

No.

Ex-Post Evaluation Report of Japanese ODA Loan Project 2009 (Thailand)

July 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

INSTITUTE OF DEVELOPING ECONOMIES-JETRO

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Preface

Ex-post evaluation of ODA projects has been in place since 1975 and since then the coverage of evaluation has expanded. Japan's ODA charter revised in 2003 shows Japan's commitment to ODA evaluation, clearly stating under the section "Enhancement of Evaluation" that in order to measure, analyze and objectively evaluate the outcome of ODA, third-party evaluations conducted by experts will be enhanced.

This volume shows the result of the ex-post evaluation of ODA Loan project that were completed in fiscal year 2005. The ex-post evaluation was entrusted to external evaluators to ensure objective analysis of the projects' effects and to draw lessons and recommendations to be utilized in similar projects.

The lessons and recommendations drawn from these evaluations will be shared with JICA's stakeholders in order to improve the quality of ODA projects.

Lastly, deep appreciation is given to those who have cooperated and supported the creation of this volume of evaluations.

July 2011

Nobuhito HOBO

Vice President

Japan International Cooperation Agency (JICA)

Disclaimer

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Thailand

Pasak Irrigation Project (Kaeng Khoi - Ban Mo Pumping Irrigation)

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1. Project Description



Figure 1. Project site



Figure 2. Pumping station

1.1 Background

In the area, which includes Kaeng Khoi district and Ban Mo district in Saraburi province in central Thailand, has good soil and water condition and therefore agricultural production in rainy season in the area has been very active. The production, however, depends on natural rainfall. The altitude of the area is high and cultivation in dry season, using water from the Pasak river which runs around the area, could be possible only in some parts of the area. The Royal Thai government planned to promote cultivation in dry season in this area by constructing pumping station, which provides water from the Pasak river. The construction of Pasak Jholasit dam was crucial in the project. In the central region in Thailand the speed of industrialization has been very high and the government needs to control the shift of the main economic activity from agricultural sector to industrial sector. In order to mitigate the friction due to the sectoral shift, it is very important to increase the productivity in the agricultural sector by the construction of irrigation facilities. The promotion of agriculture, which is considered to be well harmonized with natural environment, is necessary to enhance the “Sufficient Economy” advocated by the King of Thailand. Agricultural development by using the Pasak river water was very important for the Thai government.

The formation and the strengthening of water users group is the worldwide movement. After the currency crisis, the Thai government has changed their policy and adopted Participatory Irrigation Management (PIM) policy. Since this project started before the policy change, the role of water users group in this project was not so important. After the policy change, the water users group has been strongly encouraged to strengthen its role in this project. As a result, water distribution in the project site has been well organized and the government has been collecting full amount of the electricity fee from the water users groups for the pumping operation. This project is very significant for the examination of the pumping irrigation projects in the future.

The main body of this project is Kaeng Khoi - Ban Mo irrigation project, which began in the beginning of 1980s. Since this project includes the funding for the detailed design for Pattananikom irrigation project, which is done in the area adjacent to Pasak Jholasit Dam, they named the project as Pasak Irrigation Project (Kaeng Khoi - Ban Mo Pumping Irrigation.)

1.2 Project Outline

The objective of this project is to stabilize the supply of irrigation water by constructing irrigation facilities such as pumping station and canals, thereby contributing to agricultural production increase, crop diversification, farmer income growth and the development of regional economy.

Table 1. Project outline

Approved Amount / Disbursed Amount	3,038 million yen / 1,799 million yen
Exchange of Notes Date / Loan Agreement Signing Date	September 1995 / September 1995
Terms and Conditions	Interest Rate: 2.7% Repayment Period: 25 years (Grace Period: 7 years) Conditions for Procurement: General Untied (Consulting services: General Untied)
Borrower / Executing Agency	Royal Thai Government / Royal Irrigation Department
Final Disbursement Date	January 2006
Main Contractor (Over 1 billion yen)	None
Main Consultant (Over 100 million yen)	Panya Consultant Co., Ltd. (Thailand) / Sanyu Consultants (Japan) / Asdecon Corporation Ltd. (Thailand)

Feasibility Studies, etc.	“Feasibility Study” JICA 1982, “Engineering Service” JICA 1985, ”Feasibility Study” Royal Thai government 1991-1993
Related Projects	“Study on Irrigated Agricultural Development and Capacity Building of Water Users Organizations for Pasak Irrigation Project (Kaeng Khoi - Ban Mo Pumping Irrigation) in the Kingdom of Thailand” JICA 2006

2. Outline of the Evaluation Study

2.1 External Evaluator

Satoshi Ohira (Keio University)

Seiro Ito (Institute of Developing Economies, Japan External Trade Organization)

Kazunari Tsukada (Institute of Developing Economies, Japan External Trade Organization)

2.2 Duration of Evaluation Study

Duration of the Study: January 2010 - March 2011

Duration of the Field Study: Total 25 days in the period between March 2010 and February 2011

2.3 Constraints during the Evaluation Study

None

3. Results of the Evaluation (Overall Rating: B)

3.1 Relevance (Rating: b)

3.1.1 Relevance with the Development Plan of Thailand

At the appraisal in 1995, the primary purpose of the 7th National Development Plan of Thailand (1991-1996) was to reduce regional income inequality and develop rural economies. It also put emphasis on crop diversification, export promotion, and poverty reduction in rural areas. In the agricultural sector, in order to maintain an average sector growth rate of 3.4%, the development plan aimed to increase and stabilize farmers' income, improve agricultural productivity and encourage agricultural processing industry. The plan intended to change the purpose of agricultural policy from promoting rice production to crop diversification. The objectives of this project were to improve the living standard of farmers and develop regional economy through increasing and diversifying agricultural production. At the time, these objectives were considered to be compatible with the national development plan.

