Thailand

"Small Scale Irrigation Programme (IV) ～(VI)"

Project Summary

Borrower	Kingdom of Thailand		
Executing Agency	Ministry of Agriculture and Cooperative, Royal Irrigation Department (RID)		
	IV	V	VI
Exchange of Notes	June 1983	July 1984	September 1985
Date of Loan Agreement	September 1983	September 1984	October 1985
Final Disbursement Date	September 1988	September 1989	October 1990
Loan Amount	¥7,310 million	¥6,900 million	¥5,293 million
Loan Disbursed Amount	¥6,707 million	¥5,787 million	¥4,448 million
Procurement Conditions	General untied (Partial untied for consulting portion)	General untied (Partial untied for consulting portion)	General untied (Partial untied for consulting portion)
Loan Conditions			
Interest Rate:	3.00%	3.500%	3.500%
Repayment Period	30 years (10 years for grace period)	30 years (10 years for grace period)	30 years (10 years for grace period)

<Reference>

1. Currency: Baht

2. Exchange Rate and Consumer Price Index

	1983	1984	1985	1986	1987	1988	1989	1990
¥/US$	237.51	237.52	238.54	168.52	144.64	128.15	137.96	144.79
Baht/US$	23.000	23.639	27.159	26.299	25.723	25.294	25.70	25.114
¥/Baht	10.327	10.048	8.783	6.408	5.623	5.066	5.368	5.765
Consumer Price Index	80.0	80.7	82.7	84.2	86.3	89.6	94.4	100

(Source) IFS materials

3. Fiscal Year: October 1 ~ September 30

[Abbreviations]

MOAC : Ministry of Agriculture and Cooperative

RID : Royal Irrigation Department

SSIP : Small Scale Irrigation Project

SAPS : Special Assistance for Project Sustainability

RCR : Project Completion Report

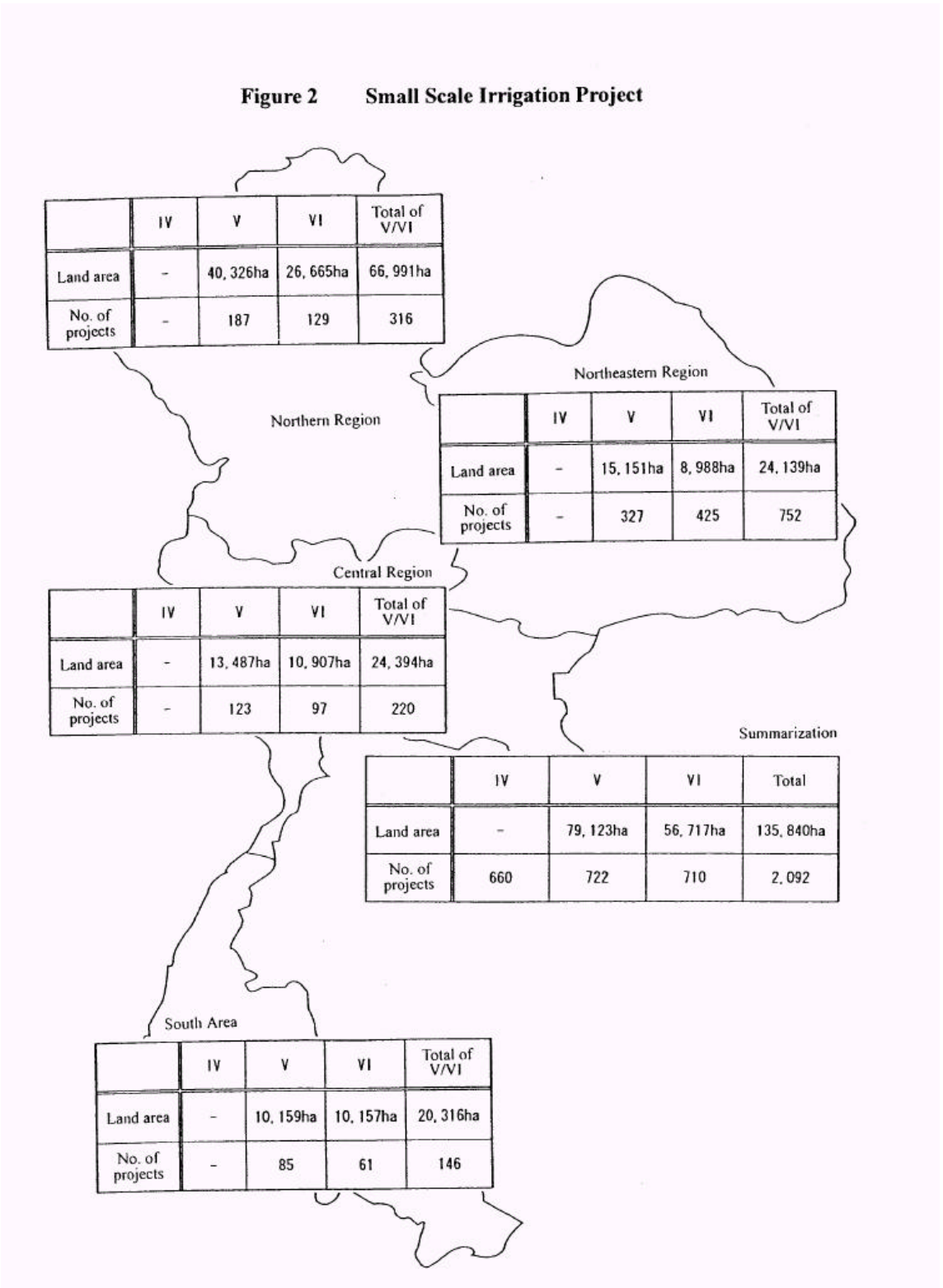
1. Project Summary and Comparison of Original Plan and Actual

1.1 Project Location

The project location covers the entire nation of Thailand, with a concentration on the northeastern part of the nation, where agriculture is particularly active. (See Figure 1 and Figure 2)

Figure II-1 General Map of Project Location

Figure 2 Small Scale Irrigation Project



	IV	V	VI	Total of V/VI
Land area	-	40, 326ha	26, 665ha	66, 991ha
No. of projects	-	187	129	316

	IV	V	VI	Total of V/VI
Land area	-	15, 151ha	8, 988ha	24, 139ha
No. of projects	-	327	425	752

	IV	V	VI	Total of V/VI
Land area	-	13, 487ha	10, 907ha	24, 394ha
No. of projects	-	123	97	220

	IV	V	VI	Total
Land area	-	79, 123ha	56, 717ha	135, 840ha
No. of projects	660	722	710	2, 092

	IV	V	VI	Total of V/VI
Land area	-	10, 159ha	10, 157ha	20, 316ha
No. of projects	-	85	61	146

1.2 Project Summary and ODA Loan Portion

This project is designed to build a large number of small-scale irrigation facilities mainly in agricultural areas that do not benefit from middle- and large-scale irrigation facilities, and it aims to secure daily life water for irrigation, stockbreeding, and fish farming in order to increase agricultural production and promote the development of farming villages. The JBIC (OECF at the time) loan covered the entire foreign currency portion of this project.

