good practice accomplished, so that the future cooperation may be implemented more effectively. Accordingly, those cooperation projects implemented in Thailand in the past with having due supports by GOJ and other donors shall be reviewed to identify useful suggestions for the directions of cooperation framework focusing on the possible rectifying of regional income disparity.

In selecting the projects in water resource-agriculture related sectors to be reviewed, a criterion was applied to satisfy the following points.

- Projects implemented in Northeast Region as the main targets
- Wider coverage of project category (Sector)
- Varieties of cooperation scheme

In addition to the above, some agriculture/rural development projects were selected from which lessons learnt concerning crop diversification and participatory rural development could be extracted. Finally, 17 projects as tabulated below were selected for review.

5.2 Lessons learnt from past projects and suggestions for future cooperation

(1) Importance of securing markets and marketing channel for crop diversification

Including the case of Nong Wai large scale irrigation system and SSIP as well, when the projects are favored with advantage in marketing condition, increase of farmers' income has been successfully materialized not only by paddy but also by vegetable production. This is particularly true in the case of Nong Wai project which enjoys the advantage that the project area is located nearby large rural urban area and the position as major vegetable producing area in the Northeast Region be firmly secured. Another factor for the success is to have an integrated agricultural extension service activity in addition to the completed irrigation facilities. Under the Modernization of Water Management System Project (JICA Technical Cooperation Project), the

project target was to promote dry season upland cropping in the paddy field with having RID and DOAE as counterparts, however, the cultivated area for upland crop in dry season could not be increased since markets and marketing channels could not be secured and moreover the price of rice was in high level during the period.

In order to effectively use the limited water resource in dry season, it is preferable to promote the production of non-paddy upland crops, but it is difficult for farmers to switch to non-paddy crops without secured markets and marketing channels even though directions at policy level are firmly confirmed. This implies the necessity to make a project formulation including the marketing aspect from the beginning under the project. Ideas suggested are to develop and apply further the concept of green/community market like the case of ALRO project or the contract farming with due collaboration with agro-industries is to be expanded as much as possible.

(2) Necessity of Farmers' participation from Planning Stage up to O & M for Effective and Sustainable Irrigation Practice

Concerning the O & M for SSIP projects which have been implemented in many numbers, the levels/qualities practiced depend so much on the localities of each project. For this, it is pointed out that farmers' participation from the very initiative of project planning is important for better understanding of the project and required organizing of farmers. In the large scale irrigation system like Nong Wai Project too, more effective water management has been realized with having high degree of farmers' participation in its O & M activities as reported. In the river basin water management activities too, low cost and effective water resource management can be realized when having active participation by beneficiary farmers in it. This is the lesson learnt from the activities of IWRM practice with people participation in Yom basin.

(3) Stabilized Water Supply and Income Increase are Incentives for Farmers' Participation

Assuming the farmers' participation as necessity for securing project efficiency and sustainability, then what are the factors to stimulate farmers' participation? From the experience in Huai Mong project, it can be pointed out that stable supply of irrigation water is the incentive for farmers' participation and the benefits obtained through effective use of water by farmers' participation in O & M is again the incentive for farmers, making a good cycle.

Preparation of guidelines and due implementation of water distribution program for each lateral canal under the Modernization of Water Management System Project are of important factors, however, it is necessary to make further analysis on different field conditions in different localities and factors to give incentives for farmers' participation.

(4) Important Points to be paid with Due Attention for Mega Projects

Lessons learnt from the Kong-Chi-Mun project indicate that there will remain substantially serious problems on O & M of facilities constructed if the project plan finalization had been done improperly at the planning stage in spite of the mega size of the project. Further to mention, the project plan was finalized without due participation of various stakeholders and the implementation was initiated in haste by political leadership alone, then a number of conflicts have arisen between the RTG implementing agency and the local residents in many localities. To

this end, it is noted that due PR, information disclosure by public hearings, people participation and advancing /exchanging of opinions shall be secured for the planning of large/mega scale projects.

In case of water diversion scheme by tunnel like Kok-Ing-Nan project, impacts on natural environments will be great and it is necessary to have environmental impact assessment completed first at the planning stage. In the case of Kong-Chi-Mun project, there have been many problem issues yet to be solved without having sufficient considerations on natural and social environments before the project implementation started. In the aspect of social environment, the understanding of the project by the people of donor basin and priority-given development projects to be implemented in advance in donor basin are of quite importance. Even the scale of development is much smaller, both donor and recipient basins had due discussion and agreement on the diversion scheme implemented in the case of Lam Phayang Pumipat diversion project.

(5) Collaboration among Ministries/Departments of RTG

In case of Kong-Chi-Mun project, the lack of required collaboration between the project implementing agency and the agriculture-related agencies due to the administrative division/separation caused negative effects on the project performance. In the medium scale irrigation projects too, there are cases collaboration with the agriculture-related agencies have not been secured adequately. It is noted that due collaboration between project implementing agency with the other Ministries/Departments in various fields is inevitable to bring about the planned project effects and performances irrespective to the scale of the projects. It is necessary to formulate programme which consists of irrigation project and agricultural extension and other related activities, including budget allocation.

(6) Framework for Encouraging Participation of Stakeholders and Support for Learning Process in Basin Water management

From several case studies concerning the basin water management, it is pointed out what is important are participation of local people, adopting local wisdoms and participatory process itself, and in order to activate the activities of RBC, participation of more stakeholders is the key while government offices and officials take the position to support the stakeholders not assuming any leadership roles. Other effective means include collaboration with the local universities in each locality and active use of NGOs as facilitator.

For the water resource management at the basin level, a linkage from community level up to the national level is necessary and the relevant government agencies should perform a role of technical supporting. Further, considering the limited water resource available in the Northeast Region, probable occurrence of water-related conflicts can be predicted in future and therefore RBC should be provided with capability in solving the conflicts. From the case of Bang Pakong RBC experience, it is considered that the success is caused by the selection of the RBC committee chairman from the private sector.

When considering possible support for the basin water resource management program from

external source, it is deemed necessary to analyze first on various stakeholders including private sector and then on government agencies concerned.

(7) Project Design

In the cooperation projects implemented in the past, there were some cases of errors in the project design itself. Under the Modernization of Water Management System Project which could not achieve the project target, lessons were learnt that it is necessary to modify flexibly the project design even in its midway if the external factors definitely so require. Also, as pointed out in many of the irrigation projects implemented, collaboration of hard nature component (Facilities construction) with the soft nature component (Extension services, marketing and participatory water management) is so important for the success of the project.

