Islamic Republic of Pakistan

FY2022 Ex-Post Evaluation Report of Japanese ODA Loan Project

"Punjab Irrigation System Improvement Project" and

Technical Cooperation Project related to ODA Loan

"Strengthening Irrigation Management System Including Agriculture Extension through Farmers' Participation in the Punjab Province"

External Evaluator: Hisae Takahashi, QUNIE CORPORATION

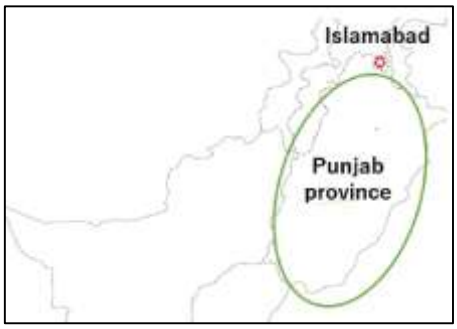
0. Summary

"Punjab Irrigation System Improvement Project" (the Project) aimed to improve agricultural productivity by rehabilitating irrigation facilities centered on distributaries and water resource management related facilities, supporting the formation and capacity building of Farmers' Organizations (FOs), and providing support for the management and preservation of underground water in the Punjab Province, thereby contributing to poverty reduction. In connection with this Project, "Strengthening Irrigation Management System Including Agriculture Extension through Farmers' Participation in the Punjab Province" (the Associated Technical Cooperation (TC) Project) was also executed to improve the efficiency of irrigation systems and support the policy of devolution of irrigation management through the formation of FOs and strengthening of their activities.

This Project has been consistent with Pakistan's development plans and development needs both at the time of the appraisal and ex-post evaluation. Furthermore, the Project's purpose was consistent with Japan's aid policy at the time of the appraisal. The collaboration with JICA supported technical cooperation and grant aid projects, and a certain degree of output were also confirmed. Therefore, its relevance and coherence are high. While the outputs increased with the addition of the target zone, the Project cost was within the plan because of fluctuations in the exchange rate and use of existing equipment. On the other hand, the Project period largely exceeded the plan. Therefore, efficiency of the Project is moderately low. According to relevant data in the irrigation zones as a whole including the target areas and beneficiaries, the area planted and production of major crops increased compared to before the Project was implemented. This has, in turn, led to higher incomes for farmers, enabling them to afford amenities like tractors, household appliances and invest in their children's education. However, the lack of comprehensive operation and effect indicator data prevents a precise evaluation of the achievement of the project's effectiveness. Therefore, effectiveness and impacts of the Project are moderately low. Regarding the Operation and Maintenance (O&M) of the Project, there are no particular issues in the policy/system aspect and preventative measures to risks, however, there are some issues in the institutional/organizational and technical aspects, and status of O&M. Therefore, the sustainability of the Project effects is moderately low.

Based on the above, the Project is evaluated to be partially satisfactory.

1. Project Description



Project Location
(source: JICA)

Rehabilitated Distributary
(source: taken by the local assistant)

1.1 Background

In Pakistan, agriculture is a mainstay of the economy and the most important resource for gaining foreign currency. It is also a key industry that provides raw materials for major industries such as textile and manufacturing. Moreover, in Pakistan, as the poverty rate in rural areas surpasses that in urban areas. As a result, developing the agricultural sector is important not only for economic growth but also for poverty reduction in rural areas by providing employment. Since irrigated farmland accounts for more than 80% of its cultivated lands in Pakistan, there is a growing consensus that developing the irrigation sector holds the key to promoting agriculture and revitalizing rural economy. The Punjab Province, having the largest area of irrigated lands among all provinces, required to ensure a stable supply of irrigation water, enhance water use efficiency through irrigation management by FO, improve agricultural productivity, and increase income of small-scale farmers, many of them were poor. To these ends, in 2005, the Irrigation and Power Department, the Government of Punjab (at that time) launched its *Irrigation Sector Reform Program*, and enhanced its efforts toward the policy goals of (1) improving the maintenance and management system of irrigation facilities; (2) enhancing the transparency of water distribution in the province; (3) improving the irrigation services; and (4) raising the water use efficiency and productivity of farm fields.

Against this backdrop, this Project was implemented to promote sector reforms in the irrigation sector by rehabilitating distributaries, which play a role in the equitable and efficient distribution of irrigation water and provide high benefits to farmers. The Project also aimed to facilitate the formation and capacity building of FOs to take over the maintenance and management of canals and to support institutional reforms initiated by the Government of Punjab, including the transfer of water management responsibilities to farmers under the *Irrigation Management Transfer (IMT) policy*.

1.2 Project Outline

The objective of this Project is to improve agricultural productivity by rehabilitating irrigation facilities centered on distributaries and water resources management related facilities, supporting the formation and capacity building of FOs, and providing support for the management and preservation of underground water in the Punjab province, thereby contributing to poverty reduction.