1.3 Background

1.3.1 State of Agriculture, Forestry, and Fishing Industries at the Time

The agriculture, forestry, and fishing industries of Thailand in 1981 constituted 21.3% of the GNP, representing the second sector after manufacturing (22.6%). The agriculture, forestry, and fishing industries of Thailand represented 60.1% of the nation's total export value and constituted its largest source of revenues. Furthermore, these industries accounted for 70.4% of the nation's employed working force, an overwhelming majority. But although the agriculture, forestry, and fishing industries are positioned as Thailand's main industries, they nevertheless face many problems, foremost among which are the following.

(1) Stagnating agricultural income and regional income disparity
(2) High unemployment rate of agricultural laborers (during the dry season)
(3) Limit to expansion of arable land
(4) Lower productivity rate and slow diffusion of agricultural technology
(5) Low enthusiasm among farmers about learning about agricultural technology

The Thai government has been working to increase and stabilize agricultural productivity through the diffusion of irrigation projects, and in the Five-Year Plan from 1982 to 1986, it has allocated 34.950 billion Baht (349.5 billion yen) for irrigation-related projects, of which 35.8% or 12.5 billion Baht (125 billion yen) are earmarked for small-scale irrigation development projects. The project objectives are to build a number of small-scale water supply facilities in agricultural areas that do not have the benefit of large-scale water-supply facilities in order to stimulate irrigation, stockbreeding, and fish farming, increase and stabilize agricultural production, promote agricultural development, and secure daily life water, so as to reduce income disparity with cities. This project forms the core of regional development and agricultural development, the areas on which the Thai government is making the greatest efforts.

1.3.2 Positioning of Small Scale Irrigation Project

Phase I of the Small Scale Irrigation Project began from 1977 with the 4th 5-Year Plan (1977 to 1981), and by the time this project, which corresponds to Phase II, began, small-scale irrigation facilities (reservoirs, levees, water volume adjustment facilities, etc.) had already been constructed

at 2,345 locations throughout Thailand.

Table 1 Number of Constructed Facilities for Phase I (1977 – 1982) Small Scale Irrigation Project

No. of facilities / Area	FY1977 (number)	FY 1978 (number)	FY 1979 (number)	FY 1980 (number)	FY 1981 (number)	FY 1982 (number)	Total of 6 years (number)	Percentage by region (%)
North	87	61	105	112	120	121	606	25.8%
Northeast	62	241	218	253	232	242	1,248	53.2%
Central	16	30	52	66	88	52	304	13.0%
South	4	19	33	40	50	41	187	8.0%
Total	169	351	408	471	490	456	2,345	100.0%

A total of 14.25 billion yen divided into 3 loans was given for Phase I of the project (Small Scale Irrigation Projects (1) to (3)), and this sum was mainly used for the purchase of construction equipment required for the construction of new irrigation facilities. In Phase II, which corresponds to this project, the ODA loan was mainly used for the procurement of civil works materials, construction machinery, and spare parts.

1.3.3 History

Following Small Scale Irrigation Projects (1) to (3), this project was implemented divided into three stages, (4), (5), and (6). The history of phases (4) to (6) is as follows.

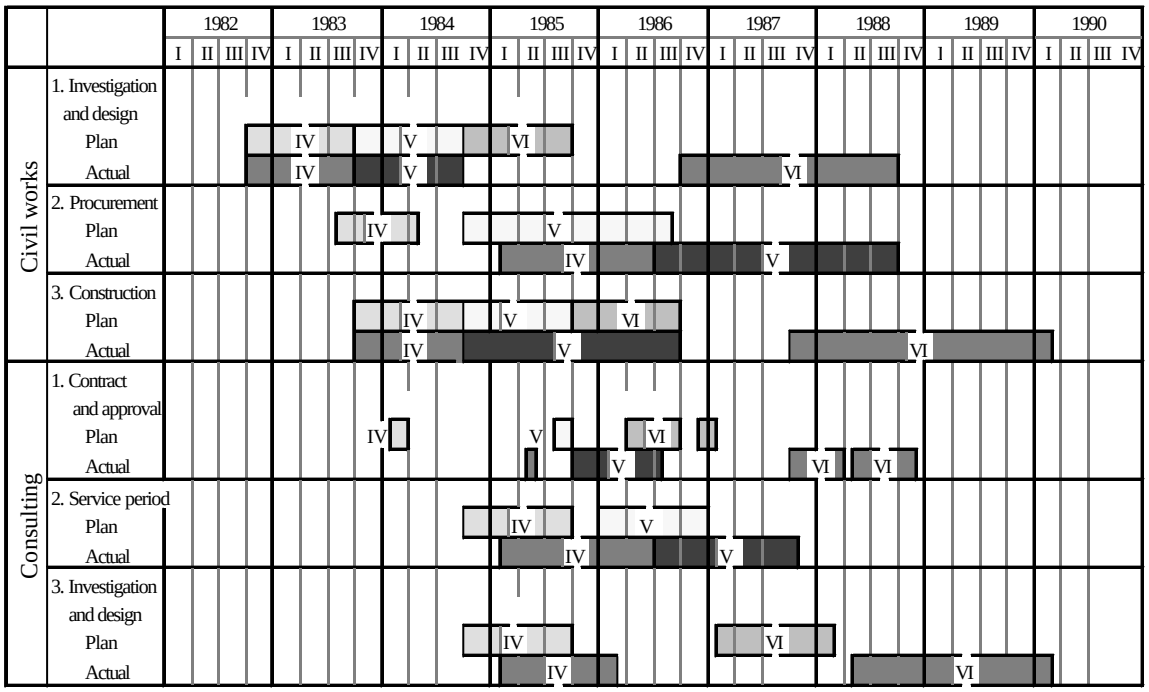
1982	December	Request of Small Scale Irrigation Project (4) as a candidate project of the 10th ODA Loan by Thailand
1983	Jan. ~ Feb.	Visit to Thailand by government mission and JBIC Appraisal Mission
1983	June	Exchange of Notes
1983	September	Loan Agreement signing of Small Scale Irrigation Project (4)
1984	January	Request of Small Scale Irrigation Project (5) as a candidate project of the 11th ODA Loan by Thailand
1984	Feb. ~ Mar.	Visit to Thailand by government mission and JBIC Appraisal Mission
1984	July	Exchange of Notes
1984	September	Loan Agreement signing of Small Scale Irrigation Project (5)
1984	December	Request of Small Scale Irrigation Project (6) as a candidate project of the 12th ODA Loan by Thailand
1985	Feb.~ Mar.	Visit to Thailand by government mission and JBIC Appraisal Mission
1985	September	Exchange of Notes
1985	October	Loan Agreement signing of Small Scale Irrigation Project (6)