As in the lessons learnt from the FAO's pilot project, delay in supply of input is fatal sometimes in the agricultural practice where cropping schedule is fixed, and the input may be a waste if applied not in time. Accordingly, it is important to grasp fully the farmers' livelihood and their strategies to survive and to formulate the project design in a way to reduce as much as possible such risk factors and restrictive factors.

(8) Roles of Development Partners

For Thailand there would be no donors already and they, any bilateral bodies and international agencies, are in the position of development partners with Thailand today. As is the case, what are the roles to be played by JICA for Thailand in water resource/agriculture sectors?

In Thailand, major part of modern irrigation development had to rely on the assistances by foreign sources in the past, however, most of the irrigation facilities could be constructed by Thai engineers with its own fund today. Under the circumstances, pipeline irrigation is an effective means to apply in wider areas in view of the high efficiency in water use, though the idea was too costly in terms of B/C ratio in the past. Further it can be said that pumping equipment could be locally manufactured year after year to meet the increasing demand in the country. This will make the needs for foreign assistances limited only in large scale pumping facility and long distance tunnel construction in future, while it is deemed necessary still to have due assistances in the field of soft nature component like water management. To this end, it can be said that technical support in introducing a broad-based water management including several river basins would be quite effective cooperation area to deal with the increasing water demand as caused by economic development in Thailand.

Those areas of assistances/cooperation which require combination of soft and hard nature programs as marketing and new program of project design are considered suitable for JICA who can deal both technical and financial cooperation combined as a program. It is also to be noted in this concern that for Thailand who is about to be a middle income country, creation of new markets and marketing channels are seemed possible with having due collaboration with private sectors.

Aside from the systems/scheme by the RTG, in the rural village, there have been activities by local people applying the local wisdom for possible safety net practices. The followings show

merely a part of it. In the areas often hit by flood and drought damages, each community has their own measures, they say.

In the rural areas, people cultivate food grains for their consumption and secured the food safety, and for the needed expenditure in emergency, they sell their livestock to meet the requirement. In 1997, those immigrant workers lost their jobs in Bangkok due to the negative effect by economic crisis and backed to the rural areas for their living. This shows that the agriculture/rural villages itself sufficiently function as a safety net.

Policies and Measures concerning Safety Net in Agriculture

Activities	Target	Description
Rice Bank	Group	Stockpile of unhusked rice at community level, loan of unhusked rice to members in case of flood, drought and bad harvest
Saving Group	Group	The association is traditional grassroots finance and members can borrow sizable amount of money in turn by reserving fund weekly or monthly. There are cases members shoulder cost for funeral each other.
New Theory Agriculture (Integrated Agriculture)	Individual	Mix farming or integrated agriculture making best use of limited water and land resources by means of ponds, and food supply and risk distribution by crop diversification
Agro-forestry	Individual	Agro-forestry is commonly plantation within forest, however, people plant trees in uplands field in Northeast. After certain period, they can get cash by sale of timbers in the event of an emergency

In view of the above, it can be said that strengthening of communities will result in reinforcing the safety net function since it can cause minimizing the shocks by climate changes, economic downturn and varieties of external negative factors and also earlier recovery from the damages.

6. Development Scenarios for Northeast Region and Options for Water Resource Development/Management

6.1. Concept of Development Scenarios

For the purpose of examination of long term support/cooperation by the Government of Japan for the sector of water resource/ agriculture in the Northeast, based on the NESDP and government policies and the circumstances in and around the Northeast Region as discussed in the foregoing, 3 scenarios were worked out as development directions for the Region. The scenarios are to cover up to the future period of 2027-2040 as the long tem perspective which focusing some 25-30 years from the present, and it can show only the primary directions considering probable uncertainties in future. The JICA Study Team formulated the water resource development/ management options for by short, medium and long term basis referring the current policies and plans prepared by the Government of Thailand. However, there is no intention to recommend or propose JICA to support implementation of these projects in the list. The followings are described about the areas the government of Japan can support by referring these existing RTG plan. In addition, the frame of support is proposed as shown below.

6.2 Development Directions for the Northeast Region

It is confirmed that "Green and Happiness Society" is the vision toward 2027 and the Government of Thailand is much positive in advancing "Sufficiency Economy" concept as suggested by the King. The development strategies under the 10th NESDP are that the Northeast is becoming 1) Production base of food and bio-fuel crop, 2) Center for food industry and Bio-ethanol, 3) Gateway to Indochina, and 4) one of the major tourist sites in the country. The scenario is proposed based on mainly 1) and 2) above.

(1) Scenario A: Full development scenario by large scale water resource development for the being the agriculture and bio-energy production base

Under this scenario, the Northeast Region is targeted to be the main production center of farm produces and bio-ethanol not only in Thailand but also in Asian region. This requires a full development of irrigation infrastructure facilities and improvement of the productivity to cope with the food and energy crisis to happen in future. By this development, living standard of the majority farmers will be greatly improved and by lowering the production cost the region can maintain enough competitiveness.

(2) Scenario B: Dual track scenario aiming at economic development by agro-industry in the core areas and raise-up of standard of living in the rain fed areas

Centering in the existing irrigation areas, more efficient agricultural production shall be attained in the region. Exporting value-added produces will activate the regional economy and domestic sale in the markets, which has more than 20 million population, will be promoted further. At the same time, challenges are to materialize production of high quality vegetables/fruits in rain-fed areas through securing small scale water sources, soil improvement, improvement in farming technologies and sufficient markets. By diversifying the source of incomes, farmers' risks will be dispersed and their quality of life could be leveled up.

(3) Scenario C: Least development scenario for the purpose of living quality improvement and sustainable rural development.

Under this scenario, practicing of sufficiency economy concept comes first. This is to protect the environments and farmers' life including water resources. Through strengthening rural communities, locally available resources be activated and well-off farmers' living be secured by value-adding with local wisdom. In other words, this scenario targets materialization of the vision "Green and Happiness Society" as conceived in the 10th NESDB plan.

6.3 Options for Water Resource Development/Management in Short, Medium and Long Term Perspectives for Each Development Scenario

Water resource development/ management plans prepared by the Government of Thailand are organized based on the proposed scenarios in the following table. The development periods are divided into three (3) terms, namely, short term (2011-2016), medium term (2017-2026) and long term (in and after 2027) in response to the target period of National Economic and Social Development plan.