<ODA Loan Project>

Loan Approved Amount / Disbursed Amount	11,382 million yen / 10,328 million yen	
Exchange of Notes Date / Loan Agreement Signing Date	May 2008 / May 2008	
Terms and Conditions	Interest Rate	1.2%, 0.01% (Consulting services and interest during construction)
	Repayment Period (Grace Period	30 years 10 years)
	Conditions for Procurement	General untied
Borrower / Executing Agency	The President of the Islamic Republic of Pakistan/ Irrigation Department, the Government of Punjab Province	
Project Completion	December 2019	
Target Area	Punjab Province (Bahawalpur, Dera Ghazi Khan, Faisalabad, and Sargodha Irrigation Zones)	
Main Contractor	-	
Main Consultants	National Engineering Services Pakistan Limited (Pakistan)/ Halcrow Pakistan (PVT.) Ltd. (Pakistan)/ Integrated Consulting Services (PVT.) Ltd. (Pakistan) (JV)	
Related Studies	Feasibility Study (2007)	
Related Projects	[Technical Cooperation Project] - Advisor for water use management in the Punjab Province (2006-2008) [ODA Loan] - Lower Chenab Canal System Rehabilitation Project (August 2005) - National Drainage Program Project (March 1997)	

<Outline of the Associated TC Project >

Overall Goal		The established model of appropriate irrigation management system[1] is disseminated in the pilot irrigation zones.
Project Purpose		The model of appropriate irrigation management system is established through verification activities in the pilot areas.
Output(s)	Output 1	Guidelines/manuals are improved and utilized to strengthen and sustain the efforts of Area Water Boards (AWBs)/FOs.
	Output 2	Appropriate water saving irrigation technologies established in the model areas are promoted in the pilot areas.
	Output 3	Capacity building methodologies are improved for relevant government staff such as the Irrigation Department of Punjab, Punjab Irrigation and Drainage Authority, and Punjab Agriculture Department personnel.
Total cost (Japanese Side)		232 million yen
Period of Cooperation		March 2009 – March 2014 (Extended period: April 2013 – March 2014)
Target Area		Punjab province (Bahawalpur, Dera Ghazi Khan and Faisalabad Irrigation Zones)
Implementing Agencies		Irrigation Department of Punjab, Punjab Irrigation and Drainage Authority, and Punjab Agriculture Department
Other Relevant Agency of Japan		Ministry of Agriculture, Forestry and Fisheries
Related Projects		Same as the "ODA Loan Project" above

2. Outline of the Evaluation Study

2.1 External Evaluator

Hisae Takahashi, QUNIE CORPORATION

2.2 Duration of Evaluation Study

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

Duration of the Study: November, 2022 – December, 2023

Duration of the Field Study: March, and June – July, 2023 (The field study was carried out by the local assistant.)

2.3 Constraints During the Evaluation Study

Based on the instruction of the JICA Evaluation Department, the field study was conducted remotely and by utilizing the local assistant for security reasons. The evaluator subsequently analysed the data gathered from the field and the findings of the study undertaken by the local assistant, and eventually made the evaluation decisions. Additionally, during and after the

[1] It does not refer to a system model regarding the practical system, but rather to a model for human resource development, which is a prerequisite for improving the practice. (Source: Documents provided by JICA, interview with the expert of the Associated TC Project)

implementation of this project, as well as even during this survey, the executing agency, the Punjab Irrigation Department (PID), experienced frequent personnel changes. Unfortunately, proper handovers were not consistently carried out during these transitions, making it challenging to obtain actual data for the operation and effect indicators necessary to assess the achievement of effectiveness, the effectiveness was judged based on qualitative information, and published information (at the district-level data for the target areas) of the Punjab Agriculture Department as a reference.

2.4 Methods and Criteria for a Comprehensive Evaluation

Regarding the Associated TC Project, after confirming the achievement of its project purpose, the synergistic effects resulting from collaboration with this Project were analysed in terms of effectiveness and impact. These finding were taken into consideration in the evaluation. As for efficiency, a comparison of the planned and actual results is provided as a reference but is not taken into account in the evaluation judgment, following the external ex-post evaluation reference.

3. Results of the Evaluation (Overall Rating: C[2])

3.1 Relevance/Coherence (Rating: ③[3])

3.1.1. Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Pakistan

At the time of the appraisal, the Government of Pakistan had formulated a water resources development strategy, and emphasized the importance of ensuring water availability to meet future increases in water demand in *the Ten-Year Long-Term Plan (2001)*. Moreover, the *Irrigation Sector Reform Plan (2005)* indicated the enhanced its efforts toward the policy goals of (1) improving the maintenance and management system of irrigation facilities; (2) enhancing the transparency of water distribution in the province; (3) improving the irrigation services; and (4) raising the water use efficiency and productivity of farm fields. *The Provincial Irrigation and Water Resources Development Strategy (2004)* also prioritized the rehabilitation of existing irrigation facilities for long-term and efficient use in the Punjab Province. Additionally, the Government of Punjab Province was promoting the IMT policy, focusing on the transfer of water management to farmers, with the aim of effective irrigation water distribution.

The long-term development plan at the time of the ex-post evaluation, *Pakistan 2025*, which identifies energy, water and food security as one of its pillars, emphasizes the need to secure water supply through more efficient water use, water conservation and reuse. *The Punjab Water Policy 2018*, formulated by the PID, also specifies the reduction of water loss in irrigated areas to ensure the water supply and manage the distribution of irrigation water. Moreover, the Punjab Irrigation

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

and Drainage Authority (PIDA), which was responsible for transferring water management to FOs, has been dismantled by *the Punjab Khal Panchayat Act (*PKP Act 2019), which was issued by the Government of Punjab in 2019. As a result, the management of irrigation facilities has once again been entrusted to PID. Therefore, the maintenance and management system of the irrigation facility primarily overseen by the farmer and intended for appraisal through ex-post evaluation was abandoned and non-existent. However, the relevance of the Project remains intact in terms of strengthening the FOs. These organizations engaged farmers as water users and beneficiaries, enabling them to utilize the capacities built.