At the time of evaluation, the 10th National Development Plan of Thailand (2007-2011) emphasizes the importance of rural development. The philosophy of “Sufficiency Economy” advocated by the King of Thailand considers the rural society to be the moral foundations of Thai society. The pro-rural policies are still an important part of Thai economy.

The PIM policy was established in the Agriculture Sector Program Loan (ASPL) by the Asia Development Bank. Water users groups established in this project is the unique one among the large-scale irrigation projects in Thailand in the sense that it collects electricity fees from farmers without arrears. The collected fees are then used to operate the irrigation pumps. The fact that there is no arrear is peculiar even in the international perspectives, and it plays an important role as a model case for promoting the PIM all over Thailand.

Although crop diversification, promoting export and reducing rural poverty are currently still a part of the national development plans, we should not pay much attention to these factors in this ex post evaluation. Rather, those are only a secondary matter. This is because this project in Kaeng Khoi - Ban Mo actually did not take into consideration crop diversification as its objective in the project period. Also, most rice crops produced in the project area were supplied for domestic consumption. Only a little surplus rice was exported to other countries. We cannot find any relationship between this project and export promotion policy. There still exists serious regional disparity in Thailand. We, however, could not find evidence that this project contributed to eradication of poverty in the rural areas. The income level of Saraburi was 1.8 times as high as the national average income in 2008. Saraburi is one of the richest provinces in rural areas in Thailand¹. The main issue of the agricultural sector in this area was not low income levels or low economic growth, but to lessen the social friction that has been caused by industrialization and to try to find a new way compatible with the aging society.

We should also note that there is a reason which made it unnecessary to promote crop diversification. In the planning period at the beginning of 1980s, it was clearly impossible to supply enough water for rice production in the whole project area due to the restricted capacity of water supply of the Pasak Jholasit Dam relative to the size of the project area. Therefore, the project intended the shift from rice production to vegetable production to some extent at that time². However, the project size was reduced to 40% of the original in the project period. Thus there is no longer the problem of water supply shortage.

Despite the dramatic economic development in Thailand and the fact that Thailand was no longer a low-income country at the beginning of canal construction, the development

¹ In four regions which include North East (0.31times), North (0.51), South (0.72) and West (0.78) , the average income is lower than the national average. East (2.44), Bangkok (2.40) and Central (1.77) in which Saraburi is included, has upper higher average than the national one.

² Appraisal report clearly intended the shift from rice based farming to the new farming by the crop diversification in this project.

plan of the planning period in the beginning of 1980s was not modified for its practice and was appraised as it was. Although the physical design of irrigation systems was altered according to the actual circumstances, in the appraisal they decided to give the yen loan to this project without reexamining the sociological and economical significance of this project. Therefore, the project operation was different from the one that they assumed at the appraisal. This problem resulted from the decision at the appraisal time. Their perspective on the development policies was inappropriate.

3.1.2 Relevance with the Development Needs of Thailand

At the appraisal time, although the market share of agriculture in the Thai economy was declining, the labor market share of agriculture in the population of productive age (15-64), the proportion of farmland in the country and the share of the agricultural products in the total export amounts were still large; 60% in 1991, 42% in 1991 and 18% in 1993, respectively. The agricultural sector had played an important role in the Thai economy. It is true, however, that yield per unit area and annual average income in the agricultural sector were low. There was also a problem of inequality within the sector.

It was impossible to irrigate the project area by the gravity irrigation system because of the low water level of the Pasak River. In the dry season, the lack of water had damaged to cultivation in the area seriously. Thus the area of cultivated land in the dry season was 30% of the one in the rainy season. In the rainy season, on the other hand, the flood had caused extensive damage to the area since there was not enough drainage system.

The production in the agricultural sector represented 16.2% of GDP in 1988, but it declined to 11.9% in 1992. The importance of the agricultural sector to the Thai economy obviously diminished in such a short period, which was an undeniable fact at the appraisal time. Nevertheless, the irrigation project was considered to be worth promoting since the labor market share of the agricultural sector (42% in 1991) and the share of the agricultural products in the total export amounts (18% in 1993) were still high.

At the evaluation time, the size of the agricultural workforce in Saraburi province, in which the project area is included, is only about 15%. This evaluation report, however, does not judge the significance of Thai agriculture, especially of the irrigation project in Saraburi, only with such a figure³. Generally, in the progress of industrialization, it is necessary to protect agricultural industry over a certain period in order to prevent widening gap between agriculture and industry dramatically⁴. It is important to increase the agricultural productivity under the

³ The proportion of agricultural sector income compared to the total provincial income of Saraburi is about 4 or 5 %. The employment proportion of agricultural sector is almost 15%.