Development scenarios and water resource development/management options

	Scenario A			Scenario B			Scenario C		
I. Outline of Scenarios	Full development option of irrigation development including large scale water diversion scheme where the NE Region will be developed to be the major production center for foods and bio-energy in Asian Region.			To achieve the economic growth by an agro-industry and improvement of living standard in rain-fed area. It is mainly targeted for effective water use, productivity improvement and crop diversification.			To expand self-sufficiency-oriented mixed farming by using farm pond with development of small scale projects aiming at possible mitigation of drought risks in the rain-fed areas.		
II. Options for Water Resource Development/ Management	Short Term ～2016	Medium Term ～2026	Long Term ～2040	Short Term ～2016	Medium Term ～2026	Long Term ～2040	Short Term ～2016	Medium Term ～2026	Long Term ～2040
1. New Develop.									
Large Scale Irri.	◎	◎							
Medium Scale Irri.	○			○	◎	◎	○		
Small Scale Irri.	○			○	◎	◎	○	◎	◎
Estuary Barrage Type	◎	◎	△	◎		△	◎		△
Pump Irrigation. （Medium scale）	△			△	○	○			
Pump Irrigation. （Small scale）	◎			◎	◎	◎	◎		
Inter-basin water Diversion									
- LPC		○			○				
- KLCM			◎						
- Water Grid			○						
- Water Network	△	○		△	○				
2. Rehabilitation									
Ex. Large Scale Irri.	△	○		△	○		△	○	
Ex. Medium Scale Irri.	△	△	△	◎	◎	◎	△	△	△
Ex. Small Scale Irri.	（Those are included in new development because main components are additional canal construction for existing small scale irrigation facilities）								
Integration & consolidation	(Those are necessary though not included in the government plan. No additional area is increased because of integration of weir.）								
On-farm& Land consolidation	△	○	○	△	◎	◎	△	△	△
3. Rain-fed Farm									
Small Scale Pond （Individual）	△	○		○	○	○	◎	○	○
Community pond	△	○		◎	○	○	○	○	○
4. Water Management									
Project level	○			○			○		
River basin level IWRM									
- Mun river basin	▬			▬			▬		
- Chi river basin	▬	▬		▬	▬		▬	▬	
- Khong river basin		▬			▬			▬	
3 basins IWRM		▪▪▪▪▪▪▪▪▪▪			▪▪▪▪▪▪▪▪▪▪				

◎: more than 200,000 rai, ○100,000-200,000rai, △: rehabilitation (△: in case of current budget in the rain fed area, ◎: more than twice in the rain fed area)

Small scale farm pond are provided by excavation of earth material at each owner's land and used for individual purpose. This is different from SSIP which has common water source at village level.

Scenario A

This is the scenario for full development option of irrigation development including large scale water diversion scheme. Under this scenario, the short term includes the following projects by using the budget as the present level, and as much as 1.062 million rai irrigation area (170,000 ha) will be newly developed.

- Upper Chi project (Large scale, 3 dams)
- 2 estuary barrage type projects (Along Mekong River)
- Medium/Small scale projects including pumping irrigation

Under the medium terms and thereafter the KLCM water diversion project will be started with much investment concentrated. Other than KLCM, therefore, only the following projects be implemented for 10 years for new development of 755,000 rai (120,000 ha). KLCM project only enables to expand the irrigation area by 2.9 million ha ultimately.

- Lam Dom Yai Large Scale Project
- Lower Nam Songkhram Project
- Medium Scale Water Network Project

Not only by the new development project, but also by the rehabilitation project, irrigation areas are planned to be expanded. Lam Pao project will have an increase of irrigation area by 3.26 million ha through rehabilitation/improvement and the total irrigation area reaches to 26.5 million rai (4.24 million ha). This will cause the irrigation ratio of about 10% at present to be raised to 46%.

Water diversion to the Chi basin and Mun basin will be implemented by a huge amount of water intake from the Kong basin. Therefore, it is needed to respond to increasing demand for water resource and strengthen water facility management to avoid flood and conflict on water resource distribution. It is proposed to implement IWRM and to establish a strong organization to handle the water diversion project.

Scenario B

Under this scenario, emphasis is placed rather on more efficient agricultural production and value-adding centering in the existing irrigation areas than the expansion of new irrigation area. Improvement in production efficiency as well as high quality products and crop/products diversification shall be sought under this scenario as well. At the same time, promotion of high-quality vegetable production and livestock industry by using the water resource in rain-fed areas shall be pursued.

Expansion of irrigation area shall be attained mainly by implementing medium and small scale projects. For short term category, 0.863 million rai (138,000 ha) will be newly developed for irrigation with the following projects with the averaged budget similar to the recent past level.

- 2 estuary barrage type projects
- Medium/Small scale projects
- Pumping irrigation projects

After the end of medium term, main implementing role will be assumed by the local administration bodies (TAOs). Major projects involved will be as follows.

- Small scale projects including the improvement and small pumping along rivers (0.9 million rai)
- Medium scale projects including medium size pumping schemes (0.36 million rai)
- LPC water diversion project to avail water source for increased pumping schemes (0.1 million rai)

In case of LPC project, increased irrigation area except 0.1 million rai is included in the Medium/Small Scale project. LPC is mainly for the improvement of water management for the overall Northeast basins. Finally the above will contribute to the increase of irrigation area by 3.9 million rai (624,000 ha).

Scenario B also includes the expansion of irrigation area by rehabilitation project and improvement in water management, 225,000 rai and 430,000 rai, respectively. As a whole, as large as 4.6 million rai (0.73 million ha) will be developed newly to attain 10.6 million rai irrigation area as the Regional total. This contributes the irrigation ratio of 10% at present to be raised to about 19%.

Under this scenario, emphasis is placed on infrastructure development towards productivity improvement and diversification by efficient use of irrigation water through improvement of existing systems. For the large scale systems, on-farm development shall be pursued so as to ease farm mechanization and avail improved on-farm facilities for rational water management at on-farm level and desired crop diversification. For the medium scale irrigation, measures to be taken are strengthening of WUG and promotion of PIM activities in parallel with the improvement of the existing facilities.

In case of scenario B where expansion of irrigation area is rather limited as compared with scenario A, it is necessary to implement possible improvement of rain-fed areas by means of farm ponds and etc. In the short term perspective, a model of high-value adding agriculture by using farm ponds is necessary to be established, while for the medium term and further future, expansion of farm ponds irrigation shall be implemented mainly by local administration bodies centering on TAOs based on the model established.

