Republic of Peru

FY2017 Ex-Post Evaluation of Japanese ODA Loan Project

"Irrigation Sub-Sector Project"

External Evaluator: Ayako Nomoto, International Development Center of Japan Inc.

0. Summary

The Irrigation Sub-Sector Project was implemented in the Pacific coastal area of Peru known as the Costa region. The purpose of this project was to improve water use efficiency and expand agricultural production, thereby contributing to increasing agricultural profits, through the rehabilitation and improvement of irrigation facilities, the development of on-farm irrigation facilities, and the strengthening of water users' organizations. The relevance of this project is rated as high; it has been consistent with the development plan of Peru for irrigation, the development needs for efficient use of irrigation, as well as Japan's ODA policy. The project has produced the following effects: more efficient use of water, increased agricultural production, and improved maintenance of irrigation facilities. It has also produced impacts such as improved agricultural income, creating job opportunities, and revitalizing regional economies. As such, effectiveness and impact of the project are also rated as high. Regarding efficiency, the project cost was within the plan; project period significantly exceeded the plan due to delays in the sub-project approval process by the Peruvian government and the executing agency, as well as delays in the formation of beneficiary groups for the introduction of advanced technical irrigation. Therefore, efficiency of the project is rated as fair. There is room for improvement in terms of sustainability, including training for beneficiaries and more frequent cleaning of the facilities developed in this project; however, there are no problems in the institutional and financial aspects of facility operation and maintenance. Therefore, sustainability of the project effects is rated as fair.

In light of the above, this project is evaluated to be satisfactory.

1. Project Description

Project locations

A rehabilitated canal (Lambayeque Region)

1.1 Background

In 2005, the agricultural industry in Peru accounted for 8% of GDP, 8% of total exports, and 28% of the working population, and played an important role in the Peruvian economy.[1] The Pacific coastal area of Peru (Costa) is an arid region with low precipitation throughout the year; thus, irrigation techniques utilize rivers and groundwater flowing from the Andean Mountains to the Pacific Ocean. Due to the fertility of the soil, the development of irrigation facilities has been vigorously implemented since the 1960s; as a result, 80% of the water use was accounted for by agriculture. As of 1994, out of the total area of irrigated farmland in Peru, 48% was situated within the Costa region; thus, it was an important agricultural production area. Despite its significance in the agricultural sector, only 75% of the irrigated agricultural land in Costa was being utilized, and water resources were not being used effectively. This is mainly due to the aging irrigation facilities, the flood damage caused by the heavy rains of the El Nino phenomenon that struck Peru from 1997 to 1998; as well as the inadequate maintenance of the irrigation facilities caused by a lack of funding and capacity in water users' organizations.[2] Furthermore, the majority of the Peruvian population (more than one-half) inhabits the Costa region, and urban water demand has increased each year. Improvement of the utilization efficiency had become an urgent issue in order to secure agricultural water.

1.2 Project Outline

The objective of this project is to improve the efficiency of water use and increase agricultural production in the Costa region by improving irrigation facilities, developing on-farm irrigation facilities,[3] and strengthening water users' organizations, thereby contributing to the increasing agricultural income.

Loan Approved Amount/ Disbursed Amount	5,972 million yen / 5,793 million yen	
Exchange of Notes Date/ Loan Agreement Signing Date	November 2006 / December 2006	
Terms and Conditions	Interest Rate	1.5 %
	Repayment Period	25 years
	(Grace Period	7 years)

[1] Source: Data provided by JICA.
[2] The operation and maintenance of irrigation facilities is primarily undertaken by water users' organizations composed of beneficiary farmers and irrigation associations below water users' organizations. One Water Users' Organization (Junta de Usuario) is established in per valley (in some cases, more than one organization in a valley) and several Irrigation Associations (Comision de Regantes) exist below the Water Users' Organization.
[3] Introduction of advanced technical irrigation.

	Conditions for Procurement: General untied
Borrower / Executing Agency(ies)	Republic of Peru / Irrigation Subsector Program:(Programa Subsectorial de Irrigaciones: PSI)
Project Completion	May 2016
Main Contractor(s) (Over 1 billion yen)	-
Main Consultant(s) (Over 100 million yen)	Tahal Consulting Engineers Ltd. (Israel)/ S&Z Consultores Asociados S.A. (Peru) (J/V), Nippon Koei Co., Ltd. (Japan)
Related Studies (Feasibility Studies, etc.)	F/S by PSI (June 2007)
Related Projects	"Irrigation Sub-Sector Project" (July 1996-June 2004) and additional lending (June 2005) (World Bank)

2. Outline of the Evaluation Study

2.1 External Evaluator

Ayako Nomoto, International Development Center of Japan Inc.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: October 2017–January 2019

Duration of the Field Study: January 21, 2018–February 8, 2018 and June 5, 2018–June 14, 2018

2.3 Constraints during the Evaluation Study

This project consists of a number of sub-projects in the Costa region (31 sub-projects related to head construction and canal development, 9 sub-projects related to measurement and control facilities, and 48 sub-projects related to on-farm irrigation facilities). In this ex-post evaluation, information and quantitative data on the project effects of all of the sub-projects were not available from the executing agency. Therefore, the effects of the project have been measured through information and cases obtained from sub-projects (Components A1: 11 and Component B: 6) in which interviews with water users' organizations and irrigation associations and farmers were conducted.

3. Results of the Evaluation (Overall Rating: B[4])

3.1 Relevance (Rating: ③[5])

3.1.1 Consistency with the Development Plan of Peru

In both the appraisal and ex-post evaluation, increased efficiency through the development of irrigation facilities and increased profitability through the introduction of advanced technical irrigation have been positioned as priorities in the development plan; the objective of this project has been highly consistent with the development plan.