⁴ Hayami, Yujiro and Godo Yoshihisa, "*Nogyo-Keizairon (Agricultural Economics New edition)*," Iwanami, 2002 is useful in understanding the story. Our evaluation is based on the understanding of the agricultural problem in the middle income countries presented in the book. Hayami, Yujiro, "An Emerging Agricultural Problem in High-Performing Asian Economies," *World Bank Policy Research Working Paper No.4312*, 2007 analyses the same

small and aging labor force and to raise the land-to-labor ratio, which contribute to human capital accumulation and transfer of younger generation to the industrial sector. We consider, although the appraisal report does not mention, that the main objectives of this irrigation project is, by improving the agricultural productivity and the land-to-labor ratio, to change into agriculture dominated by aging farmers, perform gradual labor migration from an agricultural sector to an industrial sector, and eventually make a soft landing as an industrial society⁵.

According to the Scope of Irrigation Development promoted by the Royal Irrigation Department (RID), only 22% of water demand was supplied in the central region, and so constructing an irrigation system in the region should be important. The cabinet council determined on December 18th, 2007, to increase the irrigated area to 60 million rai (1 rai=1,600m²) during the years 2008-2020.

3.1.3 Relevance with Japan's ODA Policy

The ODA white paper 1995 clearly states that Japan's ODA aims to reduce rural poverty in Thailand through the improvement of agricultural infrastructure and agricultural productivity as one of the main assistance policies to Thailand.

For the reasons mentioned above, although the operation of this project met the aims of the development policies and the development needs in Thailand and Japan's ODA policies, there were some problems with regard to the understanding of development policies and development needs in the appraisal time. Therefore its relevance is fair.

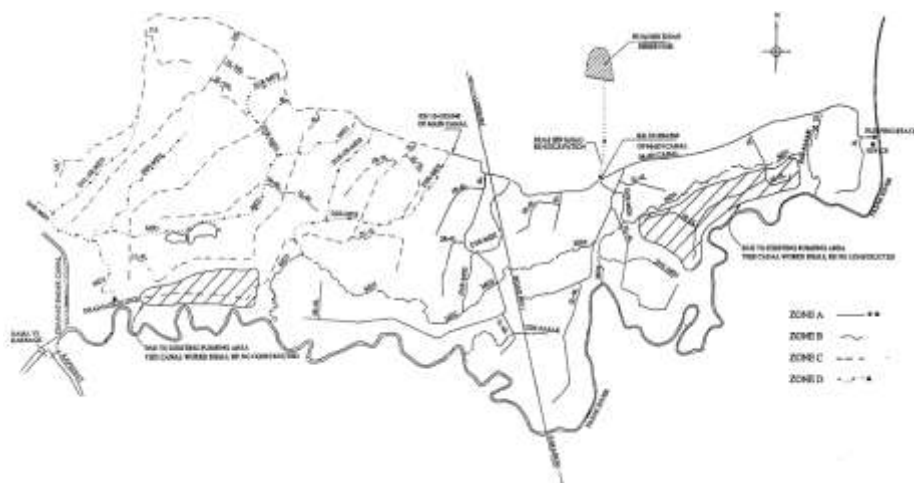
3.2 Efficiency (Rating: b)

3.2.1 Project Outputs

The irrigation system draws water from the Pasak River in Kaeng Khoi, the east end of the project area, and its main canal is extended westward to Ban Mo. The irrigation was designed such that the main canal ran through the north edge of the irrigated area and the twelve lateral canals (1L-12L) ran southward from the main canal. The construction area was farmland that was cultivated only in the rainy season since it was impossible to utilize water from the

problem more deeply. The political instability in 2010, which occurred during our evaluation research, was the typical example of the social conflicts caused by the disparity between rural and urban societies in Thailand at the middle income levels. In Saraburi, especially in the project area, the political situation was fairly stable even in the period of political turmoil.

⁵ The preparation of the project began in the beginning of 1980s. In the period the Thai government began to strengthen the effort for the productivity increase in agricultural sector instead of enlarging the cultivated areas and migration of the farmers to the new land. Please see Siamwalla, Ammar, "Land-abundant agricultural growth and some of its consequences: The case of Thailand," in John W. Mellor, ed. *Agriculture on the Road to Industrialization*, Baltimore: John Hopkins University Press. pp. 150-174. Shigetomi Shinichi, "Thailand: Agricultural development depends on world market" (in Japanese) in Shigetomi Shinichi ed. *Globalization and the change in rural market in LDCs*, Research Report, Institute of Developing Economies, Chapter 5 is also useful reference.



Source: JICA document

Figure 3. Irrigation system

Table 2. Comparison of Original and Actual Outputs

Original	Actual
【Construction】	
pump (7, 17.08cms)	As planned
canal (145.20km)	125.80km
Irrigation facilities	Almost as planned
Drainage system (97.66km)	74.98km
Demonstration farm (260ha)	640ha
Electric cables (5km)	As planned
Maintenance facilities	Almost as planned
【Consulting services】	
Foreign 109M/M Local 165.5M/M 1) detailed design (D/D redesign for KKBM and D/D for Pattananiikom and Pattananiikom Kaeng Khoi) 2) construction management	As planned

Pasak River in the dry season due to area's high altitude⁶.

The construction of the second lateral canal (2L) was canceled because poultry factories were built and the area was no more farmland. For that reason, the construction plan was slightly changed. Besides from cancelation of 2L construction, the irrigation system was constructed according to the original plan. Also, many parts of the project area were becoming

⁶ There was no reclamation in this project.

residential areas, but it hardly affected the irrigation system construction itself⁷. The project implementation agency mentions that high administrative ability of the consultants was the most important factor of what the construction went according to plan⁸.