If in case pump irrigation project would be further expanded while the present river discharge conditions remain as it is, it will be likely to cause water conflicts between the users in upstream basin and downstream basins. As is the case, a proposal to increase water resource in Chi basin by diverting surplus water from Khong basin (LPC Project) is included as a possible improvement measure. Accordingly if LPC might be abandoned due to the considerations on natural and social environments, it is important to limit the development by new pump irrigation projects and to make reasonable coordination for water use between the upstream and downstream basins. Further, it shall be necessary to improve the river flow condition through limiting the paddy planting in the existing irrigation service area in dry season.

Also, it is considered that there are possibilities to improve the O&M condition of the existing medium scale reservoirs mainly in Mun basin. By these improvements, water release in dry

season can be increased so that the river flow condition itself in related rivers could be improved as well. In case if the due water management for the entire basin could be secured in addition to the improvement of O&M and water management at the project level, water allocation for efficient agricultural production could be materialized including the needed water for environmental purpose.

Scenario C

Priority is given to the expanded practices of "Sufficiency Economy" under this scenario. Emphasis is to be placed on better management of natural resources in each locality, and based on this concept irrigation development and management shall be undertaken. In the rain-fed areas, self-sufficiency-oriented mixed farming by using farm pond shall be expanded with development of small scale projects aiming at possible mitigation of drought risks.

Under the scenario, except the 2 estuary barrage projects for which plans are on-going at present, there will be no large and medium scale development to be implemented after the end of short term. Projects to be implemented further are, therefore, only small scale projects by TAOs and rehabilitation on the existing projects. The target under the 10th agricultural development plan was applied. That is ¼ of the overall farm households shall practice "Sufficiency Economy Concept" farming. To cope with this target, it is necessary to construct about 400,000 farm ponds within the period of short term.

Since there will be no new water created, materialization of such water management in the basin as causing allocation of environmental water and needed water for salinity mitigation becomes very necessary. Through water management practice at community level, farmers will have learning opportunities, and through creating networks with other communities in the relevant river basins share common understandings so as to secure required consensus among various stakeholders in the basin.

6.4 Further Examination on Scenarios

Expected impacts and benefits by three (3) scenarios are summarized in the table shown below:

The scenario A is a huge one equivalent to the overall annual budget of RID. While the scenario B shares about 25% of the RID's annual investment budget which may be possible by allocating more for the Northeast Region within the normal budget allocation to RID. In case of scenario C, the budget allocated for Northeast Region will be reduced to a half level in the long terms, where RID's role will be shifted from development to management. When looking into the breakdown of the investment budget, the KLCM project of large scale water diversion nature shares the most of the total amount. In case of scenario B, as similar to the direction, the investment budget is shared by about half by rehabilitation and improvement projects. The scenario C shows an equivalent shares by 3 main sectors of development, rehabilitation/ improvement and improvement in rain-fed areas.

Comparison of Water Resource Development/ Management Option in Each scenario

Scenario		Scenario A	Scenario B	Scenario C
		Full development option of irrigation development including large scale water diversion for NE to be the major production center for foods and bio-energy	Economic growth by an agro-industry and improvement of rain-fed area. Mainly improvement of existing irrigation system.	To expand self-sufficiency-oriented mixed farming by using farm pond and small scale projects
1. Investment Cost	Total	936,358 Mil.Baht	210,878 Mil.Baht	85,233 Mil.Baht
	Annual	31,212 Mil.Baht	7,029 Mil.Baht	2,841 Mil.Baht
		Almost equal to RID's annual budget	25% of RID investment budget	Half of NE investment
2. Developed Irrigation Area Irrigation ratio	Area	3,300,000 ha	730,000 ha	360,000 ha
	Ratio (Current: 10.6%)	46.1 %	18.6 %	14.5 %
3.Incremental Rice Production	Volume	9.8 Mil .ton	3.3 Mil. ton	2.3 Mil. ton
	Increase	89 %	30 %	21 %
4. Beneficiaries (Household)	Number	1.6 Mil HH	1.0 Mil HH	0.86 Mil HH
	Target	Low income farmers	Both better-off and low income farmers	Low income and poor farmers
5.Value Add		To be food production base by increase of productivity. Increase fuel crop in line with bio-ethanol increase by Triple Plan	Crop diversification, safe/ quality vegetable production for processed by food industry. Distributed in NE Region and export	Value adding of agricultural produce at community level (OTOP) for occupation/livelihood improvement and income diversification
6.Environmental Impact		- Necessary to conduct S EA for Diversion - Env. Impact of Tunnel construction - Huge impact on local people	- Necessary to conduct S EA for Diversion - EIA on wetland - Increase river flow for environment	- No impact from irrigation development - Community Environmental conservation/improvement activities are expected
7 Other Issues		- Agriculture extension WUG formulation support system - Secure labour force for agriculture	- PIM/ Cost share - Capacity dev't of TAO/PAO - Secure market based on partnership with private sector - Safety and Quality Assurance	- Capacity development of TAO/PAO - Incentive for community based NRM - Participation of NGO, Civil Society
8. Overall	Positive	Increase irrigation ration and agriculture produce. More than half of farmers in NE region will benefit	Economic development through related industry Investment on water resources is current available level	Target on low income and poor farmers Least negative impact on environment
	Negative	High investment and negative impact on environment	Existing irrigated / better-off farmer will benefit more	Economic benefit is limited

In the long term perspectives the irrigation area can be increased as follows under each scenario.

Scenario A 20.4 Million rai (3.3 Million ha)
Scenario B 4.6 Million rai (0.73 Million ha)
Scenario C[#] 2.2 Million rai (0.36 Million ha)
[#] ---- Not including irrigation by farm ponds in rain-fed areas.

As the results, the irrigation ratio shall be increased by percentages as shown below.

Present	Scenario A	Scenario B	Scenario C
10.6 %	46.3 %	18.6 %	14.5 %

The increase of irrigation area is expected to cause following rice production increase.

- Yield increase in wet season (340 kg/rai ➔ 590 kg/rai)
- Expansion of planted area in dry season (30% of expanded irrigation area with 540 kg/rai)

Based on the above conditions each scenario will attain the rice production increase as shown in the following table (Comparison with 2008)

- Scenario A 89%
- Scenario B 30%
- Scenario C 21%

The number of beneficiaries by each scenario is as estimated below.

Scenario A 1.6 Million households
Scenario B 1.0 Million households
Scenario C 0.86 Million households

The scenario A will have an overwhelming majority of new beneficiary farmers and expected to bring about benefits centering to the comparatively low income farmers in the presently non-irrigated areas. The scenario B includes 1/3 of the existing irrigation areas under the project, and brings about benefits both for the middle income farmers and also for the poverty/low income farmers in the newly irrigated areas and rain-fed areas even after the project with possible effects on living standard improvement through crop diversification and value-adding. While the scenario C narrows down the target to the improvement in rain-fed areas and can be considered that the investment is focused just on low income/poverty farmers.