In light of the above, the Project is highly consistent with Pakistan's development policy at the time of the appraisal and ex-post evaluation.

3.1.1.2 Consistency with the Development Needs of Pakistan

In the Punjab Province, which has the largest irrigated area in Pakistan, agricultural productivity was low due to low availability, water losses and inefficient water use, etc., caused by aging irrigation facilities. At the time of the appraisal, wheat production in the Punjab Province of India was 4.80 tonnes per hectare (ha), while in Pakistan as a whole, it was 2.24 tonnes per ha, and in the target area of this Project, the Punjab Province in Pakistan, it was only 2.32 tonnes per ha[4]. Furthermore, rehabilitation of existing irrigation facilities was needed for long-term and effective use. Besides, improving water use efficiency, ensuring a stable water supply, and enhancing agricultural productivity through rehabilitation of distributaries and maintenance by FOs were considered important issues to be resolved.

At the time of the ex-post evaluation, wheat production stood at 2.98 tonnes per ha in the Punjab Province of India[5], 2.87 tonnes per ha in Pakistan as a whole[6] and 2.98 tonnes per ha in the Punjab Province[7]. Though the productivity has improved, it remains lower compared to the Punjab Province in India. This underscores the continued high necessity for rehabilitating of irrigation network to guarantee a stable irrigation water supply.

3.1.1.3 Appropriateness of the Project Plan and Approach

Under this Project, while the outputs increased due to the use of the remaining balance, there were no problems in this increase in terms of adequacy (see Efficiency for details). Furthermore, drawing from the lessons learned from the past similar cases where there were issues related to the lack of coordination and clarity between the Agricultural Department responsible for on-farm

[4] Source: Documents provided by JICA
[5] Source: *Agricultural Statistics at a Glance 2021*, Ministry of Agriculture and Farmers Welfare, Government of India https://eands.dacnet.nic.in/PDF/Agricultural%20Statistics%20at%20a%20Glance%20-%202021%20(English%20version).pdf (checked at August 3, 2023)
[6] Source: Agriculture Census Tables, Pakistan Bureau of Statistics, https://www.pbs.gov.pk/agriculture-statistics-tables (checked at August 3, 2023)
[7] Source: *Punjab Agriculture Statistics*

water conservation and the Irrigation Department responsible for water conservation in irrigation up to the fields, measures have been incorporated into this Project and the Associated TC Project to ensure sustainability. These measures involve utilizing FOs training to widely disseminate water-saving irrigation techniques by Agricultural Department extension officers and to support the formation and capacity building of FOs responsible for O&M. Although the FOs were disbanded after the Project was completed, it has been observed that farmers are using water-saving technologies in the target areas.

Moreover, the Project supported the formation and capacity building of FOs to strengthen the maintenance and management system of irrigation facilities led by FOs. As previously described, due to the enactment of the PKP Act 2019, the FOs were dissolved by the year of project completion and the management of the irrigation facilities was transferred again to the PID. However, at the time of the appraisal, the Government of Punjab was promoting institutional reforms on the transfer of water management to farmers, and it would have been difficult to foresee the later conversion of the same policy and incorporate it into the Project plan. Therefore, it can be said that there were no issues with the project approach.

3.1.2 Coherence (Rating: ③)

3.1.2.1 Consistency with Japan's ODA Policy

The *Country Assistance Strategy* (200) at the time of the appraisal identified support for water resources, irrigation and agriculture as priority areas, with particular emphasis on efforts to improve the efficiency of water use, users' participation and organizational system reform to maintain long-term maintenance and management systems for facilities. This Project aims to improve water use efficiency and agricultural productivity through the rehabilitation of distributary, the formation and capacity building of FOs, and support for underground water preservation and management, and is thus consistent with Japan's aid policy at the time of the appraisal.

3.1.2.2 Internal Coherence

JICA had sent the advisor for water use management to PIDA before the implementation of this Project, and active collaboration with the Project was expected. Subsequently, the examining compatibility of the guidelines/manual for strengthening FOs functions prepared by the advisor was incorporated into the activities of the Associated TC Project. Accordingly, advice and recommendations were provided to PIDA in promoting the use of the manual and in redrafting them to make it easier to use. "Lower Chenab River Irrigation Canal Improvement Project" (Japanese ODA loan) also supported the formation of FOs. In the Associated TC Project, advice on operational matters and training for FO officers were provided to support the activities of FOs formed under this ODA loan project. Therefore, a certain degree of collaboration and outputs were

confirmed as assumed at the time of the appraisal. For example, this Project and the Associated TC Project complemented each other, and the training was conducted by utilizing the experience gained, including advice based on FO activities[8].

3.1.2.3 External Coherence

In Pakistan, the World Bank (WB) and Asian Development Bank (ADB) were supporting the rehabilitation of irrigation canals on the premise of transferring irrigation management to FOs, however, the target areas were different and the WB and ADB projects did not provide technical assistance, and no direct coordination or complementary relationship with the Project was identified. In relation to the international framework, the Project was implemented to improve agricultural productivity and contribute to poverty reduction, thus it is consistent with SDG's goals 1 "No poverty", 2 "Zero hunger, and 6 "Clean water and sanitation"[9].

As mentioned above, this Project is in line with Pakistan's development policy and development needs, and there are no issues with the Project plan and approach. The consistency with Japan's aid policy, other assistance by JICA and international frameworks was also confirmed. Therefore, its relevance and coherence are high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The Project consisted of four components: 1) Civil works, 2) Institutional reform of FOs, 3) Underground water management and 4) Consulting services, at the Bahawalpur, Dera Ghazi Khan (DG Khan) and Faisalabad Zones in the Punjab province. The planned and actual outputs are shown in the table below.