3.2.2 Project Inputs

3.2.2.1 Project Period

The project period was longer than planned. The project operation was scheduled for September 1995 to November 2001 (81 months in total); however, it actually took 119 months in total and was extended until June 2005. This delay was mainly because the construction started 330 days behind schedule due to making a budget for the land acquisition and compensation⁹.

After the expiration of the yen loan project, the tertiary canals are currently under construction, financed by the Thai government. It will be completed in 2011.

3.2.2.2 Project Cost

The project cost was lower than the planned. At the appraisal time, it was estimated to cost 5,536 million yen in total, 3,038 million yen of which was appropriated from the yen loan and 690 million baht (1 baht = 3.62 yen in the exchange rate in 1995) was from the Thai government. The actual cost, however, was 3,607 million yen (65% of the planned). The amount of the yen loan was greatly reduced to 1,675 million yen. This decrease in the project cost was mainly caused by the sharp decline in the Thai baht's value during the payment period for that project due to the Asian financial crisis¹⁰.

Although the project cost was lower than planned, the project period was longer than planned, efficiency of the project is fair.

⁷ In the cases of main and lateral constructions which were financed by the yen loan. There was a revision of the detailed design in the year of 2000 because long time has passed after the feasibility study conducted by the Thai government. They redesigned the system by examining the necessary change of the canal locations due to the factors like the extension of the residential areas.

⁸ Project Completion Report (PCR). The coordination among landowners, farmers and Tambon offices (TAO) has been well organized. The fact contributed the formation of water users groups and the construction of tertiary canals. They were not the main components of the original project but became the most important components due to the new agricultural policy after the ASPL began in 1999 during the project period. The success in the coordination was the main factor which explains the smoothness of project implementation.

⁹ PCR. The preparation of this project began in the beginning of 1980s. It took long time to reach L/A after the feasibility study because they could not decide to start the construction until the completion of the construction of Pasak Jholasit Dam which supplies enough water to stop the opposition of water taking in Kaeng Khoi. When the construction completion of Pasak Jholasit Dam was almost sure, they could expect enough water supply and L/A was signed. It, however, took more time to make the budget to compensate land acquisition. Landowners were cooperative to the project and therefore there was no necessity to tackle land acquisition problem except the making of the budget.

¹⁰ 1 baht was 3.62 yen in 1995. 1 baht was 2.45 yen in 2002.

3.3. Effectiveness (Rating: a)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

The planned irrigation size was 85,695 rai at the appraisal; however, the actual irrigation size is 33,221 rai, which was 38.8% of the plan. This does not imply a failure of the project. It, rather, resulted from the decrease of farmland in the project area. This project did not aim to exploit new farmland by irrigation but to enable to cultivate in the area that were impossible to be cultivated in the dry season before and have a stable harvest in the rainy season. In consideration of the effectiveness of this project, we base our evaluation not on changes in irrigated area. Rather, we evaluate



Source: Photo taken at the time of field survey
Figure 4. Rice fields in the project area

to what extent it achieved its objectives under the current irrigated farmland: cultivation in the dry season, stable harvest in the rainy season, and effective adjustments in water supply.

It should be noted that the irrigated area in the dry season is gradually increasing and is approaching the planned size. On the other hand, the irrigated area in the rainy season has been decreasing dramatically. The ratio of the irrigated area in the dry season to the one in the rainy season was planned to be 32.6% and was 55.4% in 2008. We can also interpret this situation as evidence that cultivation in the dry season was being promoted more smoothly than the schedule.

Table 3. Irrigation size

Irrigation size	Rainy season (rai) (proportion to the planned (%))	Dry season (rai) (proportion to the planned (%))	Dry / rainy (%)
planned	85,695	27,900	32.6
2005	34,267 (40.0)	12,681 (45.5)	37.0
2006	33,933 (39.6)	17,394 (62.3)	51.3
2007	33,752 (39.4)	18,966 (68.0)	56.2
2008	36,311 (42.4)	20,121 (72.1)	55.4
2009	39,288 (45.8)		

Source: Data from the RID Kaeng Khoi office

According to the RID Kaeng Khoi office, the level of water management is evaluated based on the ratio of water demand to water supply. It is stable in the dry season, but is not stable in the rainy season¹¹. Regarding water supply management, some problems are left behind.

On the other hand, we see water supply has worked well in terms of economic impacts, that is, growth in agricultural production and income growth.

Table 4. Water supply efficiency (%)

	Rainy	Dry
2005, 2005/2006	39.68	54.23
2006, 2006/2007	93.12	52.80
2007, 2007/2008	51.35	48.93
2008, 2008/2009	87.90	52.18
2009, 2009/2010	68.01	52.04

Source: Data from the RID Kaeng Khoi office

Table 5. Project outcome

	cultivation size (rai)	input (per rai)	output (per rai)	unit price	income (baht per rai)	profit (baht per rai)	profit / input (%)	Contribution rate of the factor to the change in profit/input (%)		
								price	output	input (-)
05 wet	34,267	3,290.50	69.95	61.20	4,280.94	990.44	30.10			
05/06dry	12,681	3,323.33	71.03	54.70	3,885.52	562.19	16.92			
06wet	33,933	3,083.97	67.13	56.69	3,805.90	721.93	23.41	-22.23	-31.84	-17.40
06/07dry	17,394	3,143.21	66.23	56.35	3,732.05	588.85	18.73	10.74	20.90	-46.78
07wet (compared to 05 wet)	32,075	3,022.82	74.26	64.41	4,777.87	1,755.05	58.06	148.02 (22.68)	71.78 (26.62)	55.94 (35.16)
07/08dry	18,966	5,069.38	82.38	122.70	10,108.29	5,038.91	99.40	430.58	746.16	154.63
08wet	36,311	5,086.22	73.60	106.30	7,823.15	2,763.93	53.81	-7.32	177.05	-2.43
08/09dry	20,121	3,704.16	82.25	95.25	7,834.63	4,130.47	111.5	12.18	-44.88	-0.31

Source: Data from the RID Kaeng Khoi office: profit is defined as income minus input.