At the time of the appraisal, one of the three major objectives of *the Agricultural Sector Development Plan 2002* was to improve the profitability and competitiveness of the sector, and the rehabilitation of irrigation facilities and the development of on-farm irrigation facilities were positioned as priority projects. *The Irrigation Sector Development Plan and Strategies 2003* detailed the goals of the irrigation sector, which were to improve the profitability and competitiveness of irrigated agriculture through the efficient use of land and water. In response to this objective, specific goals such as the rehabilitation and improvement of irrigation facilities, appropriate maintenance, the development of on-farm irrigation facilities, and the technical and economic independence of water users' organization were established.

At the time of the ex-post evaluation, *the National Agricultural Policy (2016)* mentioned the expansion and modernization of the irrigation infrastructure, with particular emphasis on small and medium-sized farms. These policies aim to improve the efficiency of irrigation infrastructure, promote advanced-technical irrigation, and invest in irrigation infrastructure nationwide with a focus on small and medium-scale agriculture. In addition, *the 2021 Plan* (Plan Estratégicode Desarrollo Nacional al 2021, commonly known as PLAN BICENTENARIO), which was updated in 2015, also prioritize the diversity of agricultural production.

3.1.2 Consistency with the Development Needs of Peru

The project has been highly consistent with the development needs regarding efficient use of irrigated farmland and agricultural water during both appraisal and ex-post evaluation.

At the time of the appraisal, as described in "1.1 Background," 80% of the water used in the Costa was for agricultural purposes due to the development of irrigation facilities since the 1960s. As of 1994, irrigated farmland area in Costa accounted for 48% of total irrigated area in Peru, making it an important agricultural production area. However, only 75% of irrigated agricultural land was used in Costa due to aging irrigation facilities and lack of maintenance, while urban water demand was increasing year by year, and improvement of utilization efficiency had become an urgent issue in order to secure agricultural water.

[4] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[5] ③: High, ②: Fair, ①: Low

In the most recent years of this ex-post evaluation,[6] the importance of irrigation development and use in Costa was recognized. Agricultural water currently accounts for 86% of water use in Costa. Additionally, the Costa area accounts for 57% of the total irrigated area of the country, and it continues to be an important agricultural production area in Peru. However, only 51% of the irrigated farmland in the Costa region is used, which is not an effective use of resources. Thus, there is a continuing need to improve the efficiency of land use and utilize irrigated farmland.

3.1.3 Consistency with Japan's ODA Policy

This project was consistent with the "support for modernization of agricultural production infrastructures and production methods" and "strengthening and improving the structure of agriculture, forestry and fisheries" as priority areas in *the Assistance Program Peru (2002)* at the time of appraisal. In addition, *Medium-Term Strategy for Overseas Economic Cooperation Operations (FY2005-FY2007)* regarded "infrastructure development for sustainable growth" as one of the priority areas. In light of the shortage of infrastructure development funds in Peru, support for economic infrastructure was to be continued, and this project was consistent with this policy. Therefore, the project is overall highly consistent with Japan's ODA policy.

Thus, this project has been highly relevant to the country's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

(1) Outline of Project Outputs

This project consists of the following items, both at the time of appraisal and ex-post evaluation.

(a) Rehabilitation and improvement of trunk irrigation system infrastructure (Component A)

・ Component A1: Rehabilitation and improvement of water intakes, canals, incidental facilities, river revetment, etc.

・ Component A2: Installation of measurement and control system in the beneficiary blocks of branch canals.

(b) Development of on-farm irrigation facilities (Component B): Procurement of irrigation equipment and implementation of small-scale civil engineering work in order to introduce advanced technical irrigation (the pressurized irrigation method and advanced gravity irrigation method) as pilot projects in on-farm irrigated agricultural land.

[6] *National Statistical Information Bureau Agricultural Census (2012)* and *National Water Resource Policy and Strategy (2010)*

(c) Capacity building of water users' organizations (operation and maintenance capacity building of irrigation facilities, agricultural technical guidance) (Component C): Training and etc. for water users' organizations in Component A and water users' organizations to which farmers' groups who introduce advanced technical irrigation in Component B belong.

(d) Consulting Services: Overall supervision component, monitoring and evaluation component.

(2) Selection of Sub-Projects

Regarding the development of irrigation facilities mentioned in Component A above, the eligibility requirements of the water users' organization implementing the sub-project and the method of selecting the sub-project were determined as follows at the time of appraisal, and the actual method of selecting the sub-project is substantially the same as at the time of appraisal.

① Water users' organization participation requirements

- The recovery rate of water tariff shall be 75% or more.
- Must have a technical manager.
- The operational budget of the water users' organization is realistic in that it can be maintained and managed, and the unit price of the water tariff can achieve this.

② After selecting sub-projects only from water users' organizations with the above qualifications, the Peruvian authority examined and approved them through the National Public Investments System (SNIP: Sistema Nacional de Inversión Pública) in terms of following aspects.

- Business necessity, business content, and efficiency
- Hydraulic calculations, alternative considerations, and sustainability of irrigation facilities
- Economic evaluation

At the time of appraisal, 31 sub-projects were considered candidates; if they did not pass the SNIP's appraisal, other sub-projects were to be selected within the initial budgetary limits.

In implementing a sub-project, component A is borne by the water users' organization for 20% of cost of the sub-project, and ownership of the facilities is vested in the water users' organizations.