1.4 Comparison of Original Plan and Actual

(1) Project Scope

Project period / Project description	SSIP(4)		SSIP(5)		SSIP(6)	
	Plan	Actual	Plan	Actual	Plan	Actual
I.1 Civil works by facility						
Reservoir (number)	245		250	348	249	412
Levee (number)	190		195	233	195	221
Water volume adjustment facilities (number)	65		55	141	56	79
Total (number)	500	660	500	722	500	712
I.2 Civil works by area						
North (number)	114		125	187	125	129
Northeast (number)	255		250	327	250	425
Central (number)	81		75	123	75	97
South (number)	50		50	85	50	61
Total (number)	500	660	500	722	500	712
II. Consulting Service 1.Technical service for this project						
Foreign (M/M)	109	62	54	34.43	32	26.50
Domestic (M/M)	94	?	36	19.07	15	17.63
Total (M/M)	203	?	90	53.50	47	44.13
2.Technical service for future						
Foreign (M/M)	-		-		12	8
Domestic (M/M)	-		-		15	9
Total (M/M)	-		-		27	17

(2) Implementation Schedule



(Source: PCR)

(3) Project Cost

Comparison of Original Plan and Actual for SSIP (4) Project Cost

Item	① Plan (at the time of appraisal)		② Actual		Difference (②—①)	
	Foreign currency (¥ million)	Local currency (million Baht)	Foreign currency (¥ million)	Local currency (million Baht)	Foreign currency (¥ million)	Local currency (million Baht)
I. Civil works	5,562	988.8	5,244.8	1.062.4	▲317.2	+73.6
(1. Reservoir)	(3,107)	(431.9)	(2,720.0)	(530.4)	(▲387)	(+98.5)
(2. Levee)	(1,763)	(427.4)	(1,904.0)	(360.0)	(+14.1)	(▲67.4)
(3. Water volume adjustment facility etc.)	(692)	(129.5)	(800.8)	(172.0)	(+108.8)	(+42.5)
II. Construction machinery etc.	1,440	0.5	1,162.3	0.5	▲277.7	0
III. Consulting service	308	10.2	119.7	-	▲188.3	▲10.2
IV. Other management fees	-	100.1	—	104.8	-	+4.7
Total	7,310	1099.6	6,706.8	1,167.7	▲603.2	+68.1

(Note) 1. The entire foreign currency portion is covered by ODA loan.
2. Exchange rate: 1 Baht = ¥10 (1982) at the time of calculation, Actual 1 Baht = ¥8.3 (January 1994)

Comparison of Original Plan and Actual for SSIP (5) Project Cost

Item	① Plan (at the time of appraisal)		② Actual		Difference (②−①)	
	Foreign currency (¥ million)	Local currency (million Baht)	Foreign currency (¥ million)	Local currency (million Baht)	Foreign currency (¥ million)	Local currency (million Baht)
I. Civil works	6,016	1,002.4	5,225	1,067.65	▲791	+65.25
(1. Reservoir)	(3,324)	(481.9)	(2,659)	(543.36)	(▲665)	(+61.46)
(2. Levee)	(2,023)	(418.6)	(1,840)	(357.88)	(▲183)	(▲60.72)
(3. Water volume adjustment facility etc.)	(680)	(100.4)	(726)	(148.41)	(+46)	(+48.01)
II. Construction machinery etc.	714	0.5	479	0.5	▲235	0
III. Consulting service	170	3.7	83	1.76	▲87	▲1.94
IV. Investigation and design by RID		23.0	-	23.0	-	0
V. Other management fees etc.	-	38.3	-	58.20	-	+19.9
Total	6,900	1,067.9	5,787	1,151.11	▲1,113	+83.21

(Note) 1. The entire foreign currency portion is covered by ODA loan.
2. Exchange rate: 1 Baht = ¥10.1 (1983) at the time of calculation, Actual 1 Baht = ¥8.3 (January 1994)

Comparison of Original Plan and Actual for SSIP (6) Project Cost

Item	① Plan (at the time of appraisal)		② Actual		Difference (②−①)	
	Foreign currency (¥ million)	Local currency (million Baht)	Foreign currency (¥ million)	Local currency (million Baht)	Foreign currency (¥ million)	Local currency (million Baht)
I. Civil works	4,729	891.1	4,377	1,013.33	▲352	+122.23
(1. Reservoir)	(2,579)	(435.1)	(2,064)	(477.76)	(▲515)	(+42.66)
(2. Levee)	(1,616)	(372.1)	(1,847)	(427.76)	(+231)	(+55.66)
(3. Water volume adjustment facility etc.	(534)	(83.9)	(466)	(107.81)	(▲68)	(+23.91)
II. Procurement	-	0.5	-	-	-	+0.5
III. Investigation and design	-	25.3	-	27.41	-	+2.11
IV. Tax	-	44.0	-	34.70	-	▲9.3
V. Management fees	-	12.0	-	6.71	-	▲5.29
VI. Contingency	458	88.9	-	-	▲458	▲88.9
VII. Consulting service	106	5.0	71	3.61	▲35	▲1.39
Total	5,293	1,066.8	4,448	1,085.76	▲845	+18.96

(Note) 1. The entire foreign currency portion is covered by ODA loan.
2. Exchange rate: 1 Baht = ¥9.1 (1985) at the time of calculation, Actual 1 Baht = ¥5.31 (September 1995)

2. Analysis and Evaluation

2.1 Evaluation on Project Implementation

2.1.1 Project Scope

(1) Components

The project contents consisted principally of civil works, consulting services, and the procurement of construction machinery. The machinery procured for SSIP (IV) consisted of construction machinery such as bulldozers and equipment for repairs. That procured for SSIP (V) consisted of spare parts for the construction machinery procured in Phase I. No construction machinery nor spare parts were procured for SSIP (VI), and the loan was used only for civil works and consulting services.