We also analyze incomes and profits per unit area (rai). Especially, we place an emphasis on the latter. This is because making a high profit efficiently in the agricultural sector is the main political issue required in Saraburi Province, which is well on the way to industrialization, and in Thailand, which is middle income country, in order to promote a shift of

¹¹ The value becomes 100% when water supply is just equal to water demand. The lower value implies the water supply inefficiency: water supply is excess to water demand. Excess water supply does not always good because of the possibility of the drainage problem. Also we have to be careful to the case in which there is water distribution problem and some areas are lack of water even when the total water supply is enough.

labor force from an agricultural sector to an industrial sector while coping with aging labor force in agriculture.

The profit-input ratio greatly increases in both rainy and dry seasons in 2007. Looking at the contribution analysis of the year-on-year profit-input ratio, in which the effects of market condition (price factors) on profit increase are eliminated, it is clear that both input and output positively contribute to the increase of the profit-input ratio in 2007. We, however, should pay attention to the fact that the profit-input ratio in the rainy season in 2006 greatly decreases due to unusual weather condition. Therefore, we next show the contribution analysis in the rainy season in 2007 comparing to the rainy season in 2005¹². Under this calculation, it became clear that not only the price increase but also the improvement of productivity in both input and output positively contribute to the increase of the profit-input ratio in 2007.

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

Economic Internal Rate of Return (EIRR)

Based on the analyses conducted in the appraisal time in 1995 and in the detailed design process in 1999, we re-calculated EIRR by using the latest data on the estimated value of costs and benefits offered by the project implementation agency. The merit of reducing agricultural problems in a middle income country should be taken into consideration as a benefit; however, only the increase of agricultural income is taken into account in this report according to the EIRR calculation policy determined in the appraisal time.

EIRR : 13.2% (at the appraisal) 13.68% (1999)、12.55% (2010)

cost: construction cost, operation and maintenance cost, replacement cost

benefit: increase in farmers' income

project life: 50 years

3.3.2 Qualitative Effects

This project planned to switch main production in the project area from rice crops to vegetables. It also assumed that RID and DOAE (Department of Agricultural Extension) would plan crop diversification and would attempt it in the demonstration farm. However, the demonstration farm for the purpose was not provided, and so crop diversification was not promoted. Rather, there is an inclination to grow only rice crops. At the beginning of the planning stage, this project planned to produce a variety of crops in the project area according to the typical planting model in Saraburi Province. After the project started, however, farmers decided to mainly produce rice crops, which were suitable to the field condition in Kaeng Khoi -

¹² Number in parenthesis in Table 5.

Ban Mo area and were expected to bring in good returns with low input¹³. Vegetables are cultivated only in some parts of the project area, mainly in the upper 7L area. Although vegetable production makes a high profit, farmers can save a lot of work on rice cultivation and can expect more stable sales from rice products since the DOAE set the lowest purchase price¹⁴.

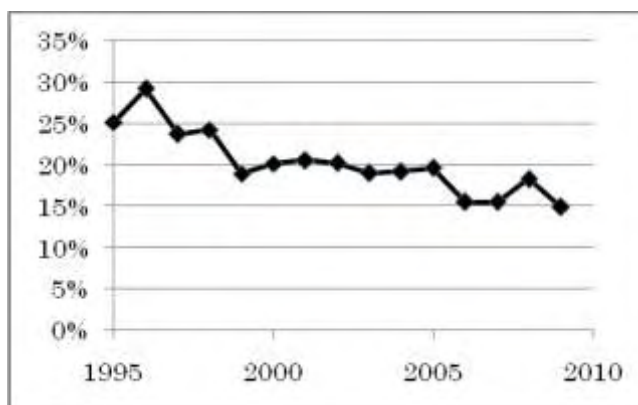
According to the RID officers who are in charge of demonstration farm, the DOAE and any other government agencies were not concerned in the project of product diversification in the farm. The demonstration farm was used only for demonstrating the usefulness of the tertiary canals¹⁵. At the appraisal time, it was an appropriate prospect that crop diversification would be promoted in view of the limited capacity of water supply from the Pasak Jholasit Dam and the project area, which, however, did not assume the farmers' rational behavior mentioned above and also did not take into consideration aging of farmers. Considering the current policy of rice price, the sufficient water supply to the project area and the farmers' rational behavior in aging, it was an unerring judgment that the project did not promote prevalence of technology for vegetable production. It is only natural that almost all farmers are engaged in rice farming. Although it has taken different steps from the planned one, this project greatly contributed to improvement of farmers' life and regional economic development, which were the ultimate purpose of the project.

This project has largely achieved its objectives, therefore its effectiveness is high.