Component B selected a group of farmers who wanted to introduce advanced technical irrigation among water users' organization that carried out the sub-project in Component A1 after enlightening, disseminating, and supporting the on-farm irrigation technology under Component C. A total of US$12,000 per household was borne by the government (this project) as an incentive for farmers, in connection with construction of common use facilities (water intake and joint infrastructure), and the remainder was borne by the farmers. Farm-level development was initially borne entirely by farmers under the Ministry of Agriculture and Irrigation's ordinance. However, since the formation of sub-projects did not progress, up to 50%

of the investment amount was changed to the burden of the government (this project) in 2013 in order to promote advanced technical irrigation projects, and the incentive for farmers has been improved.

(3) Comparison of planned and actual outputs

At the time of appraisal, 31 sub-projects were planned under Component A1. Although some initially planned sub-projects were replaced by others, the final number of sub-projects remains at 31, which is almost as planned. As mentioned above, at the time of appraisal, it was assumed that the sub-project candidates would change. Of the 31 candidate sub-projects present at the time of appraisal, 20 were implemented; the remaining 11 were not implemented, mainly because water users' organization's own contribution (20% of the sub-project cost) could not be expended. Some sub-projects were implemented under the related project supported by the World Bank. Eleven new sub-projects were then submitted to JICA for consent before implementation.

As for Component A2, of the 12 sub-projects agreed to by JICA, the final number of completed sub-projects is 9; this is 75% of the planned number for Component A2. Component A2 failed to adhere to the plan for the following reasons: (1) measurement and control facilities were a low priority for the water users' organizations, and each water users' organization did not pay their own contributions, that is 20% of the sub-project cost. Further, many water users' organizations stopped the implementation of the plan because it was burdensome to prepare and submit detailed design reports (prepared by a consultant hired by the water users' organization) that were required after they were qualified as sub-projects. (2) sub-projects were not materialized due to the low level of completeness of the detailed design reports (though in case of materialized sub-projects, the quality of detailed design reports improved after being redesigned by the consultant under the project).

Component B did not assume a clear number of sub-projects at the time of appraisal. Of the 102 projects agreed upon by JICA after the commencement of the project, 48 were completed, accounting for 47% of the planned value. Component B's plan was not achieved because: (1) the cost required was higher than in the detailed design report, and it became necessary to reconsider the project plan and the formation of a sub-project was not advanced because the amount of incentive to farmers (US$12,000 per household) for the above-mentioned joint part (water intake, joint infrastructure) was not sufficient; and (2) In order to promote advanced technical irrigation, incentives were improved for the farmers. Originally, 100% of the investment amount at the farm level had been borne by farmers by ministerial ordinances; this was lowered to 50%, and the rest was to be borne by the government (project). However, the formation of sub-projects had not been progressed as scheduled and could not begin due to time constraints.

The degree of achievement of the project outputs as a whole would be 88% of the target when using the weighted average, reflecting the percentages of A1, A2, and B (72.3%, 11.1%, and 16.5%, respectively) to the sum of the components A and B of the planned project cost.

Table 1. Planned and actual outputs

Component	Plan	Actual
Component A1 (number of sub-projects)	31 sub-projects in all 10 regions in Costa	31 sub-projects in 6 regions[7] in Costa （Headworks: 5 sites, Canal: 117 km）
Component A2 (number of sub-projects)	12	9
Component B (number of sub-projects)	102	48
Component C	n.a.	Component A: Number of participants: 8,157 persons from 15 water users' organizations Component B: Number of participants: 10,355 persons from 10 water users' organizations
Consulting services (Excluding Component C)	- Overall project management - Monitoring and evaluation	Same as planned

Source: Documents provided by JICA, response to questionnaire and interviews with the executing agency.

Headwork (Lima Region)

Rehabilitated canal (Lambayeque Region)

3.2.2 Project Inputs

3.2.2.1 Project Cost

The project cost was within the plan (90% of the planned amount). Considering the number of sub-projects which were not completed (Component A2 and Component B), as discussed in "3.2.1 Project outputs," the degree of achievement of the project outputs as a whole is 88% of

[7] Piura Region, Lambayeque Region, La Libertad Region, Lima Region, Ica Region, Arequipa Region

the planned level; thus, it can be said that the actual project cost is almost commensurate with the degree of achievement of the project outputs.

Table 2. Planned and actual project cost

(Unit: million yen)

	Planned (Appraisal)						Actual (by source)		
	Foreign currency		Local currency		Total		ODA Loan	Peruvian side	Total
		ODA Loan		ODA Loan		ODA Loan			
Component A	200	84	4,583	3,788	4,783	3,872	3,976	604	4,580
Component B	585	211	366	366	951	577	373	117	490
Component C	0	0	557	447	557	447	614	50	664
Consulting services	138	138	600	600	738	738	830	96	926
Administrative expenses, etc.	0	0	746	0	746	0	0	936	936
Taxes	190	0	1,236	0	1,426	0	0	1,141	1,141
Price escalation	37	14	104	75	141	89	0	0	0
Contingency	41	15	318	234	359	249	0	0	0
Total	1,191	462	8,510	5,510	9,701	5,972	5,793	2,944	8,737

Source: Compiled from documents provided by JICA and the executing agency.
Note: 1) Exchange rate was 1 sol=31.6 yen in planned amounts and 1 sol= 33.8 yen in actual amounts (2007–2015 averages). 2) There is no information regarding a breakdown of local and foreign currencies for actual amounts.

3.2.2.2 Project Period

The project period significantly exceeded the plan by 168% (114 months compared to the planned 68 months). The main reasons that the project period exceeding the plan include (1) prolonged negotiations with consultants and delayed conclusion of consultant contracts by one year, (2) delays in the appraisal and approval of sub-projects (delays in contributions from water users' organizations, additional time necessary in the approval of sub-projects, due to correction and/or reformulation of technical files delivered by the water users' organizations, and redesign of approval procedures due to SNIP system revisions), and (3) delays in the formation of Component B sub-projects, as shown in "3.2.1 Project outputs."