(2) Changes in Project Scope

The application method for a small scale irrigation project is for the future beneficiary (farmers' association) to submit an application, which is then agreed upon and approved at the village level, after which it undergoes a review process at the district and prefecture level. Applications that have made it this far are then submitted to Water Resources Development Promotion Coordination Committee. This committee finalizes the areas where projects are to be implemented, the project amounts, and the budget ranges from among the project applications received from each district and prefecture level, and allocates the implementation of projects to the various executing agencies[1], including RID. A number of standards are employed in the small scale irrigation project selection process, the main ones being the maximum construction cost for one project (2 million Baht in 1980, 4 million Baht in 1982, 10 million Baht in 1992, and currently 15 million Baht), and the construction period (which used to be one year maximum, including the survey, design, and actual construction, but the construction period was later revised to one year maximum). Moreover, the system is characterized by the fact that the one-fiscal year unit is used as the time unit (Even if the implementation schedule lasts 1 year or less, the project is not accepted if it straddles two fiscal years.)

Under this bottom-up project selection process, differences between project plans and actual performance are unavoidable. The main changes in the project scope for SSIP (IV) to SSIP (VI) for this project are described below. In all cases, the civil works costs fell within the planned amount, and it was possible to increase the number of facilities constructed.

[1] The government agencies related to small scale water resources development number 16, as follows. (1) RID, (2) Public Works Dept., (3) Mineral Resources Dept., (4) National Energy Agency, (5) Local Administrative Dept., (6) Social Development Dept., (7) Land Development Dept., (8) Regional Development and Promotion Dept., (9) Domestic Safety Council, (10) Agricultural Reform Section, (11) Health Dept., (12) Farmers Support Mobile Unit, (13) Agricultural Cooperative Promotion Dept., (14) Public Welfare Dept., (15) Fisheries Dept., (16) Prefectural Administration Dept.

	Major Changes	Reasons for Changes
SSIP (IV)	- Under the initial plan, small-scale irrigation facilities were to be constructed at approximately 500 locations, but actually such facilities were constructed at approximately 660 locations. - An overseas study tour of RID employees that had been planned as part of the consulting services was cancelled.	- Civil works costs were lower than initially estimated, and therefore it was possible to construct small-scale irrigation facilities at more locations. (Average construction cost per location was 2.54 million Baht.) - Per the policy of the Ministry of Finance of Thailand, ODA loans cannot be applied to overseas training of civil servants.
SSIP (V)	- Under the initial plan, small-scale irrigation facilities were to be constructed at approximately 500 locations, but actually such facilities were constructed at 722 locations. - An overseas study tour of RID employees that had been planned as part of the consulting services was cancelled.	- Civil works costs were lower than initially estimated, and therefore it was possible to construct small-scale irrigation facilities at more locations. (Average construction cost per location was 2.348 million Baht, as compared to estimated cost of 3.196 million Baht.) - Same reason as above.
SSIP (VI)	- Under the initial plan, small-scale irrigation facilities were to be constructed at approximately 500 locations, but actually such facilities were constructed at 712 locations.	- Civil works costs were lower than initially estimated, and therefore it was possible to construct small-scale irrigation facilities at more locations.

2.1.2 Implementation Schedule

Regarding construction for SSIP (IV), projects whose completion during FY84 (October 1983 to September 1984) were implemented as projects during FY85 (October 1984 to September 1985). Similarly in the case of SSIP (V), construction was divided between FY85 and FY86. As previously mentioned, small-scale irrigation projects have been implemented continuously since 1977, and following this project, implementation of similar projects is to go on continuously through budget measures by the Thai government. Moreover, since the projects are implemented divided by fiscal year, the construction delay incurred for SSIP (IV) and SSIP (V) is not considered to represent a problem in particular.

On the other hand, the implementation of the SSIP (VI) project was temporarily frozen due to a

revision of all foreign currency loans by the Thai government at the end of 1985. Although the project was resumed in 1987 at the request of the RID, there were only few projects for which completion was forecast during FY88 (October 1987 to 1988), and the majority of projects were resumed from FY89 (October 1988 to September 1989). The SSIP(6) construction project unavoidably had to be completed with a great delay in February 1990.

This delay was mainly caused by delays in the selection of the consultants and tendering procedures. The procurement items consisted mainly of construction and repair equipment and spare parts, and the procurement delays are a point that should be improved since they greatly affect civil work.

A summary of the major changes in the implementation schedule of this project is provided in the following table.

	Changes	Reasons for Changes
SSIP (IV)	Construction was delayed by 1 year, and procurement by approximately 2 years compared to the initial plan.	① The number of implemented constructions was increased. ② The selection of the consultants was delayed.
SSIP (V)	Construction was delayed by 1 year, and procurement by approximately 2 years compared to the initial plan.	① The number of implemented constructions was increased. ② Ratification of the contract took 8 months.
SSIP(VI)	Construction start was delayed approximately 3 years.	Per the policy of the Thai government, the use of ODA loans for the SSIP program for 1986 was temporarily frozen (1985). Thereafter, upon request by the RID, the use of ODA loans was allowed again (1987), and this ODA loan was used for the 1988 and 1989 portions.

2.1.3 Project Cost

The major changes in the construction costs in SSIP (IV) to SSIP (VI) are listed the following table. In all cases, the actual foreign currency amount that was used was lower than the initially planned amount, while the local currency portion exceeded the initially planned amount.