[8] Source: Questionnaire answers and interview with the expert of the Associated TC Project

[9] Source: SDGs document https://www.mofa.go.jp/mofaj/gaiko/oda/sdgs/about/index.html (checked at August 3, 2023)

Table 1 Planned and Actual Outputs

Item	Plan		Actual	
1) Civil works	Lining (km)	Rehabilitation (km)	Lining (km)	Rehabilitation (km)
Bahawalpur	Approx.190	Approx.150	194	142
DG Khan	Approx.540	Approx.140	529	157
Faisalabad	Approx.430	Approx.600	455	516
Total	Approx.1,160	Approx.890	1,178	815
(Added) Sargodha	—	—	Widening and rehabilitation of feeder: Approx.105 km, Escape: Approx.18 km	
2)Institutional reform of FOs	- Formation and capacity building of FOs at the target area - Irrigation management transfer of distributaries to FOs - Training on the role of FOs in irrigation facility management, necessary skills and equitable irrigation water supply and distribution		As planned[10] - A total of 254 FOs was formed. - Irrigation management transfer to the representatives of FOs - Training for trainers (TOT) (195 trainers in total)/ FO training (357 participants in total)[11]	
3)Underground water management	- Awareness-raising on underground water status and use through farmers' participatory approach. - Continuous underground water monitoring (400 monitoring points assumed) - Analysis of field for water balance models at each canal		As planned - Implementation of awareness activities: A total of 19 times and 2,306 participants - The setting of 499 underground water monitoring points - Data collection and analysis of field for water balance models	
4)Consulting services	-Detail design, assistance for the tendering, supervision of the construction, etc.		As planned	

Source: Documents provided by JICA and questionnaire answers

As shown in Table 1, the outputs were as planned, except of the additional civil works for the widening and rehabilitation of water canals and the construction of an escape in the Sargodha Zone. These additions were made by the utilization of the remaining balance generated by a decrease in the yen equivalent value due to the exchange rate fluctuations[12], and the use of existing equipment owned by the executing agency for various activities related to support for the institutional reform of FOs. The Sargodha Zone, the area with the lowest water supply unit in the Punjab Province, faced frequent canal breakages and overflows due to the aging of existing facilities. Though the need for rehabilitation was high, the budget for the rehabilitation of

[10] This output was implemented in collaboration with the Associated TC Project. See [Cooperation between the Project and Associated TC Project] for more information.

[11] The training for FO was mainly conducted on the role of FOs in the maintenance of irrigation facilities and the necessary skills, using teaching materials (FOs in general, accounting and work manuals, conflict resolution case studies, guidelines for training instructors, flow observation manuals, etc.) prepared with JICA's support for the FOs formed under the Project.

[12] At the time of appraisal: 1 rupee = 1.93 yen; at the time of contracting: 1 rupee = 1.09 yen.

distributaries was insufficient, which was a factor in its selection as an additional target area[13]. The change was justified as the improvement of irrigation facilities in the area is considered to contribute to improving agricultural productivity in the Punjab Province. The change did not affect the Project cost, while it did affect the extension of the Project period (see 3.2.2.2 Project period).

【Cooperation between the Project and Associated TC Project】

The Project and the Associated TC Project had individual outputs and different indicators for assessing their effectiveness and impact. As illustrated in the figure below, the two Projects had interrelated objectives to achieve the project purposes and overall goals by leveraging the outputs of each project. In particular, the collaboration with the Associated TC Project was made for the Institutional reform of FOs to implement the training. Specifically, officers responsible for providing training to the FOs formed by the Project and the experts responsible for delivering technical training were recruited as PIDA staff. The Associated TC Project was primarily responsible for training these recruited experts and improving the training contents based on the practical experiences of the FOs. Furthermore, due to PIDA's limited expertise in implementing this Project, experts from the Associated TC Project also assisted in promoting the Project by suggesting job descriptions and qualification criteria for PIDA staff, among other responsibilities.