Concerning the environmental considerations, the Scenario A requires to carry out SEA as it includes large scale trans-basin water diversion as the core of development strategy. Under this scenario, it is necessary to complete careful environmental considerations as noted below.

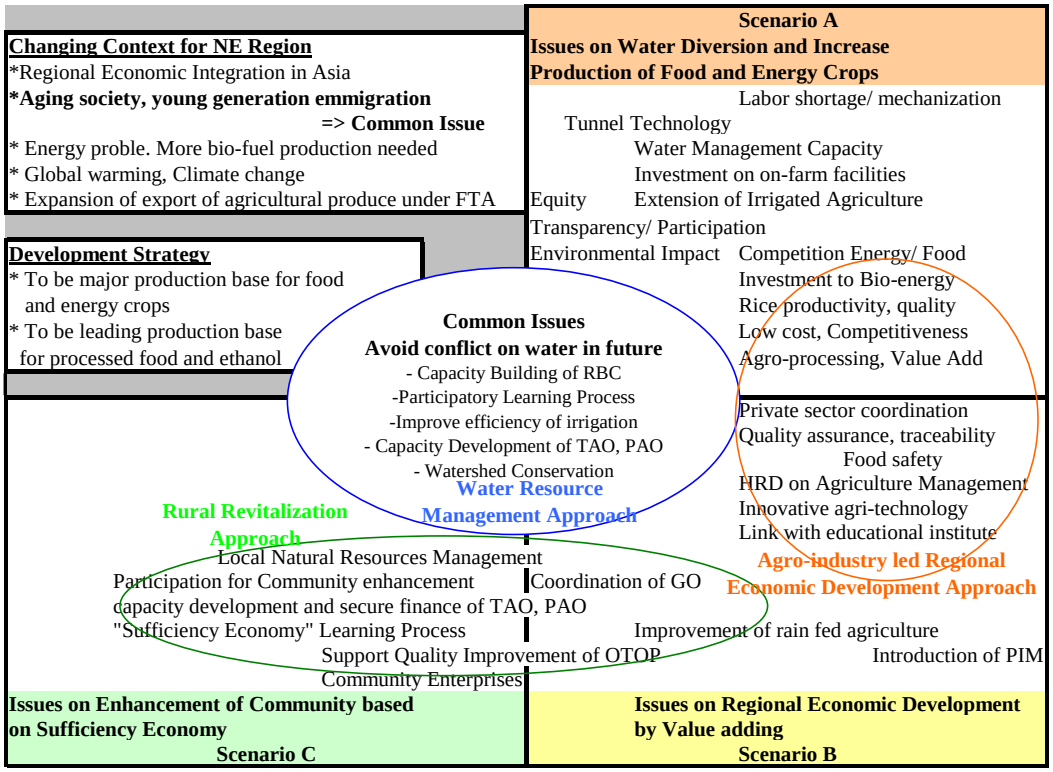
-Effects on natural environments by excavation of 80 km long tunnel and also by such large scale water diversion
-Effects on wetlands in particular
-Effects on local people as social environments by effects on wetlands on which people depends substantially their livings
-Possibility on salinity damages as caused by expansion of irrigation areas

Under the Scenario B, improvement of the existing irrigation systems is the main strategy. However in this case too, SEA is necessary if new irrigation development including medium scale dam/reservoir or the LPC project to challenge water balancing between the neighboring basins would be included. This includes development of two (2) important wetlands and therefore careful and sufficient studies on the effects on natural environments shall be required. It shall be noted further that improvement of river flow condition could be expected through construction and improvement of O & M for medium scale dams/reservoirs and also materialization of the LPC project, which allow securing of needed water for environmental purpose. While, the Scenario C will not cause any substantial environmental effects and it is expected that improvement of environmental condition through conservation and reasonable use of natural resources be positively enhanced at the community level.

7. Framework for Assistance to Reduce Regional Disparity in the Northeast Region

7.1 Issues in each Development Scenario and Necessity of Cooperation and Assistance

Issues in each development scenario presented in Chapter 6 are summarized in diagram below. Higher priority areas for cooperation and assistance needs of Thai Government are grouped and proposed as approach to rectify regional disparity.



7.2 Approach to Rectify Regional Disparity

Regional disparity used to be recognized as a major issue of the nation since 1970's. The 4th NESDP (1977-1981) focused on regional development plan under the banner of "Rectifying Regional Disparity", while the succeeding 5th NESDP set "Poverty Reduction" and "Rural Development" as main theme. While poverty ratio is decreased considerably due to continuous

rural development effort, regional disparity has not been solved. Any of single project or program cannot solve regional disparity problem, rather it can be achieved as the result of continuous development effort of local people, who are main actors of local development initiatives. Three approaches to reduce regional disparity are proposed as follows;

(1) "Water Resources Management" approach

When considering medium and long term development, resources base for sustainable development shall be considered. In case of the Northeast region, industry to be developed may be related to agriculture and water resources is most important resource among others. Not only for agriculture, but for agro-industry and other industries, water is very important. Growing population in the city and town increase demand for water consumption and conflict over water allocation may happen in future. Potential of water development is already marginal level and problem shall be solved through management of water resources, otherwise a need to divert water from other basin.

Thai government sets institutional framework for integrated water resources management at river basin level by establish RBC and through stakeholder participation. Poor coordination among RID, who is the largest water user and operator of irrigation facilities and DWR, who plays role of controller and promoter of river basin management, is the major issue. It is also necessary to develop incentive mechanism for local participation of people and local administration, to enhance capacity of technical staff of RBC for hydraulic model development as tool for basin management. Moreover, capacity development of RBC to promote participatory process of all stakeholders is important.

(2) " Regional Economic Development through Agro-industry" approach

Along with the national development strategy for the Region as to be "Production base of food and bio-fuel crop", "Center for food industry and Bio-ethanol" and "Gateway to Indochina", it is proposed to enhance large number local Micro and Small Medium Enterprises (M&SME) on food industry, which has 60% share of establishments in the Northeast region. In order to revitalize local economy directly related to enhancing livelihood of local people, it is preferable to support M&SME in enhancing management capacity and improvement of quality of product, but not to invite small number of Giant Company in Agro-industry to the Northeast region.