	Changes	Reasons for Changes
SSIP (IV)	Foreign currency amount was 8.2% lower and local currency amount was 6.2% higher than initially planned.	① Foreign currency portion was reduced due to high yen. ② The increase in the local currency portion was due to a rise in the number of constructed irrigation facilities.
SSIP (V)	Foreign currency amount was 16.2% lower and local currency amount was 7.8% higher than initially planned.	① At the time of the planning, 1 Baht = 10.1 yen, but during the construction implementation period, the yen rose, changing the exchange rate to 1 Baht = 8.33 yen. As a result, the civil work cost, which had been estimated at 6,016 million yen, was actually 5,225 million Baht, and the construction machinery and spare parts procurement cost, which had been estimated at 714 million yen, was actually 474 million yen. ② Since the start of consulting services was delayed, M/M was shrunk. ③ The increase in the local currency portion was due to the increase in the number of constructed irrigation facilities.
SSIP (VI)	Foreign currency amount was 16% lower and local currency amount was 1.8% higher than initially planned.	① At the time of planning, the exchange rate was 1 Baht = 9.1 yen, but the yen rose to 5.31 against the Baht, and it became possible to increase the number of irrigation facilities to 712 locations compared to the initially planned number of 500. Civil work costs, which were initially estimated at 4,720 million yen for the foreign currency portion, and 891.1 million Baht for the local currency portion, turned out to be actually 4,372 million yen and 1,013.33 million Baht. ② The increase in the local current portion was due to the larger number of irrigation facilities that were built.

As described above, facilities exceeding the initially planned number were constructed for SSIP (IV) to SSIP (VI), and no problem is considered to exist with regard to both foreign currency and local currency expenses.

2.1.4 Implementation Scheme

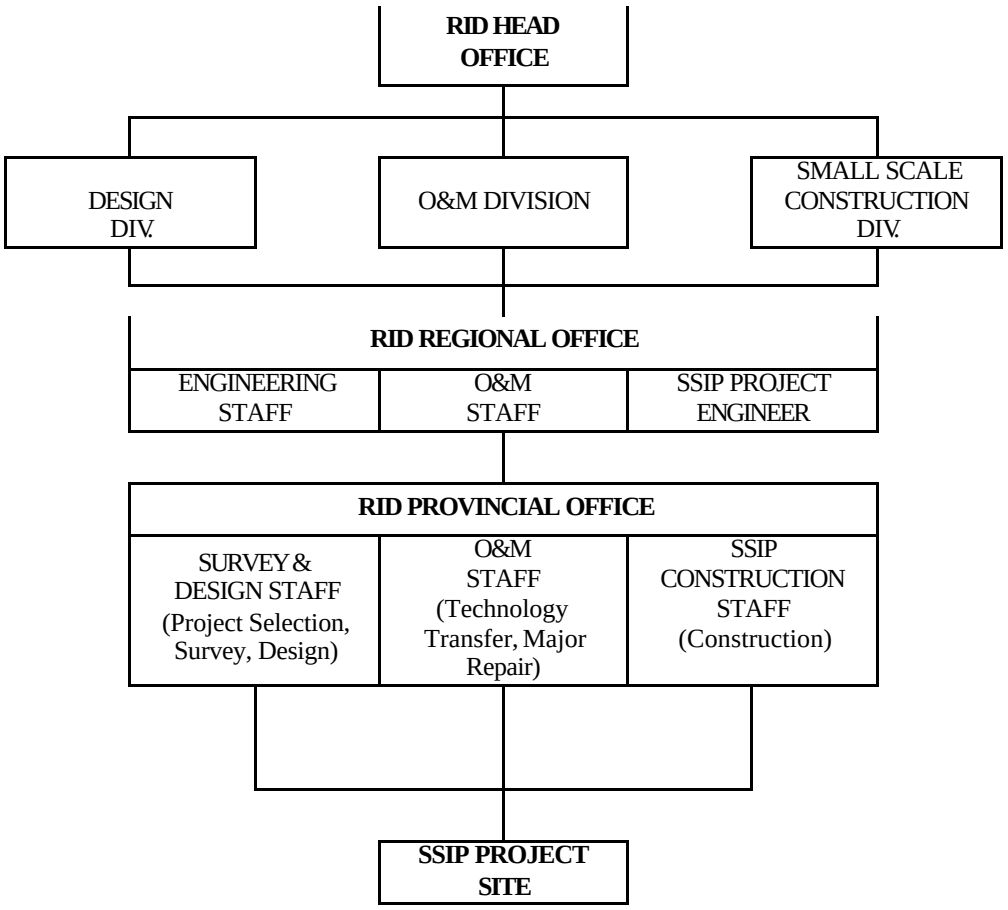
(1) Executing Agency

The executing agency for this project is the Royal Irrigation Department (RID) of the Ministry of Agriculture and Cooperatives (MOAC). Since it was established, the RID has had experience with the implementation of large-scale and medium-scale irrigation construction projects, and its technological capabilities are sufficient for the implementation of SSIPs. However, at the time of the SSIP's first phase project start in 1977, the RID was given only project expenses and a budget frame, and no personnel and system for the implementation of SSIPs, and construction machinery was also in short supply. Therefore, the RID began to work on developing this organization, preparing systems, and developing implementation methods at the same time it was implementing SSIPs. Up to the present time, the RID has implemented more than 8,500 small-scale irrigation projects, and it is judged that, through this experience, it has satisfactorily provided an organization and systems for promoting projects. A comparison of the situation in 1989 and 1998 shows that the number of regular employees increased approximately 10% to 8,539, and employed workers increased approximately 30%, to 45,868. On the other hand, the budget increased about 3.3 times, to 30.6 billion Baht.

In the beginning, the RID's Small Scale Irrigation Construction Department was in charge of SSIPs, but in 1981, the RID established the SSIP Project Office, which started performing management and coordination of SSIPs on a concentrated basis. The 12 regional RID offices have SSIP construction corps and construction centers, and are in charge of SSIP surveys, construction, and the maintenance of constructed facilities (part of the construction work is performed using leased equipment). Design is performed by the RID Headquarters Design Department. In 1986, there were about 6,000 SSIP-related engineers and employees. The implementation scheme is considered to be largely functioning satisfactorily, and the implementation capabilities of the RID are highly rated.

Figure 4 shows an organization chart of the RID in 1985.

Figure 4 Organization Chart for RID



(2) Consultants

Since the Japanese consultants were hired using the short-list method for Small Scale Irrigation Project (SSIP) (1), consultants have been systematically hired from the same company for Phase I projects SSIP(2) and (3), as well as SSIP(4) to (6), which constitute this project. The contents of the consulting services for SSIP (4) to (6) are as follows.