Table 3. Planned and actual project period

	Planned (appraisal)	Actual
Signing of loan agreement	December 2006	December 2006
Consulting services (Including Component C)	December 2006–July 2012	October 2007 –February 2013
Component A	July 2007 –April 2011	June 2008 –October 2014
Component B	August 2007 –February 2011	March 2010 –May 2016
Project completion (project period)	July 2012 (68 months)	May 2016 (114 months)

Source: Documents provided by JICA and the executing agency, response to questionnaires by the executing agency.
Note: Definition of project completion set at the appraisal was completion of self-evaluation by the executing agency. Actual project completion is the timing when all the project component completed.

3.2.3 Results of Calculations for Internal Rates of Return (Reference only)

At the time of appraisal, the Financial Internal Rate of Return (FIRR) was not calculated, nor was the Economic Internal Rate of Return (EIRR) of the project as a whole. At the same time, the EIRR calculations were performed using one of the larger representative sub-projects, but the sub-project was ultimately not executed in the project.[8] Since the condition differs from the time of appraisal, no comparison can be made. However, as a result of calculating the EIRR of the Tukume project (canal development) in the Lambayeque Region, which is one of the relatively large-scale sub-projects at the time of ex-post evaluation, using the following calculation basis that was used at the time of appraisal, the EIRR of the Tukume project was 29.6%.

- Expenses: Project cost and maintenance expenses (excluding taxes).
- Benefits: Expansion of agricultural production through refurbishment of irrigation facilities and farming guidance.
- Project life: 25 years.

Thus, although the project cost was within the plan, the project period significantly exceeded the plan. Therefore, efficiency of the project is fair.

3.3 Effectiveness and Impacts[9] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

In this project, the following Operation and Effect Indicators[10] were established to measure project effects. Although some data were available at the time of completion, data on Operation

[8] At the time of appraisal, the EIRR was calculated as 19.7% for the Chincha Alta project (canal improvement).
[9] Sub-rating for Effectiveness is to be put with consideration of Impacts.
[10] They were set as indicators of component A1.

and Effect Indicators, which indicates trends in the entire project, were not monitored by the executing agency and could not be obtained at the time of ex-post evaluation.

Table 4. Operation and effect indicators (for 31 sub-projects under Component A1)

Indicator	Target	Actual	
	2014	2016	2018
		Year of Completion	2 Years after Completion
Irrigated area (ha)	162,693	110,913	110,913
Number of direct beneficiaries (or households)	53,986	40,534	40,534
Cultivated area of major crops (ha)	162,693	108,782	n.a.
Production volume of major crops(t)	7,321,185	n.a.	n.a.
Yield of major crops (t/ha)	45	n.a.	n.a.
Collection ratio of water tariff (%)	100	92	n.a.
Efficiency of conduction (%)	90	89	n.a.
Efficiency of distribution (%)	90	72	n.a.
Budget allocated for operation and maintenance in the budget of water users' organizations (%)	75	n.a.	n.a.
Number of irrigation associations that implement proper operation and maintenance of irrigation facilities (number)	96	72	n.a.

Source: Documents provided by JICA, questionnaire responses from the executing agency and interviews with the executing agency.

Note: 1) The figures for irrigated area, number of direct beneficiaries, cultivated area of major crops, yield of major crops, and number of irrigation associations that implement proper operation and maintenance of irrigation facilities are "total". The figures for collection ratio of water tariff, efficiency of conduction efficiency of distribution, budget allocated for operation and maintenance in the budget of water user's organizations are "average". 2) The figure for collection ratio of water tariff at completion is for 2015, and the figures for efficiency of conduction and efficiency of distribution at completion are for 2014.

However, at the sub-projects visited during the field survey,[11] these indicators generally indicate an improvement trend after the project. Taking into account the results of the qualitative survey,[12] it can be said that the effects of this project have been generally as planned, as discussed in the following paragraphs.

(1) Irrigated area and number of direct beneficiaries

[11] For Component A, 11 sub-projects were visited. Eleven sub-projects were selected to cover northern, central, and southern Costa.

[12] In the field survey, 11 sub-projects, 6 water user's organizations (32 committee members, of which two were women) and 8 irrigation associations (36 committee members, of which three were women), 43 ordinary farmers other than committee members,(of which five were women) were interviewed on Component A through key-informant interviews and group interviews. Irrigation associations have been further subdivided by region-based committees or sectors, and interviewees have been led by representatives of each committee/sector. Representatives of various committees/sectors with different conditions were collected and interviewed at the sub-project site, from the committees/sectors near the intake to the committees/sectors at the end. Component B was interviewed through group interviews with six farm groups (15 in total, one woman).

The water utilization efficiency improvement and agricultural production expansion were expected in effect 162,693 hectares of agricultural land and 53,986 households. In reality, after the changes to the target sub-project mentioned in "3.2 Efficiency" were implemented, 110,913 hectares of agricultural land and 40,534 households benefitted.

(2) Cultivated area, production volume, and yield of major crops

In the above-mentioned Tukume project, which was the largest of the sub-projects, the cultivated area increased drastically because water could be distributed to the end of the canal that had not been previously reached. Otherwise, however, the cultivated area remained unchanged or slightly increased because it mainly focused on the rehabilitation or improvement of the existing canals. Production volume and yield also tended to increase and improve. According to interviews with water users' organizations and irrigation associations, the improvement of soil and fertilizer was also reported. Additionally, the increase in water volume increased the number of harvests and shortened the cultivation period, resulting in an increase in production volume and an improvement in unit yield.