3.4 Impacts

3.4.1 Intended Impacts

In order to evaluate the effectiveness of irrigation water supply, in the section 3.3 we analyzed not only the water supply itself but also the crop diversification and



Source: Data from National Statistical Office Thailand
Figure 5. Employment in agricultural sector/ employment in total (Saraburi province)

¹³ Information in the interview with RID Kaeng Khoi officers and documents in the office.

¹⁴ We did interviews with RID Kaeng Khoi officers and farmers in the project site. Also we interviewed with some agronomists in Thailand which include researchers in Khon Kaen university. According to them, when farmers maximize their profit, they consider not only monetary expenditure but also labor input in their calculation.

¹⁵ By the construction of tertiary canals, farmers can save their labor input to obtain water and increase their profit per input. JICA is conducting impact evaluation for this project at the same time of this evaluation research. Many consultants who were in charge with this project stressed that the construction of tertiary canals are very important in the project. Therefore, JICA decided to do strict impact evaluation in order to test the effect of tertiary canals on productivity. The tentative result of the research suggests us that the effect of tertiary canals on productivity is very small. Production activities are stopped during the construction period and therefore the data for strict evaluation has not been collected yet. By collecting more data, we can examine the effect of tertiary canal on productivity. It is better to keep collecting the data to do strict impact evaluation. We can guess, from the interview with the related persons in the research, that the construction of tertiary canals would contribute to the increase in profit per labor input even in the case of zero productivity effect.

improvement of farmers' life, which are regarded as the impacts of the project.

Although it temporarily increased at the time of the Asian financial crisis, the percentage of the agricultural population in Saraburi Province has smoothly declined to about 15% at the time of evaluation¹⁶. The project area is most industrialized in Saraburi Province, where the elderly people remain in the agricultural sector and the young leaves for the industrial sector. In other words, the economy in that area has shifted to the one in which each household divides household-labor time rationally between industrial and agricultural sectors activities. It is desirable for the households to undertake a policy that does not give rise to friction between industrial and agricultural sectors, which can be realized by achieving high profit-input ratio in agricultural sector. Low income in agriculture has not always been treated seriously. In this sense, this project made meaningful contributions since the irrigation system enabled the farmers in the project area to realize low-input and high-profit rice farming and reduce friction on the decision of how to divide household-labor time between agriculture and other economic activities. In the area, industrialization has paced gradually, not dramatically, being compatible with agriculture to some extent. The farmers' living standard in the area is high, and there seems no big complaint against regional difference¹⁷. It is also true, however, that many farmlands in the project area are cultivated not by a landlord but by a person who lives outside the area and rent the land.

3.4.2 Other Impacts

Regarding the impact of this project on natural environment, at the appraisal time it was concluded that there would be no problem, and we really have not received any report with regard to its problem that we should pay attention to¹⁸.

There was also no problem in the aspects of resident relocation and land condemnation. Actually, it was not necessary to relocate residents, and this project's having a strong connection with the royal project made it easy to come to an understanding about land condemnation from the residents¹⁹.

Judging from yield data, the construction of the tertiary canals seemed to have had no visible impact; however, we infer that promise of tertiary canal construction made it easier for the government to obtain farmers' approval for this project after the government promised that the farmers can use irrigation water more conveniently through the tertiary canals. It became

¹⁶ Note that the calculation is based on provincial data for Saraburi.

¹⁷ When there was a serious social conflict between agriculture and industrial sectors or between urban and rural sectors in 2010 in Thailand, the situation in the project area was modest compared to that in North or Northeast regions.

¹⁸ Environmental assessment was conducted at the appraisal time. All the information about the environmental impact during the project period are from PCR and interview with RID Kaeng Khoi officers.

¹⁹ According to the information in the interview with project related persons, the project area is next to the area which has been benefited from small scaled pumping irrigation project and it was easy for government officers to persuade farmers in the project area the significance of pump irrigation.

clear from an interview survey that both the RID that was in charge of the construction of the tertiary canals and the farmers who utilized it had not expected that the construction of the tertiary canals should have a positive effect on their income. Instead, they considered that its major benefits were to help farmers in using irrigation water more conveniently as compared to plot-to-plot irrigation, and to prevent farmers from coming into a conflict over water distribution. As a result, the construction of the tertiary canals had a positive effect on the formation of the Water Users Groups (WUGs.)

3.5 Sustainability (Rating: a)

3.5.1 Structural Aspects of Operation and Maintenance

The regional office 8, a regional organization of the RID are supposed to manage the main and lateral canals and farmers were supposed to manage the tertiary canals after the completion of the irrigation system. Everything is going well according to plan, although the regional office 10 instead of the regional office 8 actually took charge of the management at the evaluation time due to reorganization of the RID.

The Pasak Jholasit Dam O&M office is positioned under the regional office 10. Under the Pasak Jholasit Dam O&M office, its first and second branch offices are organized in Pattananikom and Pattananikom - Pattananikom Kaeng Khoi and in Kaeng Khoi - Ban Mo, respectively. The coordination between the branches works well under the Pasak Jholasit Dam O&M office.

The WUGs are well organized and have a monthly meeting. Their water management in the tertiary canals is doing very well. All electric fees for irrigation pump in the dry season are paid from the WUGs. Also, there is no big problem in distributing water among farmers. They, however, are not satisfied with water distribution among the WUGs. Under these circumstances, the senior organization that supervises the whole project has meetings from 2008 and started to take measures to reconcile the conflict among the WUGs.