	Consultant Work Plan	Consultant Work Contents
SSIP (IV)	Overseas: 109 M/M Domestic: 94 M/M	(a) Work related to tender for machinery and equipment (b) Project maintenance and accomplishment evaluation (c) Data processing using computers (d) Cooperation and support for overall implementation of project including training of staff on Thai side (e) Survey and design work for candidate project locations
SSIP (V)	Overseas: 54 M/M Domestic: 36 M/M	(a) Implementation and monitoring of construction management, maintenance, and operational planning (b) Cooperation and support for overall implementation of project including training of staff on Thai side
SSIP (VI)	Overseas: 44 M/M Domestic: 30 M/M	(a) Implementation and monitoring of construction management, maintenance, and operational planning (b) Project maintenance and accomplishment evaluation (c) Support for drafting of future plans, etc.

The contents of consulting work gradually shifted from technical aspects to "software" aspects. The hiring of consultants ended with SSIP (VI) and in subsequent SSIP projects, the RID is smoothly performing construction management, maintenance, and monitoring based on the know-how it obtained from consultants. The executing agency highly evaluates the consultants.

2.2 Evaluation on Operations and Maintenance

2.2.1 Operations and Maintenance Scheme

In small-scale irrigation projects, responsibility for equipment maintenance has been transferred to the prefectural government, and will ultimately be transferred to the beneficiaries (irrigation associations) with technology transfers from the RID. Therefore, the role of the RID following the construction of irrigation facilities will be limited to performing major facility repairs and providing technical advice regarding the use of facilities to farmers. The major facility repairs and advice to farmers by RID is provided by operation and maintenance (O&M) engineers belonging to the 12 regional RID offices. Based on this role of the O&M engineers, the RID is required to perform the implementation planning for the efficient management and operation of irrigation facilities, and it has been fulfilling this function since 1983. Also, in 1984, Mobile Repair Units (MRU) and Mobile Campaign Units (MCU) were established as part of the RID to promote efficient repairs and ensure the penetration of SSIP responsibilities, tasks, water usage planning, etc., to farmers. Until now, 15 MRUs and 12 MCUs have been established under the regional RID offices.

Since, as mentioned earlier, the responsibility for SSIP maintenance will be ultimately transferred to beneficiary groups, engineers involved in the design and construction of RID SSIPs exceeded 6,000 in 1986, while during the same period, technicians and engineers for the operation and maintenance

of facilities numbered just 327, broken down into 193 engineers and 134 technical staff. Even adding to these 177 non-technical staff and 1,478 non-technical employees, operation and maintenance workers totaled 1,982.

2.2.2 Operations and Maintenance

Regarding post project operation and maintenance (O&M), the implementation scheme and implementation plan were not always clearly established during Phase I (1977 to 1981), and constituted one of the SSIP themes. However, during Phase II (1982 to 1986), Post Project O&M strengthening was promoted based on the RID implementation plan established along government policies. According to this implementation plan, the operation of SSIP facilities was transferred to prefectural governors based on a cabinet council decision in March 1981, and beneficiary groups (irrigation associations) became responsible for facilities operation within the range of their respective capabilities. According to the specifications stipulated in the "Prime Minister's Office Rules on Water Usage and Maintenance of Small Scale Water Resources Development Projects" of July 1982, committees at the village, district, and prefectural levels are to register all projects and administer water usage and management. The foremost responsibility lies with beneficiary-related committees, and the prefectural governors and district leaders are thus invested with the responsibility to manage, monitor, and evaluate water usage. On the other hand, government agencies related to the promotion of agriculture are responsible for providing suitable advice and technical support to beneficiary groups and related committees.

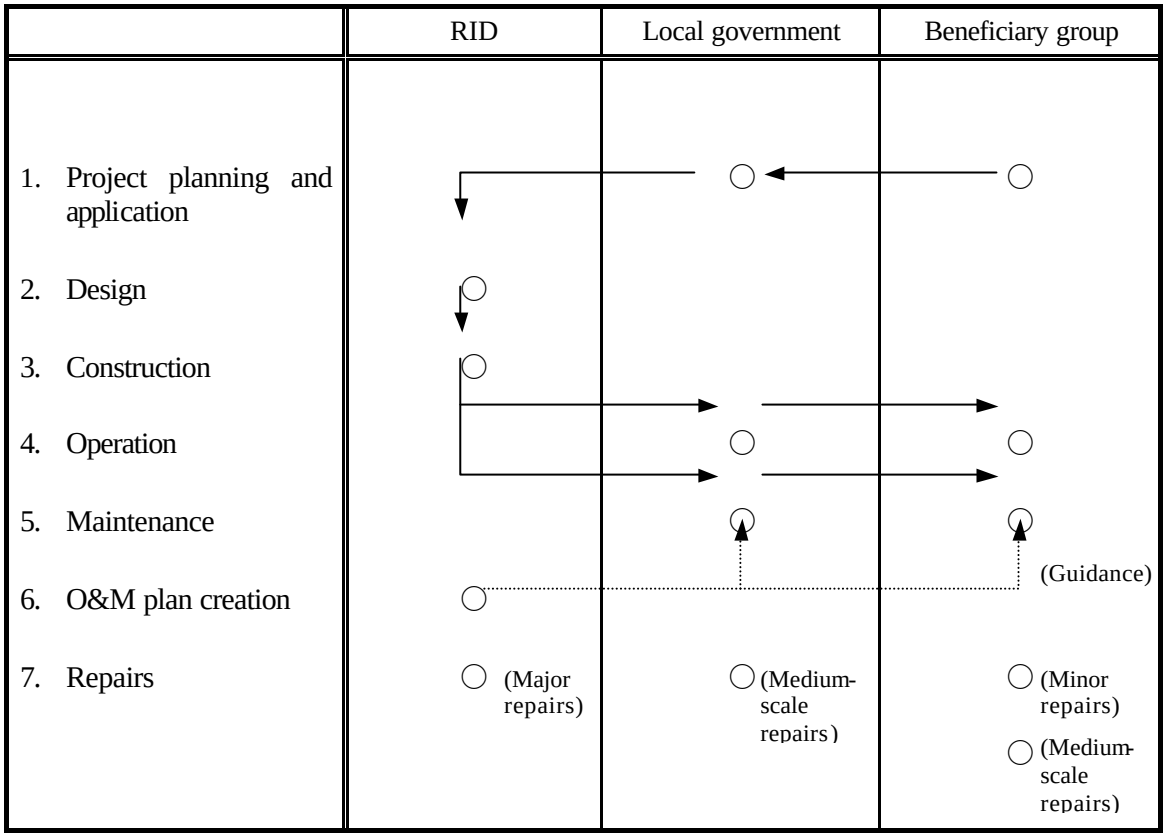
Implementation plans (SSIP's post project O&M plans) for the effective operation and maintenance of irrigation facilities determined and implemented by the RID, which are designed to systematically establish post project operation and maintenance systems of small-scale irrigation facilities, whose number is increasing, and to systematically provide human, financial, and physical support, were drafted in 1982 according to the above-mentioned government policies, and began being implemented from 1983. An outline of the implementation plan is provided below.