Table 5. Cultivated area and production volume (sub-project wise)

	2006	2008	2010	2011	2012	2013	2014	2015	2016	2017
1. Cultivated area（ha）										
Facalá project	8,520	n.a.	n.a.	n.a.	n.a.	n.a.	8,520	8,410	8,390	8,450
Paiján project	3,890	n.a.	n.a.	n.a.	n.a.	n.a.	4,116	4,123	4,051	4,083
Tukume project	n.a.	7,500	n.a.	10,000	9,800	9,000	8,500	9,000	10,500	10,919
El Pueblo project	n.a.	6,150	n.a.	6,183	6,184	6,184	6,176	6,181	6,182	6,183
Matriz project	n.a.	n.a.	3,310	n.a.	3,320	3,650	3,880	3,850	3,878	n.a.
Victoria project	n.a.	n.a.	n.a.	850	n.a.	n.a.	855	887	893	923
2. Production volume (thousand tons)										
Facalá project	616	n.a.	n.a.	n.a.	n.a.	n.a.	591	576	539	626
Paiján project	304	n.a.	n.a.	n.a.	n.a.	n.a.	304	312	251	309
Tukume project	n.a.	68	n.a.	78	80	83	86	87	87	93
El Pueblo project	n.a.	40	n.a.	49	43	46	49	53	53	49
Matriz project	n.a.	n.a.	59	n.a.	62	75	87	83	86	n.a.
Victoria project	n.a.	n.a.	n.a.	47	n.a.	n.a.	47	49	50	51
3. Yield（t/ha）										
Facalá project	72	n.a.	n.a.	n.a.	n.a.	n.a.	69	69	64	74
Paiján project	78	n.a.	n.a.	n.a.	n.a.	n.a.	74	76	62	76
Tukume project	n.a.	9	n.a.	8	8	9	10	10	8	9
El Pueblo project	n.a.	7	n.a.	8	7	8	8	9	9	8
Matriz project	n.a.	n.a.	18	n.a.	19	21	22	22	22	n.a.
Victoria project	n.a.	n.a.	n.a.	55	n.a.	n.a.	55	55	56	55

Source: Responses to questionnaires by water users' organizations.

Note: 1) Facalá project is a headwork development. Other projects are the rehabilitation/improvement of canals. 2) The main crops are as follows. Facalá project: sugarcane. Paiján project: sugarcane. Tukume project: rice, maize, and cotton. El Pueblo project: rice. Matriz project: maize and potatoes. Victoria project: maize and sugarcane.

(3) Collection ratio of water tariff

As of 2017, the average collection ratio of water tariff for the four water users' organizations that responded to the questionnaires was 87%, and the ratio remained at a high level. In particular, the Chancay-Lambayeque Water User's Organization (Lambayeque Region), which implemented seven Component A1 sub-projects, the highest number in the project, and is the nation's largest water user's organization in terms of coverage, collects 100% of its water tariff because it is prepaid.

On the other hand, the Chili Regulado Water Users' Organization (Arequipa Region), which implemented two Component A1 sub-projects, has a water tariff collection ratio of only 70% as of 2017. According to explanations from the water users' organization, nine installment payments are made annually, and the water tariff collection ratio is the figure at the end of the year. If the collection ratio is low, it means there was a payment delay at the end of the year. If left unpaid, water will not be distributed the next year. The water users' organization is making efforts to collect their water tariff through issuing notice to farmers who have not been paid their water tariff.

Table 6. Collection ratio of water tariff (average)

	2006	2014	2015	2016	2017
Collection ratio of water tariff (%)	85	92	91	90	87

Source: Response to questionnaires by water users' organizations.
Note: The number of respondents (water users' organizations) is four (for seven sub-projects).

(4) Efficiency of conduction and distribution

The efficiency of conduction and distribution has improved drastically since the implementation of the project. As of 2017, the average conduction and distribution efficiency of the sub-projects that responded were 80% and 71%, respectively, which was a significant improvement from 43% and 48% before the project was implemented (2006).

Table 7. Sub-project wise efficiency of conduction and distribution (average)

	2006	2008	2011	2012	2013	2014	2015	2016	2017
Efficiency of conduction (%)	43	80	84	98	96	82	83	83	80
Efficiency of distribution (%)	48	84	74	71	67	66	67	69	71

Source: Responses to questionnaires by Water users' organizations.
Note: The number of respondents is eight (sub-projects).

(5) Securing of maintenance costs and the state of maintenance

According to the water users' organizations and irrigation associations visited, the ratio of maintenance costs to the budget is between 60% and 65%, and although the target value has not been reached, a certain level of maintenance costs has been secured. Regarding the number of irrigation facilities that were properly maintained and managed by water users' organizations, all eight of the sub-projects responded that they were properly maintained.

3.3.1.2 Qualitative Effects (Other Effects)

Effects commonly reported in interviews with the water users' organizations, irrigation associations, and beneficiary farmers, and effects that are considered to be particularly prominent cases, are as follows.

Increase in water volume and shortening of water distribution time

Water volume increased in almost all sub-projects. Farmers shared the view that there was sufficient water throughout the year, that water loss was reduced, and that the shortening of water distribution time was the greatest effect. In some cases, water could be distributed to areas where the water had not previously reached because of its location at the end of the canal.[13]

Increase in production and introduction of new crops

Previously, crops were cultivated once a year; after implementation, in some cases, the crop could be cultivated twice a year and the production increased due to the shortening of the harvest period.