Although we do not grasp the participation rate, there existed 21 WUGs in 2008 and were 1,433 participants in total.

At the evaluation time, the RID Kaeng Khoi office and the WUGs are well communicated. As time goes by, however, some senior members of the WUGs are replaced, and it will make difficult to share information and maintain coordination between the RID Kaeng Khoi office and the WUGs. In an interview survey, some people proposed to establish a national monitoring system in order to maintain the PIM, which could assist in smoothly



Source: Photo taken at the time of field survey

Figure 6. WUGs meeting

adjusting the difference of opinion between the RID Kaeng Khoi office and the farmers' groups²⁰. It would be desirable for the better PIM to take into consideration the cases unique to each region and share experience and information nation-wide.

3.5.2 Technical Aspects of Operation and Maintenance

Although it has only 5 O&M technicians, the RID does not have any big trouble about maintenance of the irrigation systems and water management thanks to the WUGs. They have had no serious problem so far, but it will be a major challenge in future to improve the efficiency of water supply mentioned in Table 4. For that purpose, it is necessary for O&M technicians to grasp how much demand for water there exists and obtain management skills in water supply based on expertise in hydrology²¹.

3.5.3 Financial Aspects of Operation and Maintenance

According to the RID Kaeng Khoi office, it is running short of budget, which, however, is not a serious problem to operate the irrigation system in the present condition.

Although all of those fees are paid from the WUGs, the WUGs do not always collect the electric fees for irrigation pump from all of the beneficiary farmers. It is necessary to improve the system of WUGs further.

3.5.4 Current Status of Operation and Maintenance

The RID has coped with some troubles about management and maintenance of the irrigation system caused right after the completion of the construction and currently has no big problem. There exist some areas that suffered flood damage due to lack of drainage systems, which are, however, only a part of the whole project area. Anyway, the RID has adequately dealt with each problem so far.

No major problem has been observed in the operation and maintenance system, therefore sustainability of the project is high. Therefore, we evaluate the effect of this project is highly sustainable.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project is effectually executed as a supporting project for Saraburi Province in a middle income country, Thailand. Despite the fact that the implementation of the project differs from the plan set in the appraisal, this project has successfully achieved its ultimate goal. Based

²⁰ Information from WUGs members.

²¹ According to the former manager at the RID Kaeng Khoi office, current staffs at the office have high ability in O&M activities and there is no problem in maintaining the project. It, however, is necessary to have training sessions to obtain higher ability in the management.

on the current evaluation criteria that emphasize consistency between the plan and actual implementation, we cannot evaluate the relevance of this project as high; however, this project can receive a high evaluation rating in the sense that the project was not bound by plan but was appropriately managed under the change in circumstances. The problem exists not in the implementation but in the plans in the appraisal. In light of the above, this project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 To Royal Thai Government

The project implementation agency should monitor the management in each regional office in order to maintain the PIM and should share its experience and information nation-wide.

4.2.2 To JICA

JICA should conduct impact evaluation for this project continuously, collect the data over the years and discuss how project evaluation should be utilized.

4.3 Lessons Learned

The economic development support project should not only aim at poverty reduction and income growth, but also take into consideration the fact that suitable agricultural policies change according to the stage of economic development in the project area.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1.Project Outputs	<p><u>Construction</u></p> <ul style="list-style-type: none"> - irrigation pump (7、17.08cms) - canals(145.20km) - canal related equipments - drainage(97.66km) - demonstration farm (260ha) - electric cable (5km) <p><u>maintenance equipments</u> omit</p> <p><u>Consulting services</u> foreign 109M/M local 165.5M/M</p> <p>detailed design (redesign for KKBM, D/D for Pattananikom and Pattananikom Kaeng Khoi)</p>	<p>Construction</p> <ul style="list-style-type: none"> - as planned - 125.79766km - Details are in PCR - 74.9756km - - 640ha - As planned <p>As planned</p> <p>As planned</p>
2.Project Period	September 1995 - November 2001 (81 months)	September 1995 - June 2005 (119 months)
3.Project Cost		
Amount paid in Foreign currency	3,038 million yen	1,799 million yen (PCR)
Amount paid in Local currency	2,498 million yen (690 million baht)	1,936 million yen (789 million baht)
Total	5,536 million yen 3,038 million yen	3,607 million yen 1,675 million yen
Japanese ODA loan portion	1 baht = 3.62yen (As of September 1995)	1 baht = 2.454yen (PCR)
Exchange rate		

Column 1: Income from dry season rice cultivation

The major objectives of irrigation projects are: (i) to make it possible to cultivate in the areas where it is impossible to cultivate only by rainwater, (ii) to secure water stably even with the lack of precipitation, and (iii) to solve the problems of water distribution in plot-to-plot irrigation and easily distribute water among farmers. The achievement of the objective (i) can be easily observed and evaluated. Now, what can we say about the objectives (ii) and (iii)? In this column, we shall discuss these based on the impact evaluation for this project.

Actually, we cannot make the evaluation for the objective (ii) clear at the present moment since the data is available for only the first one year. From the one-year data, we only mention regarding the objective (iii).

According to the interview with the RID officers in 2006, the objective (iii) should have been important in this project. The tertiary canals should have made plot-to-plot irrigation unnecessary and enabled farmers to secure water stably. They expected that agricultural production would increase thanks to the tertiary canals because output is sensitive to small adjustments in water supply right after the planting period, and the tertiary canals made it easier to control water supply.