By developing domestic market in the Region and export to Indochina and China with new production development suitable for those countries, such local food industries will be promoted and expand employment.

Supply of raw materials, i.e. agricultural produce, shall be stabilized and quality of those shall be improved through support for farmers. In turn, value adding to agricultural produce gives higher income to farmers.

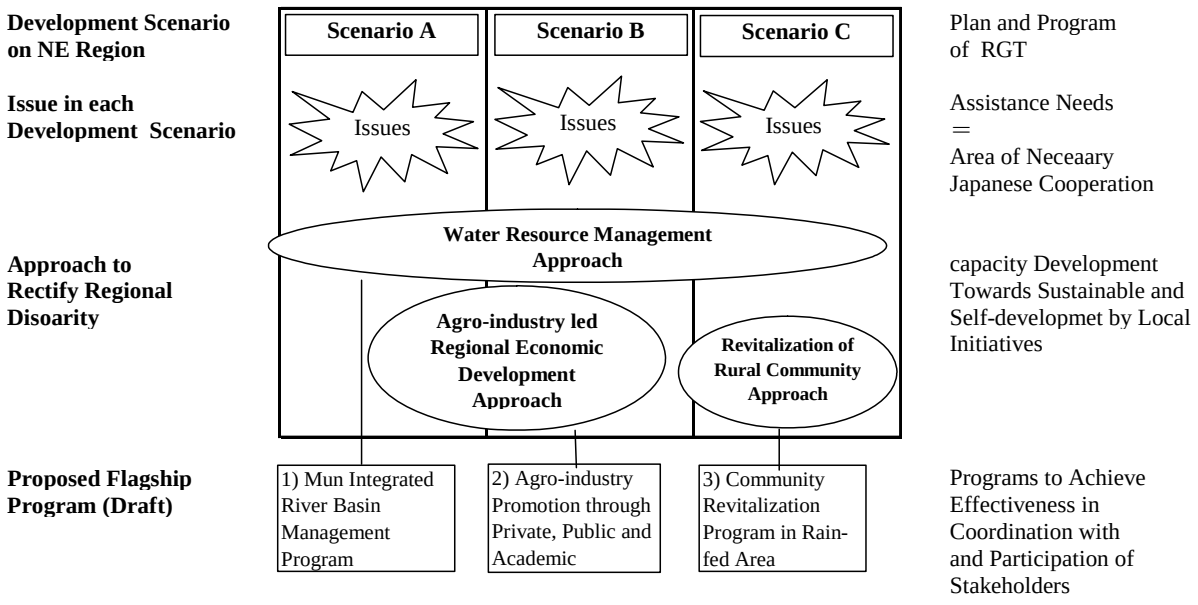
(3) "Revitalization of Rural Community" approach

It is necessary to take countermeasures to organize suitable environment which enables farmers to make living by agriculture and to live good lives, so that it is possible to avoid probable

depopulation in the future. Especially, in the rain fed areas with insufficient water resources, it is recommended to promote community strengthening and self-sufficient mixed farming based on "sufficiency economy concept" to increase tolerance against external shocks such as economic crisis and climate change, and to promote sustainable development, since Northeastern people still regard mutual help of family and community as important part of life, and participate in social events and group activities in the community. In addition, it is desirable to promote economic activation by means of regional sources such as processing, marketing of surplus foods. The rural revitalization approach aims at liable community formulation, where people can make living, after they work away from home for a period of time of life. It is necessary to establish structures for support of community.

7.3 Proposed Flagship Program for each Approach

Following flowchart shows proposed approaches for reduction of disparity and draft flagship programs resulting from development scenarios. It should be said that outcome is limited for small scale single agency's cooperation program. Above mentioned approaches are not only for single government agency but involvement of multi stakeholders are necessary for implementation. Therefore, it is proposed joint implementation of "Flagship Program" with RTG. JICA plays a role of facilitator and coordinator.



(1) IWRM program for the Mun basin (draft)

The Northeast Region is divided into three (3) major basins of Khong, Chi and Mun and there already established three (3) RBCs, one each for each basin. It is considered adequate basically to formulate an IWRM program with each basin as a basic unit to be implemented by each of RBC as a core of the management body. In the Northeast Region there have to be three RBCs effectively functioning in future, one each for each basin, but with the following reasons, IWRM practice should be first

implemented/strengthened in Mun basin.

- The balance of water volume between upstream and lower stream is the worst in Mun basin and the water resource is insufficient in the upstream basin.
- There have been many water use facilities constructed in Mun basin both in upstream and lower stream reaches, leaving no room for further development. However, there is no coordination by and between the upstream and lower stream and each of major facilities are operated independently.

Moreover, the Mun basin is the main production area of value-added jasmine rice for export, while the basin includes relatively poor provinces such as Buri Ram, Surin and Sisaket. Therefore, it is expected that the program can improve farm household income and revitalize the rural economy. Furthermore, the basin has issues such as negative impacts on natural environment caused by the past projects and therefore, the IWRM program is expected to solve those problems. In practicing the IWRM program, there are several important elements such as participations by civil society and stakeholders, learning process, capacity building for RBC who is the core management body and formulation of IWRM basin plan. DWR, RID, Provincial offices and TAOs will play a main role as implementation agencies. Collaboration and coordination among such related agencies (RID and DWR in particular) are quite important and it is deemed essentially important to create good examples through attaining due coordination at the program implementation level in addition to the political will at the higher policy level.

1) Participations by civil society and stakeholders and learning process

Stakeholders are people living in the basin, farmers, industrial water users, local government and central government etc. All the stakeholders have to participate in solving the water related problems. Learning in participatory manner is also important through planning for water allocation and other activities for studies on IWRM concept and water environment in each locality.

2) Capacity building of RBC

Under the RBC, working groups for each tributary basin and technical working group are to be organized. In case of Mun river basin RBC, groups have been organized and existing, but there have been no substantial activities by them. Capacity building takes time and there must be medium-long process to be completed, and it is considered necessary to provide technical support to RBC under the short term perspective.

3) Formulation of IWRM plan for the basin

The subject plan is a road map showing the investment schedule in future for multi-purpose and medium/long term water management project including various sectors such as irrigation, urban water supply, rural water supply, flood control, hydropower generation, drainage, water quality and environment. Therefore, the plan shall be prepared in conformity with the existing national level plans and/or integrated or intensified with them.