In Component B, water was able to be pumped to a higher altitude that was previously impossible to cultivate; therefore, in some cases, the cultivated area has been enlarged, productivity has improved, and quality has improved.

Regarding Component B, advanced technical irrigation enabled efficient water use, and high value-added crops and new crops (asparagus and cotton) were introduced.

Strengthening the Organizational Capacity of Water Users' Organizations

Participation in training in the component for capacity building of water users' organizations in this project has led to learning where to maintain and it is utilized in subsequent maintenance, especially at the irrigation association level. In addition, the efficient use of water after project implementation is achieved due to an increase in knowledge and practice, including preparation of work plans for water distribution and usage of meters and tools. Manuals are also utilized.

Reduction of maintenance burden

[13] In one case, there was a complaint that water supply was reduced. Irrigation associations and farmers believed that it was caused by the design of the canal but according to the PSI, the removal and cleaning of sedimentary garbage is insufficient.

All of the water users' organizations, irrigation associations, and farmers felt that the reduction in maintenance burden was a major positive outcome. Previously, the area around the canal used to be covered with dense grasses and accumulated dirt and trash, which obstructed the distribution of water. The labor and cost of weeding and trash removal were burdensome; however, this project greatly reduced maintenance of the improved portions of the canals, thus relieving this burden significantly.

3.3.2 Impacts

3.3.2.1 Intended Impacts

At the time of the appraisal, "improvement of agricultural income," "creation of employment opportunities," and "revitalization of regional economies" were the projected impacts. The following impacts were confirmed through interviews with beneficiaries.

(1) Improvement of Agricultural Income and Living Conditions

- In four of the sites interviewed in the qualitative survey, the opinion was that agricultural income increased by about 30% due to an increase in production. In addition, the development of access roads in this project has made shipping from some sites easier.
- Previously, borrowings had to be made at the time of cultivating; however, borrowing became unnecessary or the amount of borrowing decreased after implementation.
- All Component B farmers experienced significant increases in agricultural income, expansion of sales channels, increased agricultural spending, and purchases of new land.
- Increases in income have resulted in improvements in living conditions, including renovations of houses, purchases of home appliances, and investments in education (advancing to technical schools and universities).
- Implementation of Component B has allowed some farmers to live with their families and subsist solely on agriculture, despite the fact that they were formerly migrating.

(2) Creation of employment opportunities and revitalization of regional economies

- There is a case in which the water volume increased due to the construction of the head work, and a private enterprise developed agribusiness for export of jojoba, grape, asparagus, etc. (head work in Bernalese, Ika Region). Employment has been generated in the crop processing factory, and about 400 positions (for harvesting, packaging, etc.) have been generated in the region (300 households participating in the irrigation association). Therefore, families and relatives are able to obtain work.
- Component B farmers have hired local residents during cropping and harvesting.
- In some cases, land prices increased due to the development of canals.

Farmers visited water users' association for payment of water tariffs (Lambayeque Region)

Filtering facilities and a farmers group in Component B (Lima Region)

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

No negative impact on natural environment has been identified. In this project, environmental considerations were confirmed in accordance with *the JBIC Guidelines for Environmental and Social Considerations* (2002). According to interviews with the executing agency, mitigation measures were appropriately taken based on monitoring plans regarding air pollution, noise vibrations, and water pollution during construction, which are commonly caused by irrigation development, and no major problems occurred. According to the executing agency, all the sub-project sites do not correspond to natural conservation areas such as national parks or habitats of rare wildlife such as endangered species.

(2) Resettlement and Land Acquisition

No land acquisition or resettlement has occurred as a result of the implementation of this project. In addition, the executing agency and the water users' organizations for which the interview were conducted confirmed that consultations with the residents revealed no complaints for all the sub-projects at the time of the implementation of this project.

(3) Unintended Positive/Negative Impacts

- Following implementation of this project, an irrigation association has carried out additional canal rehabilitation in a PSI project. In the future, the irrigation association plans to rehabilitate the main canal and extend the rehabilitation canal covered by this project. According to the irrigation association, the experience of the implementation of this project has led to the improvement of the irrigation capacity of the association, and further development has become possible.
- A woman who participated in a Component B farm group introduced advanced technical irrigation on land inherited from her father, and her own income from agriculture enabled

her to make decisions within her home. For example, she bought an apartment with her own funds and rented it out.

- As for the Component B farmer groups, nearby farmers often visited them and received training. As a result, 18 new areas of advanced technical irrigation were launched by neighboring farmers who visited the farm groups.

From the above, it is difficult to compare the plans and the results of the effectiveness of the project because quantitative data on operation and effect indicators, which indicates the trend of the entire project, are not available, and a part of the sub-project has been changed. However, it can be said that the results of the qualitative surveys are taken into consideration and the sub-projects that were visited during this survey generally show a trend of improvement after the project. Regarding impact, the expected improvement in agricultural income, the creation of job opportunities, and the revitalization of regional economies have been observed. Therefore, the project has largely achieved its objectives, and the Effectiveness/Impact is high.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional / Organizational Aspect of Operation and Maintenance

The operation and maintenance of the facilities developed in this project is carried out by the water users' organization and its irrigation association. The organizational structure (decision-making and jurisdiction) and the division of roles between them are clear, and support from local governments will be provided as necessary. Therefore, there is no problem.

One Water Users' Organization (Junta de Usuario) has been established per valley (in some cases, more than one organization in a valley) and several Irrigation Associations (Comision de Regantes) exist below them. Water users' organizations are responsible for the operation and maintenance of headworks and large-scale main canals, and irrigation associations are responsible for other canals. Irrigation associations also undertake the operation and maintenance of the secondary and lower canals. The responsibility for operation and maintenance of irrigation facilities primarily rests with water users' organizations, but some of the operations and maintenance of irrigation facilities can be entrusted to irrigation associations. Based on this, the irrigation associations maintain the irrigation facilities as described above.