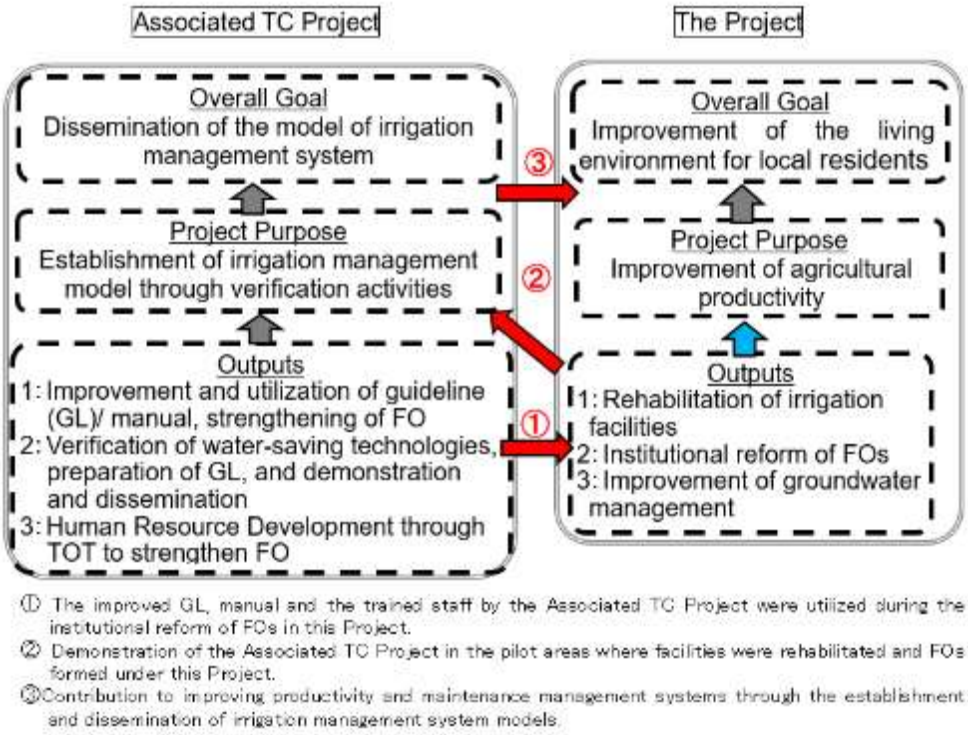


Figure 1 Cooperation between the Project and Associated TC Project

Source: Prepared by the evaluator based on the documents provided by JICA

[13] Source: Documents provided by JICA and questionnaire answers

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total cost of the Project was planned to be 12,832 million yen (ODA loan: 11,382 million yen). The actual project cost was 11,171 million yen (78% of the plan), within the plan. The main reasons why the project cost was lower than planned were fluctuations in the exchange rate that occurred from the time of appraisal to the conclusion of the contract for the civil work, the use of existing equipment owned by the executing agency for some of the equipment used in the institutional reform of FOs[14].

Table 2 Planned and Actual Project Costs

(Unit: million yen)

Item	Plan			Actual		
	Total	ODA loan	Pakistan side	Total	ODA loan	Pakistan side
Civil works	7,701	7,701	0	8,704	8,704	0
Institutional reform of FOs	1,075	1,075	0	274	274	0
Underground water management	85	85	0	19	19	0
Consulting services	807	807	0	728	728	0
Price escalation	763	763	0	0	0	0
Physical contingencies	481	481	0	77	0	77
Land acquisition	86	0	86	0	0	0
Administration cost	546	0	546	95	0	95
Taxes, etc.	818	0	818	671	0	671
Interest during construction	402	402	0	543	543	0
Commitment charge	68	68	0	60	60	0
Total	12,832	11,382	1,450	11,171	10,328	843

Source: Documents provided by JICA and questionnaire answers

Note 1: Exchange rate 1 rupee =1.93 yen (As of the appraisal in January 2008), 1 rupee = 0.996 yen (Actual: average rate during the project implementation period)

Note 2: Figures in the table may not add up to the total due to rounding.

(Reference[15]) Project cost of the Associated TC Project: The actual cost by the Japanese side was 232 million yen, which was slightly exceeded the planned amount of 200 million yen.

3.2.2.2 Project Period

The Project period was planned to be 70 months, from March 2008 to December 2013, however, the actual Project period[16] was 140 months, from May 2008 to December 2019, significantly exceeded the plan (200% of the plan).

[14] Source: Documents provided by JICA and questionnaire answers

[15] For the project cost of the Associated TC Project, while comparisons of planned and actual costs are described, they are not taken into account in the evaluation decision in principle based on external ex-post evaluation reference.

[16] As defined at the time of the appraisal, the Project period is defined as the month the loan agreement is signed to the month consultancy services are completed.

Table 3 Planned and Actual Project Periods

	Plan	Actual
L/A signing	May 2008	May 2008
Selection of consultant	March 2008 – December 2008	June 2008 – September 2009
Detail design	January 2009 – October 2010	September 2009 – Unknown
Tendering	January 2009 – September 2010	March 2010 – June 2011, October 2013, (Added) October 2017 Note
Rehabilitation of distributaries	November 2009 – April 2013	February 2011 – June 2015, (Added) November 2017 – December 2019
Institutional reform of FOs	November 2008 – October 2013	June 2010 – March 2015
Underground water management	November 2008 – October 2013	September 2010 – March 2015
Consulting services	January 2009 –December 2013	September 2009 – June 2015, (Added) July 2017 – December 2019
Project completion	December 2013	December 2019

Source: Documents provided by JICA
Note: (Added) is the duration of the additional output in the Sargodha Zone.

The major reasons for the delays were as follows[17].

- Delays in the enforcement of the L/A due to the preparation of various documents, etc., and selection of the consultants and contractors
- Extension of the Project period due to implementation of additional scopes[18] (outputs planned at the time of the appraisal were completed in June 2015, and extension of the Project period beyond that date was due to additional scopes).
- Delays in the assignment (recruiting) of training officers and agricultural experts, and consequent delays in the implementation of the TOT.
- Frequent change of personnel (transfers) in the executing agency during project implementation

(Reference[19]) Project period of the Associated TC Project: The actual Project period was 61 months, which slightly exceeded the planned 50 months.

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

The Economic Internal Rate of Return (EIRR) for the Project at the time of the appraisal was 22%. For the assumptions calculating EIRR, the costs included the Project costs (excluding taxes) and maintenance costs, the benefits were increased revenue in agricultural crops, and the project life was 25 years. At the time of the ex-post evaluation, recalculation of the EIRR was not possible because data on agricultural production in the target area was not available, despite attempts to

[17] Source: Documents provided by JICA, interviews with the executing agency and expert of the Associated TC Project
[18] The additional output involves the widening and refurbishing of irrigation canals in the Sargodha zone, with a total length accounting for approximately 6% of the entire project (refer to 3.2.1 Output).
[19] For the Project period of the Associated TC Project, while comparisons of planned and actual periods are described, they are not taken into account in the evaluation decision in principle based on external ex-post evaluation reference.

obtain it from the executing agency.