4) Related Projects to be implemented after the formulation of Integrated River Basin

Management Plan

Priority projects under the integrated river basin management plan may include the followings;

- Rehabilitation and improvement of medium scale irrigation facilities
- Consolidation of the existing weirs on tributary
- Construction of fish ladder
- Construction of facilities for water quality improvement

Moreover, promotion of crop diversification, value adding to the crops, watershed conservation activities and so on along with IWRM will be implemented. Participatory Irrigation Management (PIM) is to be promoted in Thailand so as to transfer the activities for irrigation management from RID to Water Users along with implementation of rehabilitation and improvement works. Experience of Flagship Program and lessons learned are expected to be shared with other RBCs in Thailand as well as other country in Mekong Region.

(2) Agro-industry Promotion through Private, Public and Academic Cooperation (Draft)

Aiming at reducing regional disparity, promotion of agro-industry will be proposed for regional economic development and creating employment opportunity. Linkage with agriculture sector, product development attractive to consumer and marketing is necessary. Demand driven agriculture development needs private sector's involvement in terms of crop diversification. Target area shall be in completed large scale irrigation, with stable agriculture production, and good reputation. Khon Kaen, Kalasin, Udon Thani, and Nakhon Ratchasima is proposed. Proposed activities are agricultural related industry (seeds, farming machines, and agricultural materials), food processing industry, and sale (retail selling, restaurant, hotel and so on). It is effective to integrate and cluster these activities under the support of Japanese Government though site survey and dispatch of experts.

Since agencies concerned are various, such as Ministry of Industry, MOAC, Ministry of Education and so on, JICA is expected to play a role of facilitator among them. Some of the expected tasks are out of Scope of Works in the Study, it is proposed to implement additional studies and examine following matters:

1) Develop R&D center for food by Linking Private Sector – Public – Academic Institution
2) Inviting advanced (Japanese) private enterprise (food and agro-processing) and link with local M & SMEs
3) Local product development and marketing through cooperation of agriculture, manufacturing and commercial sector
4) Advance technology for agriculture management and HRD of next generation
5) Other projects concerned (draft)
    - Advancement of agricultural technology by means of IT and nourishment of young farming managers;

- Extension of collaboration with private sector, demand-driven agriculture and rural development model to the surrounding countries; and
- Rehabilitation of irrigation facilities for production improvement and land consolidation (Japanese ODA loan)

(3) Community Revitalization Program in Rain-fed Area (Draft)

Livelihood improvement of farm household in rainfed area needs different approach from irrigated area. Expansion of cultivation area and improvement of productivity are major focus in irrigated area. It is important, on the other hand in rainfed area, to have better farm income with low input together with reduction and diversifying risk of drought and flood. H.M King's "Sufficiency Economy" concept provide rational for such approach in community development and agricultural development. Government agencies apply this concept to agricultural promotion and community development. However, different government agencies conduct activities without coordination in the same area which has less effective and no synergy effect.

In the short term, the Program formulate consortium of stakeholders and promote Sufficiency Agriculture by application of the Model. At the same time, it is important to provide learning process and capacity development of communities in order to obtain capacity of problem solving by local people to cope with future issues such as aging society. For capacity development of local people, it is necessary to have local people practicing trial and errors process by themselves and expand further their practices with having concrete achievements. For this sake, it is necessary to have a framework which may support the local peoples' initiatives by adequate combination of various schemes.

Flagship program will be implemented at local level with multi stakeholders. One expert will be attached to Program Coordinating Unit in central government agency (NESDB or MOAC-OPS) and coordinate with other Japanese input like JOCV, SV and Training scheme to carry out the Flagship Program. Best practice, lessons learnt and Model from the other project implemented shall be fully utilized and updated.

1) Revitalization of agriculture and rural areas based on Sufficiency Economy Agriculture
   - Farmer-to-Farmer extension on Sufficiency Economy Agriculture (integrated agriculture) together with promotion of crop diversification through Green and Community Market. (Construction of farm ponds for Sufficiency Economy by PAO, TAO included.) (Technical Cooperation Project by ALRO)
   - Nourishment of community enterprise and market development, setting TAO as a focal point (collaboration with short term experts and Senior Volunteers)
2) Support of learning process and promotion of people's initiative for self development
   - Participatory planning at village level and provision of learning process (ALRO, FAO poverty alleviation model)
   - Formulation of mechanism to promote people's initiatives
3) Preparation for the future

- Development of next generation leader (JOCV and training)

4) Collaboration after flagship program

In the medium term, input from Japan shall be knowledge base such as sharing Japanese experience, and linking with scientific researchers, assuming that coordination among stakeholders are established.

- Local Economic revitalization utilizing local resource, local wisdom and local culture (OTOP, Green Tourism, etc.) (Campaign and Contest)
- Continue to support local initiative by participation and coordination among TAO, colleges, government agencies, NGO and Community
- Trial on new form of agriculture (low labor intensive agriculture for aged, high quality and profitable agriculture, hydroponics etc) based on collaboration of research and government agencies.

8. Recommendations

Recommendations were prepared by the Study Team for JICA's further consideration based on the understanding/knowledge and lessons learnt as obtained through the subject study. The recommendations include proposal to JICA for further examining on the following points in addition to the scope of study that "Directions on cooperation framework in medium/long term perspective for rectifying the regional disparity in the Northeast Region (mainly in water resource management and agriculture sectors) shall be worked out."

8.1 Important Points to be paid Attention for Implementation of Programs/Projects toward Rectifying of Regional Disparity in the Northeast Region

(1) Fostering Good Governance through Program/Project Implementation (Public Participation and Information Disclosure)

In case if JICA would provide assistances in capacity development of Thai Government agencies and activities led by local people's initiatives, public participation from planning stage and information disclosure shall be paid with special attention by JICA for implementation of cooperation projects with the relevant Government agencies.

JICA is recommended to support concrete planning process and implementation with people's participation. Practical approach to create occasions and atmosphere where Thai Government agencies can realize the importance of participation from planning stage, transparency and equity, is preferable so as to make direct approach to avail participation as pre-condition for financial and technical cooperation.

(2) Necessity to Formulate Project with Multi-Agencies and to Eradicate Sectionalism

As mentioned in the proposed flagship program, effective management of programs and/or projects requires integrated approach to meet local people's needs. In order to achieve it, program to cooperate among different government agencies shall be necessary. JICA shall play such facilitation role to formulate multi-agencies program aside from ordinary single agency's

request and proposal. Cooperation with private sector in demand driven sustainable development is recommended as a cooperation scheme suitable to Thailand as a middle income country.