Organizational Structure of Water Users' Organization

Although the size of the water users' organizations varies greatly, in general, the organization consists of executive staff members (presidents, chief accountants, secretariats, directors, etc.) who are not paid (only allowances) who are selected by all members and paid general staff members. The general staff consists mainly of the management department (accounting, etc.) and the operation and maintenance department (manager in charge of each irrigation association,

headworks construction manager and operator). Separately, a manager, who is a contracted professional, is in charge of management of the water users' organizations.

The annual general meeting is held twice a year (approving the budget for the next year and reporting income and expenditures) to four times a year, and all members are required to participate in the meeting (Members are called twice. The first meeting requires 50% or more participation, and the decision making at the second meeting can be made only by participants).

Organizational Structure of Irrigation Associations

Each irrigation association consists of senior officials (president, chief accountant, secretary, directors, etc.) and a small number of regular staff (secretaries, operators, accountants, etc.). The annual general meeting is held twice a year (budget approval for the following year, income and expenditure report, etc.).

Relations with PSI and Local Governments

The water users' organization is registered with the National Water Management Bureau (ANA: Autoridad Nacional del Agua), and ANA approves the annual cultivating plans, water tariff, irrigation infrastructure maintenance plans, etc. of each association through local offices. The regional government monitors the operation and maintenance of the irrigation facilities, and if there is a problem, the regional government will provide financial support for repair.

3.4.2 Technical Aspect of Operation and Maintenance

The water users' organizations and irrigation associations have no technical problems with respect to the maintenance of the facilities developed in this project. However, there are no systems in place for maintaining and improving skills, such as a regular training system, and some organizations do not share or transfer skills.

Specialized operators are assigned in each water users' organization and operate and maintain the headworks based on manuals.

Regarding the routine operation and maintenance of trunk canals, as no special advanced techniques are required, no issues are observed. The monitoring of irrigation associations by the water users' organizations is being carried out. However, PSI and the water users' organizations have indicated that some irrigation associations are in need of improvement because they were unable to open and close their floodgates on time and the number of maintenance practices was limited.

There is no regular training system. PSI provided training for water users' organizations and irrigation associations on maintenance (e.g., water volume measurement, water distribution, tariff collection, management methods) in connection with newly developed projects, but will not follow-up thereafter. Some organizations believe they need regular training. Large water

users' organizations have a large number of general employees, and technology is being transferred. However, some small water users' organizations and irrigation associations do not share or transfer skills as an organization due to the replacement or retirement of executives and employees.

3.4.3 Financial Aspect of Operation and Maintenance

No financial problems are observed in terms of the operation and maintenance.

The main financial sources of the water users' organizations and irrigation associations are water tariffs, and revenues and expenditures are almost constant. Water tariffs are basically collected by water users' organizations and distributed between water users' organizations and irrigation associations under their jurisdiction after a small portion has been paid to the government (in some cases, collection of water tariffs is outsourced to irrigation associations). Distribution ratios are not uniform, but vary among water users' organizations and irrigation associations.

As shown in "3.3.1 Effectiveness," the water tariff collection rate at the completion of the project was 92%, and the average water tariff collection rate under the sub-project jurisdiction, which was examined in the field survey at the time of the ex-post evaluation, was 87%; this rate is maintained at a high level without any issues. Although the collection rate has been decreasing in some organizations, according to PSI, they are able to conduct sufficient maintenance from the water tariff as a whole. In many cases, the water tariff is paid in advance, and water is not distributed if no payment is made. Thus, the system ensures that water tariffs are collected.

The maintenance costs account for about 60% to 65% of the expenditures in the water users' organizations and irrigation associations interviewed. Large-scale repairs and the renewal of observation equipment will be funded by the reserves of water users' organizations and, if necessary, by regional governments. Disaster responses are funded by the central government.

3.4.4 Status of Operation and Maintenance

The facilities developed by this project are regularly cleaned and maintained, and the conditions of the facilities are generally good. However, some problems have been observed as some facilities require more frequent cleaning in order to secure the water volume.

Maintenance of headworks and large-scale canals are mainly carried out annually (in some cases, twice a year). After the harvesting of the main crops, maintenance is planned and executed (concrete repairs and dredging of sedimented sand and stones using machinery) based on an evaluation of the current state of the facilities. In addition, herbicidal treatments and trash removal are performed twice to four times a year, although this varies depending on the sub-project.

According to the field survey at this ex-post evaluation and PSI, the facilities developed in this project are well maintained. However, there are cases in which, in canals flowing through urban areas, the residents dump their garbage into the canals. The garbage accumulates and eventually affects the water volume. Additionally, in some canals, illegal occupants in the vicinity of the canal installed pipes for drainage on their own. Water users' organizations and irrigation associations have requested that the city hall remove these, but this has yet to be completed.

Among the sub-projects examined on-site during ex-post evaluation, 11 concrete panels were damaged due to heavy rains and flood damage in early 2017 on the Paiján Canal in La Liberta. While this does not necessarily affect the function of the canal, some unrepaired canals are listed within the central government budget for restoration.