In light of the above, although the Project cost was within the plan, the Project period largely exceeded the plan. Therefore, efficiency of the Project is moderately low.

3.3 Effectiveness and Impacts[20] (Rating: ②)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

In the Project, the area benefited from the Project, the crop area planted, the collection rate of irrigation water charge, the number of FO, and the number of underground water monitoring points were set as the operation and effect indicators to analyze the Project's effectiveness. The baseline and target values are shown in the table below. The actual values could not be obtained from the executing agency during this ex-post evaluation survey as described in "2.3 Constraints During the Evaluation Study." Consequently, while the accurate analysis of each indicator's achievement level is not possible, an attempt was made to assess the effects of the Project after its implementation based on information obtained through interviews with the executing agency and beneficiaries, along with utilizing available statistics published by the Punjab Province.

Table 4 Operation and Effect Indicators Set at the Time of the Appraisal

	Baseline value	Target value	Actual value
	Average 2005-2006	2024 5 years after completion Note	
1)Area benefited by the Project (ha)	664,200	664,200	N.A.
2)Crop area planted (ha)			
Rice	47,454	48,169	N.A.
Cotton	121,654	127,962	
Maize	49,613	50,839	
Sugarcane	55,613	56,935	
Wheat	274,409	282,427	
Oilseeds	29,855	30,511	
3)Collection rate of irrigation water charge (%)	36.5% Note2	80%	N.A.
4)Number of FO	105	179	—
5)Number of underground water monitoring points	45	400	N.A.

Source: Documents provided by JICA

Note: According to the documents at the time of the appraisal, a timeline was set for five years corresponding to when the effects of the irrigation projects were expected to be generated.

[20] When providing the sub-rating, Effectiveness and Impacts are to be considered together.

1) Area benefited by the Project

The target value for the area benefited (irrigation benefited area) was set at the same area as the baseline value, because the rehabilitation of irrigation canals is supposed to increase cropping intensity (without changing the benefited area) in Pakistan[21]. Although the achievement status cannot be accurately analyzed as the actual data have not been confirmed, it is considered that the area benefited has exceeded the target value when the planned outputs plus the additional area in the Sargodha zone are taken into account. Moreover, the qualitative effects described below also report an increase in the area benefited through interviews with farmers[22] conducted during the site visits.

2） Crop area planted

Data for the entire district that includes the target area covered by the Project is used as reference information (see Annex 1). Compared to before project implementation, the crop area planted was 1.9 times in the Bahawalpur Zone, 1.7 times in the DG Khan Zone and 0.9 times in the Faisalabad and Sargodha Zones on average. With the exception of the cotton acreage, which decreased in the overall target area (falling below one time in two zones), major crops such as rice and maize have exceeded their pre-implementation levels. As the target values set at the time of the appraisal were all around 1.02-1.03 times of the baseline values, it is considered that the implementation of the Project has had an effect, albeit indirect information.

(Reference indicator) Production volume of major crops

Although varying by crop, the average production of major agricultural crops including rice, cotton, maize, sugarcane and wheat increased compared to pre-implementation levels in each target zone at the time of the ex-post evaluation (see Appendix 2). Particularly, rice production increased significantly in the Bahawalpur Zone by 3.4 times, the DG Khan Zone by 4.9 times, the Faisalabad Zone by 2.5 times and the Sargodha Zone by 1.5 times. The data represents the overall production in the entire district, including the target area, and therefore may not directly demonstrate the effects of this Project. However, during interviews with farmers, nearly all respondents reported an increase in production after the improvement of irrigation facilities, thus suggesting an increase on the production of major crops in the target area.

3) Collection rate of irrigation water charge

Irrigation water charges are collected from farmers every six months. Since actual figures were not provided, objective assessments based on factual data are not possible. However, according

[21] Source: Questionnaire answers, ex-post evaluation report “Lower Chenab Canal System Rehabilitation Project”.
[22] A total of 17 sites were visited in the target areas of the Bahawalpur, DG Khan, Faisalabad, and Sargodha Zones. Group interviews were conducted with 68 farmers, and in DG Khan Zone, interviews were also conducted with six farmers in non-target areas.

to the executing agency and farmers, the collection rate has remained low at the time of the ex-post evaluation (see "3.4.4 Financial Aspect" for details).

4) Number of FOs

Over 250 FOs were formed in the target area during the Project's implementation. However, with the dismantling of PIDA in 2019, all FOs were dissolved. As a result, no FOs were present during the ex-post evaluation, thus making this indicator not applicable.

5) Number of monitoring points of underground water

Through the implementation of the Project, 168 new monitoring points were established in the Bahawalpur Zone, 205 points in the DG Khan Zone, and 126 in the Faisalabad Zone at the time of the Project completion. Although it was not possible to obtain responses from the executing agency on the monitoring status at the time of the ex-post evaluation, it should be noted that awareness activities related to groundwater condition and utilization were conducted for farmers during the Project implementation. These activities contributed to the improvement of local people's knowledge[23].

3.3.1.2 Qualitative Effects (Other Effects)

Through the visits to the target areas and interviews with farmers conducted by the local assistant during the ex-post evaluation, the following findings were confirmed.