8.2 Cross border/Regional Cooperation

(1) Regional Cooperation Partnership in the Era of Borderless Economy

Movement of goods, people, money across the border is so voluminous and it is to be taken into account in development of local area. Long-term perspective including surrounding countries and wider regional view shall be considered in order to conceive future cooperation framework of JICA. To do so, JICA is suggested to transform country assistance to regional assistance policy in this particular region. With cooperation to be implemented with Thai Government agencies as partner, JICA can extend its cooperation to surrounding countries. Such new style of partnership might be suitable to Thailand who is becoming to middle income country.

(2) Preparation for Future Water / Food Crisis with Climate Change

In the long term perspective, as forecasted by many researches, demand on food and water in the world become increasing, and when combined with climate changes impact, food and water crisis may surely occur in the world. Considering these issues, it may be necessary to consider trans-boundary water diversion scheme for implementation together with due trans-boundary environmental management. It also shall be implemented through appropriate process based on prior consent for agreement among MRC countries. Lower Mekong countries can cooperate in development for common future, and Japan shall play an important role in technical and financial cooperation within Greater Mekong Sub region cooperation framework.

8.3 Sharing of Japanese Experience with Thailand on Issues of Maturing Society

(1) Aging Society, Shortage of Next Generation Farmers and Depopulation

The Northeast region is facing labor shortage problem currently, and issues of aging society and depopulation in rural society are high lighted. Therefore, practical actions shall be taken at national level as well as local level at the soonest. Since Japan has experienced the same issues, it is proposed to share such experience and lessons learned with Thai Government and local community level so as to prepare policy and local actions to cope with agrarian community under aging era.

(2) Towards Self-Governance at Local Level

Not only capacity development of local administration but also Local economic development in partnership with private sector and effort of local community for self-governing is important for local development. Local level communication and experience sharing between Thailand and Japanese rural area is desirable. Under decentralization reform, role of small rural infrastructure development has been transferred to PAO and TAO but without budget support. Financial support system such as issuing local government bond, direct finance to local government by foreign loan may be necessary to be considered in future.

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Abbreviation

ACMECS	Ayeyawady-ChaoPhraya-Mekong Economic Cooperation Strategy
ADCA	Agricultural Development Consultants Association (in Japan)
ADB	Asian Development Bank
AFTA	ASEAN Free Trade Agreement
ALRO	Agricultural Land Reform Office
ARD	Office of Accelerated Rural Development
ASEAN	Association of South East Asian Nations
ASPL	Agricultural Sector Program Loan
BAAC	Bank for Agriculture and Agricultural Cooperatives
BOD	Biochemical Oxygen Demand
CDD	Community Development Department
CF	Community Forest
CLCO	Central Land Consolidation Office
CLMV	Cambodia, Laos, Myanmar, and Vietnam
DDPM	Department of Disaster Prevention and Mitigation
DEDP	Department of Energy Development and Promotion
DGWR	Department of Ground Water Resources
DLD	Department of Livestock Development
DMR	Department of Mineral Resources
DNP	Department of National Parks
DO	Dissolved Oxygen
DOAE	Department of Agricultural Extension
DOF	Department of Fisheries
DWR	Department of Water Resources
EC	Electric Conductivity
EIA	Environmental Impact Assessment
ESCAP	Economic & Social Commission for Asia & the Pacific
EGAT	Electricity Generating Authority of Thailand
FAO	Food and Agriculture Organization of the United Nations
FCRC	Field Crop Research Center
F/S	Feasibility Study
FTA	Free Trade Agreement
GAP	Good Agricultural Practice
GDP	Gross Domestic Product
GIS	Geographic Information System
GMS	Greater Mekong Subregion
GPP	Gross Primary Product

GRP	Gross Regional Product
HACCP	Hazard Analysis-Critical Control Point System
HAI	Human Achievement Index
HDI	Human Development Index
HIA	Health Impact Assessment
HPI	Human Poverty Index
HRD	Human Resource Development
IEA	International Energy Agency
IEE	Initial Environmental Examination
IWRM	Integrated Water Resource Management
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JMC	Joint Management Committee
JOCV	Japanese Oversea Cooperation Volunteer
JTEPA	Japan-Thai Economic Partnership Agreement
KCM	Khong-Chi-Mun
KLCM	Khong-Loei-Chi-Mun
KKU	Khon Kaen University
KU	Kasetsart University
LDD	Land Development Department
LMB	Lower Mekong Basin
LPC	Huai Luang-Lam-Pao-Chi
MCM	Million Cubic Meter
MOAC	Ministry of Agriculture and Cooperatives
MOI	Ministry of Industry
MoNRE	Ministry of Natural Resources and Environment
MRC	Mekong River Commission
M&SME	Micro and Small Medium Enterprise
NE	Northeast
NEA	National Energy Administration
NEB	National Environmental Board
NEQA	Improvement and Conservation of National Environmental Quality Act
NESDB	National Economic and Social Development Board
NESDP	National Economic and Social Development Plan
NGO	Non Governmental Organization
NSO	National Statistical Office
NWRC	National Water Resources Committee
OAE	Office of Agricultural Economics

OCSB	Office of Cane and Sugar Board
ODA	Official Development Assistance
OECF	Oversea Economic Cooperation Fund (in Japan)
O&M	Operation and Maintenance
ONEPP	Office of Natural Resources and Environmental Policy and Planning
ONWRC	Office of National Water Resource Committee
OPS	Office of Permanent Secretary
OTOP	One Tambon One Product
PAO	Provincial Administration Organization
PCD	Pollution Control Department
PDR	People's Democratic Republic
PIM	Participatory Irrigation Management
PWA	Provincial Waterworks Authority
RBC	River Basin Committee
RDI	Research & Development Institute/ Khon Kaen University
RFD	Royal Forest Department
RID	Royal Irrigation Department
RIO	Regional Irrigation Office
RTG	Royal Thai Government
SEA	Strategic Environmental Assessment
SIA	Social Impact Assessment
SSIP	Small Scale Irrigation Project
SV	Senior Volunteer
TAO	Tambon Administrative Organization
TB	Tributary Basin
TCP	Technical Cooperation Project
TDRI	Thailand Development Research Institute
TDS	Total Dissolved Solid
THB	Thai Baht
TMD	Thai Meteorological Department
UNDP	United Nation Development Programme
WB	World Bank
WUA	Water Users Association
WUG	Water Users Group

Exchange Rate

THB 1.0 = JPY 2.745 (July, 2010)

US$ 1.0 = JPY 88.66 (July, 2010)

Unit

1.0rai = 0.16ha

MCM = 1,000,000m^3