Thus, some minor problems have been observed in terms of the technical aspect and current status. Therefore, sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Irrigation Sub-Sector Project was implemented in the Pacific coastal area of Peru known as the Costa region. The purpose of this project was to improve water use efficiency and expand agricultural production, thereby contributing to increasing agricultural profits, through the rehabilitation and improvement of irrigation facilities, the development of on-farm irrigation facilities, and the strengthening of water users' organizations. The relevance of this project is rated as high; it has been consistent with the development plan of Peru for irrigation, the development needs for efficient use of irrigation, as well as Japan's ODA policy. The project has produced the following effects: more efficient use of water, increased agricultural production, and improved maintenance of irrigation facilities. It has also produced impacts such as improved agricultural income, creating job opportunities, and revitalizing regional economies. As such, the effectiveness/impact of the project is also rated as high. Regarding efficiency, the project cost was within the plan; project period significantly exceeded the plan due to delays in the sub-project approval process by the Peruvian government and the executing agency, as well as delays in the formation of beneficiary groups for the introduction of advanced technical irrigation. Therefore, efficiency is rated as fair. There is room for improvement in terms of sustainability, including training for beneficiaries and more frequent cleaning of the facilities developed in this project; however, there are no problems in the institutional and financial aspects of facility operation and maintenance. Therefore, sustainability is rated as fair.

In light of the above, this project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

The water users' organizations and irrigation associations that operate the sub-projects vary in size, and small-scale organizations/associations do not necessarily inherit operations and maintenance and management skills. As a result, in some cases, the skills and frequency of operation and maintenance are not consistent; however, PSI does not have a system and budget established to follow-up the situation. In addition, PSI does not establish a system for collecting data to verify the effects of this project. In order to effectively utilize the facilities developed in this project over the long run, it is desirable that the PSI apply for funding from the Ministry of Agriculture and Irrigation, and follow-up on the state of the operation and maintenance tasks and effectiveness of the facilities, and implement of operation and maintenance training for the water users' organizations and irrigation associations.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

1. Importance of Financial Analysis for Selection of Beneficiary Organizations in Projects Assuming Partial Cost-Sharing by Beneficiary Organizations

This project is composed of a large number of sub-projects, and the self-burden of beneficiaries (water users' organizations) is essential to the execution of the sub-projects. During the implementation of the project, many sub-projects were changed, although changes in sub-projects had been assumed to occur even at the time of the project appraisal. The reason for this is that although the water users' organizations agreed to the 20% cost-sharing at the time of sub-project application, many of the sub-projects were ultimately unwilling to contribute 20% and were thus withdrawn from the project. Originally, the percentage of cost-sharing was 15 % and increased to 20% later under the related project supported by the World Bank. This revised percentage was applied to this project. In selecting the sub-projects, the necessity of the project, economic performance assessment, financial condition, etc. was examined, a practice that was initiated under Unidad Coordinatoria del Proyecto Subsectorial del Irrigacion; UCPSI (the former organization of PSI). Regarding the financial condition of water users' organizations, the water tariff collection rate was mainly examined, and detailed financial analyses such as borrowing capacity were not performed. Water users' organizations that finally implemented more than the originally planned number of sub-projects were creditworthy and able to borrow from private banks for the self-burden portion of the project. If water users' organizations with high creditworthiness were selected from the beginning, it would have been possible to

minimize the sub-project selection modifications because they would have contributed their portion by borrowing the necessary amount from the start. As a result, the project would have been implemented more efficiently. This system of own contribution by beneficiaries is effective given the high need to cover the obsoleted infrastructure. For projects that consist of sub-projects in which some costs are assumed to be borne by beneficiaries, a more detailed review of the financial status of the beneficiary organization is necessary.

2. The necessity of establishing a data collection system for measuring project effects

At the ex-post evaluation, it was not possible to collect quantitative data on the effects of the entire sub-project, such as cultivated area, production volume, water tariff collection rate, efficiency of water conduction and distribution, maintenance cost, and the number of irrigation associations that properly conduct maintenance. At the time of appraisal, PSI, the executing agency, was supposed to collect such data; however, the data collection system at PSI was not clearly formulated. PSI is an organization mainly engaged in the development of irrigation facilities and does not generally collect data such as cultivated area and agricultural production volume, which were specified as the effect indicators. This information is managed by ANA (cultivated area) and agricultural offices (production), and PSI does not have access to specific data at sub-project level, because it is managed by the beneficiary organizations and institutions mentioned above.

Therefore, during the project planning phase, it is necessary to grasp the jurisdiction and system of the data management organization, to establish a system within the executing agency, or to establish a system for ensuring data collection. For example, data collection could be ensured by having relevant organizations participate in the project in the form of steering committees.

END

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs - Rehabilitation and improvement of irrigation facilities (intakes, canals, incidental facilities and river revetment etc.) (Component A1)	31 sub-projects	31 sub-projects
- Installation of measurement and control system (Component A2)	12 sub-projects	9 sub-projects
- Installation of advanced technical irrigation (Component B)	102 sub-projects	48 sub-projects
- Capacity building of water users' organizations (Component C)	n.a.	- Number of participants for training for Component A: 8,157 persons from 15 water users' organizations - Number of participants for training for Component B: 10,355 persons from 10 water users' organizations
- Consulting services (excluding component C)	Overall management and supervision component, Monitoring & evaluation component	Same as planned
2. Project Period	December 2006 –July 2012 (68 months)	December 2006 –May 2016 (114 months)
3. Project Cost ODA Loan Portion Peruvian side Total Exchange rate	 5,972 million yen 3,729 million yen 9,701 million yen 1 sol ＝ 31.6 yen (As of December 2004)	 5,793 million yen 2,944 million yen 8,737 million yen 1 sol ＝ 33.8 yen (Average from January 2007–December 2015)
4. Final Disbursement	October 2014	

Note: Information on the breakdown of foreign currency portion and local currency portion of actual project cost was not available