However, the tentative result from the impact evaluation shows that the effect of the tertiary canals should not be overestimated.

	min	0.25	median	0.75	max	average	Standard deviation	NA	sample
size (rai)	1	12	20	37	390	27.529	25.691	0	504
income per rai	161.6	7070	8080	8585	262600	11241.653	22228.841	0	504
water source									
rainfall	101	6367.391	8080	8080	50500	8545.063	8087.202	439	504
KKBM	202	7070	8080	8712.051	262600	11619.986	23801.273	77	504
tambon	3838	7070	8080	8963.75	10100	7714.476	1692.005	490	504
cooperative	5941.176	7015.893	7575	8080	60600	9715.825	10869.451	480	504
canal									
main canal	2020	7070	8080	8945.714	262600	16296.556	38555.248	431	504
lateral canal	2335.12	7070	8080	8963.75	232300	11755.283	29528.56	446	504
sub lateral canal	101	7070	8080	8669.167	202000	11263.425	18856.647	315	504
earth ditch	774.333	7070	8080	8585	93167.347	8961.34	10036.384	423	504
tertiary canal	5050	7070	8080	8585	121200	10068.116	16603.182	457	504
plot to plot	4208.333	7070	8080	9090	80800	9742.083	10653.606	432	504

The table above shows that there is almost no difference in income per rai between the case with tertiary canals and the one without them. Looking at the average income in each group, there certainly is a big difference. This is because each group has different exceptional data and such extremely high- or low-income data have a large effect on the average income. On the other hand, the 25th percentile, median and 75th percentile of income in each group are almost equal. This means that the middle part of the income distribution in each group is similar. Therefore, we can tentatively conclude that the tertiary canals have no significant effect on income increase unless we take into consideration the cost of adjustment for water distribution in plot-to-plot irrigation or evaluate from the perspective of the objectives (ii) and (iii).

Column 2: Summary of Impact Evaluation

Under the commission from JICA, we conducted a four-round household survey from 2009 to 2010 to estimate the impacts of Kaeng-Khoi Ban Mo (KKBM) Pump Irrigation scheme. Total of 826 households were selected and interviewed. As primary and secondary canals were already in operation at the time of survey, we focused on the impacts of tertiary canals.

It is well known that impact evaluation of infrastructure is difficult. This is due to difficulty in randomization and broad spillover of program impacts that effectively wipes out the control group. Our focus on the tertiary canal was strategically determined in light of these difficulties: First, tertiary canals are partially constructed and we could expect to employ plot-level difference-in-differences (DID) estimator. Ordering of tertiary canal construction was determined administratively, started from the closest area to the pump to the furthest. This ordering is expected to be uncorrelated with farmer ability, and provides credible ground for implementing DID estimator. Second, small program impacts due to limited capacity of tertiary canals to serve plots allow us to find the control group within the irrigation scheme. The availability of control group in the neighborhood of the treated group lends support for credible impact evaluation.

DID estimates of all crop profits indicate large impacts of tertiary canals. Depending on estimation equation specifications, impacts range from 68,663 - 70,316 Bahts in 2009 dry season, 44,712 - 45,693 Bahts in 2009 wet season, and 62,276 - 62,930 Bahts in 2010 dry season, although 2009 wet season impacts are not statistically significant. These large impacts can be conceptually divided to two steps: First, farmers began to utilize the previously uncultivated plots in the dry seasons. Tertiary impacts on cultivation probability are large, an increase of 20% - 30% points in dry seasons (all tertiary canals) and an increase of 10% points in wet seasons (only concrete tertiary canals). Second, conditional on cultivation, accessibility to tertiary canals provides equally large profits as cultivated control plots, and accessibility *per se* does not seem to give extra profitability over the cultivated control group plots. Estimated

results are robust to various specification changes.

The results confirm that the initial goal of the project in increasing land use intensity is achieved successfully. However, it is achieved under shrinking irrigated area due to industrialization and urbanization that allowed RID to operate at low irrigation efficiency with limited water supply capacity. With modest productivity and profitability impacts of tertiary canals conditional on cultivation, tertiary canal construction in KKBM is best described as having an encouragement impact.

While tertiary canals' impacts on profits are positive and statistically significant in KKBM, one should not conclude that JICA should always invest in the future tertiary canal projects. One must be reminded that there are conditions that helped KKBM tertiary canals to have impacts at plot level: smaller pressure on water supply capacity due to shrinking command area in the face of industrialization and urbanization, existence of uncultivated plots in dry seasons, good relationship between RID and farmers, and well governed and well functioning WUGs. In the future tertiary irrigation projects, one is advised to compare with KKBM if similar conditions exist. In addition, as it requires fine tuned consensus in constructing tertiary canals, it is recommended to assist WUGs and government officers in providing capacity boosting training and operations to increase their governance abilities.

Given the general aversion towards impact evaluation of infrastructural projects by other donors, it is recommended that JICA to continue its evaluation of infrastructure projects for its unique contribution to the knowledge base of development policies. Under the general infeasibility of randomized control trials of infrastructure, use of triple difference estimator is expected to ameliorate endogeneity issues to some extent, which can be achieved by conducting baseline survey two periods ahead of project operation. Feasibility studies can be used as a part of baseline, whose contents can also be used for policy development to give immediate feedback even before the project becomes operational. Use of feasibility studies for evaluation and policy development requires closer collaboration between operation department and evaluation department within JICA.