(1) RID staff participate in the drafting of a request plan at the prefectural and district level upon receipt of a request for the construction of water facilities
(2) Technical support for farmers and prefectural governments by RID staff concerning operation and maintenance aspects
(3) Implementation of various projects aimed mainly at education of farmers
(4) Implementation of O&M work
(5) Preparation of personnel and equipment required for O&M
(6) Management of implementation schedule
(7) Transfer of O&M responsibility to beneficiaries

Figure 5 shows a simplified flowchart of the operation and maintenance responsibility system.

Figure 5 Responsibility System for Small Scale Irrigation Projects

(Items marked with ○ have responsibility)



With regard to repairs of irrigation facilities, the share of the cost borne by the RID, Thai government, local government, and beneficiary varies according to the amount of money required for the repair. From 1989 to 1997, the following classification was used.

(1) When repair cost exceeds 150,000 Baht:
Repairs are made by the RID, and the repair cost is paid for from the RID's budget.

(2) When repair cost is between 5,000 and 150,000 Baht:
The repair cost is borne by the Thai government, local government, and beneficiaries with respective ratios of 60%, 20%, and 20%[2].

(3) When repair cost is less than 5,000 Baht:
The repair cost is borne entirely by the beneficiaries.

[2] Prior to 1989, repairs costing between 5,000 and 100,000 Baht corresponded to this category. From 1997, the repair cost categories have not changed, but the ratios borne were changed to 80% by the Thai government and 20% by the local government.

Table 2 shows the trend in maintenance costs (total expenditures for RID repair and improvement work including Phase I Project) from 1982 to 1992. The increase in the number of repairs and repair costs since 1990 is due to the fact that small repairs by beneficiaries were not sufficiently performed, making it necessary to increase the RID's maintenance budget and also increase the number of repairs.

Table 2 Actual Results of Performed Repair and Improvement by RID

Year	Number of repairs & improvements	Maintenance cost (1 million Baht)
1982	67	23.7
1983	97	27.8
1984	77	33.7
1985	n.a.	29.5
1986	79	40.4
1987	121	44.5
1988	87	53.1
1989	112	102.7
1990	194	168.2
1991	218	210.3
1992	266	263.1

The maintenance of the facilities constructed during this project is to be transferred to the beneficiaries with the implementation of technology transfer, but there are variations in the implementation status of this maintenance transfer among the various areas. In the case of irrigation facilities in the northern part of Thailand, the organization of water users is making progress, annual maintenance plans consisting mainly of labor supply are being fully used and well implemented. By contrast, in the northeastern part of Thailand, through organization is progressing, the establishment of maintenance systems is still incomplete, the RID points out. An interview survey (2.3.2 Quantitative Effects, Table 8) conducted in 1993 shows that the organization percentage of irrigation association is 82% in the northern part of Thailand, while it is only 56% in the northeastern part.

2.2.3 Operation and Maintenance Issues

The constructed SSIP projects are being widely used by farmers, and policy efforts are being made regarding operation and maintenance. However, regardless of the transfer of O&M duties to Local Administrative Agency, the transfer to beneficiary groups has not been fully achieved. In this project, the participation of the beneficiaries was required at all stages, but there are cases where actual participation by beneficiaries has been insufficient. In cases of insufficient beneficiary participation, the major reasons are thought to be the fact that the organization of the beneficiary group (irrigation association) has not gone smoothly, low awareness about operation and

maintenance, and delays in establishing a maintenance system. While operation and maintenance-related problems probably vary according to the area, the Local Administrative Agency, the RID, and the beneficiaries should conduct discussions, analyses, and develop solutions for the causes impeding the transition of beneficiaries to autonomous operation and maintenance.

On the other hand, there is the problem of the accumulation of sand in reservoirs and the upstream section of dams, and water damage of the edges of canals, etc., which occur as time passes after facilities are constructed. Daily maintenance by beneficiaries is also insufficient in this regard, probably due in part to the fact that the organization of water users has not made enough progress, and the implementation of repair and improvement work by the RID to restore project functions is thought to be required as a real solution.

The following 5 items were pointed out as small-scale irrigation project improvement points in SAPS (Special Assistance for Project Sustainability) implemented in 1993.

(1) Functional improvement of existing facilities:
Securing of adequate water resources corresponding to water demand of village, and improvement and maintenance of facilities.

(2) Strengthening of beneficiary organization:
Participation in leader education and SSIP projects, and frequent visits and support by related government organization

(3) Rationalization of O&M activities:
Making beneficiary organizations aware of O&M responsibilities and rationalization and simplification of repair work procedures

(4) Improvement of O&M data management:
Full implementation of SSIP project data management by the RID and establishment of O&M department dedicated to SSIP

(5) Development of future water resources:
Study of volume of water resource that can be developed by watershed, and realization of fair water usage

These proposals, while being premised on the principle that, in small-scale irrigation projects, beneficiaries such as farmers, etc., should organize irrigation associations and autonomously perform maintenance, also hold that the RID should take the initiative in the current stage where the organization of beneficiaries and autonomous maintenance are still insufficient, and suggest ways for the RID to make improvements. We are fully aware that the participation of the beneficiaries at all stages of the implementation of these improvements, from planning to project implementation, is necessary. In the Small Scale Irrigation Repair and Improvement Project[3] (SSIRP), the next project after this project that is currently being implemented with an ODA loan, various measures to encourage the participation of beneficiaries have been set up, including a system for the submission

[3] This project is designed to perform repairs and improvements for approximately 600 small-scale irrigation facilities out of 1,100 existing small-scale irrigation facilities where urgent repair and improvements are desirable. The implementation of this project commenced in 1998.

of papers of demands from beneficiaries to the RID. Through these initiatives, it is hoped that the organization of beneficiaries will progress and that maintenance will start being smoothly performed.