(1) Changes in major crops

75% of respondents indicated a change (increase) in the types of crops they cultivate. Due to the rehabilitation of irrigation canals, farmers have opportunities to choose the crops they cultivate, as they can consistently obtain an adequate supply of irrigation water at the necessary timings for crop growth[24]. Furthermore, in the Faisalabad Zone, agricultural land that was previously fallow is now used for rice cultivation, contributing to increased rice production in the area. In the Sargodha Zone, despite high demand, crops such as maize[25] and canola, which were previously difficult to cultivate, have become viable options.

(2) Introduction and use of irrigation models

In the target areas, through the FO training provided by the Associated TC Project, water-saving

[23] Source: Documents provided by JICA, questionnaire answers

[24] Although it varied from area to area, it was confirmed through the interviews that irrigation water increased by about 25% in the target areas after the irrigation canals were rehabilitated. On the other hand, in the non-target areas, all respondents reported no change in the quantity of irrigation water.

[25] The maize mainly grown in Faisalabad is a hybrid variety of maize that requires timely and regular water for cultivation.

technologies for efficient water use, such as Laser Land leveling[26] and Bed and furrow[27], have been introduced. Although the FOs have dissolved at the time of the ex-post evaluation, particularly laser leveling continues to be adopted by farmers in the target area, contributing to the efficient use of irrigation water, as confirmed during site visits.

(3) Design and construction from the beneficiary's perspective

The evaluation and satisfaction of farmers regarding the rehabilitated irrigation facilities are high. All respondents in the interviews affirmed that the design and quality of the rehabilitated irrigation facilities were appropriate. Since the lining of brick canals have been changed to concrete canals, many areas have experienced a reduction in breaches, leakages, and water theft, ensuring the reaching of irrigation water to the tail area of the canals. The participation of farmers in the construction work and the monitoring carried out by FOs were also cited as factors contributing to the high satisfaction with the design and construction[28].

Rehabilitated Distributary (Sargodha Zone)

Crops Grown in the Tail End of Distributary (Source: taken by the local assistant)

3.3.1.3 Achievement of the Outputs and Project Purpose of the Associated TC Project[29]

3.3.1.3.1 Achievement of Outputs

The achievement status of each output was as follows at project completion; Outputs 1 and 2 were achieved, and output 3 was achieved to a certain extent.

Output 1 "Training materials and operational references are improved/developed to strengthen and sustain the efforts on Area Water Board (AWBs) / FOs." (Achieved): The training materials and operational references were compiled in response to the farmer's opinions, and PID and PIDA staff are capable of utilizing these for the implementation of AWB/FO training.

[26] The height of the land leveling blade towed by a tractor, is monitored with a laser. The laser controls the leveling height and ensures high leveling accuracy, preventing water from stagnating in low-lying areas and hollows, and reducing water wastage and runoff.

[27] Mechanical ridge formation. Machines allow ridging with less disturbance and faster water flow and enhancing the effectiveness of controlling underground seepage losses.

[28] Source: Interviews with the farmers

[29] Source: Documents provided by JICA, questionnaire answers, interview with the expert of the Associated TC Project

Output 2 “Appropriate water saving irrigation technologies established in the model areas are promoted in the main pilot area” (Achieved): Demonstration activities of water saving irrigation technologies were conducted in the pilot areas. The materials have been distributed to the Agriculture Department and the Water Management Institute in the Punjab Province for use in disseminating the water saving technologies.

Output 3 “Capacities for training and guidance are improved among relevant government personnel such as Punjab Irrigation Department, PIDA, and PAD”. (Achieved to a certain extent): Training manuals and guidelines for the training management cycle were compiled, and TOT training was conducted for the staff of each relevant agency. However, it was not clearly defined to what extent the staff of each relevant agency would be involved in the TOT.

3.3.1.3.2 Achievement of the Project Purpose

Regarding the Project purpose of “the model of appropriate irrigation management system is established through verification activities in the pilot areas”, the materials compiled by the Project were being utilized in approximately 60% of the FO training programs in the pilot areas at the time of the project completion. Furthermore, over 90% of the farmers in the model areas expressed interest in applying the water saving irrigation techniques they learned through the demonstration and various materials. In a survey of TOT participants, half of the respondents (with a response rate of 57%)[30] reported that they were applying the skills and techniques they gained through TOT in their work and training.

Since 2019, the maintenance of irrigation facilities was transferred to PID, and PIDA was dismantled. PIDA officials who participated in the TOT during the project implementation and were in a position to continue their training were transferred to the Punjab Khal Panchayat Authority ("PKPA"), which was established by the PKP Act 2019. At the time of the ex-post evaluation, the activities of the PKPA had not been clearly defined, and training programs to take over the human resource development model for irrigation management systems was not ongoing. However, at the time of the ex-post evaluation, it was observed that water-saving technologies were being widely utilized in the target areas, indicating that the objectives of the Associated TC Project have been partially achieved.

[Effects generated through the collaboration of this Project and the Associated TC Project]

The Project was conducted to improve agricultural productivity in the target areas through the rehabilitation of irrigation canals, the formation of FOs responsible for their maintenance, and support for training in water-saving technologies, as well as O&M of irrigation canals, in coordination with the Associated TC Project. The Associated TC Project used the irrigation canals

[30] 111 out of 195 TOT participants responded.

rehabilitated by this Project to verify water-saving irrigation technologies and improved the training content based on the operation practices of the FOs that the Project supported to form. In the Project, FO training was conducted utilizing trainers and teaching materials developed and improved by the Associated TC Project. It can be said that each activity was implemented in coordination with each other, leading to improvements of agricultural productivity.