2.2.4 Impact on the Environment

No problems in particular were pointed with regard to the project's impact on the natural environment during the appraisal. Small-scale irrigation projects are believed to have only a minor impact on the environment, and the latest survey in this regard consisted only of an interview of the RID. According to the RID, this project has almost no impact on the natural environment.

2.3 Project Effects and Impacts

2.3.1 Quantitative Effects

Three result indices have been selected to measure the economic results of this project. They are (1) increase in production of agricultural products, (2) Increase in production of livestock, and (3) Increase in fish farming production. Table 3 shows how production and revenues for agricultural products, livestock, and fish farming have changed before and after the implementation of this project for SSIP (V) and SSIP (VI).

Table 3 Average Production Increase for 1 Project

	SSIP (V)			SSIP (VI)		
	Before project implementation	After project implementation	Increased portion	Before Project implementation	After Project Implementation	Increased portion
①Rice cropping						
Rice cropping surface	717 rai (114.7ha)	774 rai (123.8ha)	57 rai (9.1ha)	748 rai (119.7ha)	807 rai (129.1ha)	59 rai (9.4ha)
Production per unit area	300kg/rai (1.88mt/ha)	374kg/rai (2.34mt/ha)	74kg/rai (0.46)	300kg/rai (1.88mt/ha)	374kg/rai (2.34mt/ha)	74kg/rai (0.46)
②Dry season vegetables						
Rice cropping surface	42 rai	93 rai	51 rai	45 rai	100 rai	55 rai
Production per unit area	1,137kg/rai	1,207kg/rai	70kg/rai	1,137kg/rai	1,207kg/rai	70kg/rai
③Dry season field crop						
Rice cropping surface	41 rai	91 rai	50 rai	45 rai	99 rai	54 rai
Production per unit area	465kg/rai	753kg/rai	288kg/rai	465kg/rai	753kg/rai	288kg/rai
⑤Livestock production increase	—	12,000 Baht	12	—	12,000 Baht	12
⑥Fish farming production increase	—	68,000 Baht	68	—	50,000 Baht	50

(Source) PCR

For agricultural products, both the arable land surface and the production per unit area have increased as the result of the construction of irrigation facilities. Table 4 compares the economic internal rate of return (EIRR) for each project phase at the time of the appraisal and the evaluation (recalculated based on FY1994 data).

Table 4 Changes of Economic Internal Rate of Return in Each Project

	SSIP (IV)	SSIP (V)	SSIP (VI)
At the time of appraisal	13.2%	13.9%	13.4%
At the time of evaluation	14.9%	17.4%	17.1%

Note) The EIRR for SSIP (4) and SSIP (5) was calculated using project costs and maintenance expenses as the costs, and the increase in revenues from agricultural products, livestock, and fish as the benefits. For SSIP (6), the EIRR was calculated during both appraisal and evaluation by adding labor reductions to the benefits.

For all the project phases, the achievements exceeded the EIRR at the time of appraisal. Adding to the fact that the construction cost per project was lower than planned, increases in the production per unit area contributed to a higher EIRR.

Table 5 shows the trend in agricultural production value from 1976 to 1991 in the whole of Thailand and in the northern, northeastern, central, and southern parts of Thailand, where small-scale irrigation projects have been implemented. Small-scale irrigation projects are believed to have contributed to the increase in agricultural production value in the above areas.

Table 5 Trend in Agricultural Production Value

(Unit: million Baht)

	1976	1981	1986	1991
Whole of Thailand	166,534	194,023(+16.5%)	228,191(+17.6%)	282,739(+23.9%)
Northern	37,584	43,789(+16.5%)	48,018(+ 9.7%)	52,106(+ 8.5%)
Northeastern	36,894	44,726(+21.2%)	53,306(+19.2%)	69,047(+29.5%)
Central	9,379	13,484(+43.8%)	12,959(- 4.9%)	11,934(- 7.9%)
Southern	29,740	39,247(+32.0%)	49,565((+26.3%)	77,909(+57.2%)

Note) The production value is represented in constant value terms with 1988 serving as reference. The figures in parentheses are the change percentage from the previous period (5 years before).

2.3.2 Qualitative Effects

The following effects were expected from the implementation of this project.

(1) Improvement in people's livelihood by securing daily life water during the dry season
(2) Reduction of drought damage through rainy season refill irrigation
(3) Increased production of livestock, fish farming, etc.
(4) Creation of employment opportunities through construction of irrigation facilities
(5) Organization of farmers through construction, maintenance, and operation of tertiary canals

The first survey (implemented from November to December 1992, questionnaire method using written questionnaires and the second survey (implemented from January to February 1993,

interview method by surveyors), which were conducted by SAPS as mentioned above covered 351 and 200 projects, respectively, thus a total of 551 projects. Table 6 shows a summary of the parts related to the effects of the project.

Table 6 Survey Results of Project Effects and Impacts by SAPS

Effect	Survey	Description of Effect
1) Frequency of use of daily life water	First survey	Daily life water was used in 82% of the surveyed projects.
2) Use for livestock breeding	First survey	Daily life water was used in 90% of the surveyed project.
3) Use for fish farming	First survey	Fish farming was performed in approx. 1/3 of the surveyed projects.
4) Improvement of rainy season irrigation	Second survey	Irrigation efficiency was improved in 87% of the surveyed projects.
5) Improvement of dry season irrigation	Second survey	Irrigation efficiency was improved in 74% of the surveyed projects.
6) Organisation of farmers	Second survey	Water users' groups (WUG) were organized in 82% of the projects surveyed in the northern part of Thailand, with 77% organized prior to project implementation, and 5% after project implementation. WUGs were organized in 56% of the projects surveyed in the northeastern part of Thailand, with 4% of WUGs existing prior to project completion, and 52% of WUGs organized following project completion.
7) Future of SSIP	Second survey	75% of the farmers at the surveyed project locations thought that SSIP would also be necessary in the future for their village.

While, as mentioned before, improvements are needed in the area of maintenance, SSIP projects are considered to be effective by the majority of farmers, based on the above-described survey results. However, as mentioned in the description of the operation and maintenance system, in order to maintain the effects of the projects, it is believed necessary to further improve the current maintenance status. Furthermore, major repairs and improvement work by the RID is also required in order to continue maintaining the effects of this project.