In terms of promoting project implementation, advantages and disadvantages were identified. The Project also included the objective of transferring the maintenance of the rehabilitated irrigation canals to the FOs. On the other hand, in the Institutional Reform of FOs, the progress of the Project stagnated due to the lack of experience in recruitment work of the executing agency in charge of deploying experts, as well as the movements of the stakeholders who held irrigation water rights. In light of these circumstances, the support from Japanese experts in the recruitment processes, coupled with their active involvement in the Associated TC Project, played a pivotal role in advancing the Project's initiatives related to the institutional reform of FOs, which had previously been difficult. At the same time, the activities of the two projects were closely coordinated, thus delays in this Project also affected the progress of the Associated TC Project. For example, the Associated TC Project was in charge of a TOT for PIDA staff who supported the capacity building of FOs. However, there were delays in recruiting staff responsible for the Project and the agricultural experts for developing water-saving agricultural technologies. Accordingly, the Associated TC Project could not start full-scale activities for a certain period. During this period, they allocated resources to support the promotion the implementation of this Project[31].

3.3.2 Impacts

3.3.2.1 Intended Impacts

As the impact of the Project, “increase in farmers’ income” and “improvement of local residents’ living environment” were expected. Through interviews with the executing agency and farmers in the target areas, the following impacts were confirmed.

(1) Increase in farmers’ income

In the Punjab Province, statistics on the increase in farmers’ incomes were not comprehensively compiled and were difficult to obtain. On the other hand, in interviews with farmers, over 90% of respondents reported an increase in farm income after the Project’s implementation[32]. Specifically, the proper distribution of water to the end of irrigation canals at right timing allowed for the use of fallow lands and the selection of crop types, resulting in increased yields, leading to higher farmers’ incomes. The main explanations given for each zone are as follows.

[31] Source: Questionnaire answers and interview with the experts of the Associated TC Project

[32] On the other hand, in areas not covered by the project, all respondents indicated that there was no change in income from farming.

Table 5　Examples of Income Improvement in Each District

Target zone	Example of effects
Bahawalpur	- After irrigation canals were improved, crop yields increased, making agricultural activities more profitable. - Due to less dependence on expensive and lower quality groundwater, the economic burden has been reduced.
DG Khan	- After the improvement of irrigation canals, the problem of water shortage was solved and the yield increased by 15-20%. Income has also increased accordingly. - Farming has become profitable, and some farmers have begun to take up activities and start new lifestyles.
Faisalabad	- Due to the stable water supply, there are more options for crops. Particularly during the summer, when water availability typically decreases and high temperatures require more water, the benefits are even greater. Maize, which is grown twice a year, in spring and summer, has seen a significant increase in production in the area due to high demand in poultry feed and edible oil markets. Wheat yields have also increased from 20-25 mounds[33]/acre to 40-50 mounds/acre, leading to higher incomes[34].
Sargodha	- One of the major changes after the rehabilitation of irrigation facilities is the increased availability of irrigation water, allowing for the cultivating rice on land that was previously left fallow. As a result, rice production has increased, leading to higher farmers' incomes.

Source: Interviews with farmers

(2) Improvement of the living environment for local residents

In the target areas, various changes in living conditions were observed after the Project was implemented. For example, before the project implementation, when irrigation water was scarce, many farmers had to go out as laborers in other places. However, after the project implementation, farmers were able to engage in agricultural activities on their own land. Moreover, with the expansion of cultivated areas and higher crop yields, income has improved, enabling families to afford children's education and medical services. Additionally, changes such as the purchase of agricultural machinery, livestock, and household appliances like televisions, refrigerators, and air conditioners have also been reported.

3.3.2.2 Other Positive and Negative Impacts

1) Impacts on the Environment

The Project was classified as Category B based on the "JBIC Guidelines for Confirmation of Environmental and Social Considerations" (April 2002), as it had minimal undesirable effects on the environment. Moreover, an Environmental Impact Assessment report is not required by domestic law. Planned measures to prevent water pollution by stopping the flow of water, instructing farmers on the use of pesticides, and monitoring water quality and salt damage were

[33] The unit is used to measure wheat and other crops in some regions such as Pakistan. (Mound)
[34] The fact that the Punjab Province subsidizes wheat and canola, which allows farmers to earn a reasonable income, has also contributed to the increase in farmers' income.

implemented during the construction, and no negative impact on the natural environment occurred as a result of the Project implementation.

2) Resettlement and Land Acquisition

This Project rehabilitated existing facilities, and resettlement and land acquisition were not assumed as of the appraisal and did not actually occur[35].

3) Gender Equality

The Project planned to promote awareness of women's roles in agricultural work, irrigation and water resources management, and women's participation in FO activities through training in the Institutional Reform of FOs. The training was conducted as planned, and in some areas, women were found engaging in agricultural work such as livestock rearing, grass cutting, cultivation, cleaning, sorting, and packing. However, there were no observed changes in the roles of women following the training, and it was not possible to assess the expected level of female participation[36].

4) Marginalized People

In the Punjab Province, small farmers with land holdings of less than 1 ha make up 34%, and those with land holdings of less than 5 ha account for 85% of the total. The proportions are almost similar in the target areas, and the stable supply of irrigation water has contributed to an increase in the income of small farmers, many of whom are poor. For example, farmers in the tail-end of the canals, who did not have access to sufficient irrigation water before the project implementation, are the beneficiaries who have benefited the most from the rehabilitation of canals. As previously described, effects such as increased yield and choice of crops grown have been reported. Although no official data are available, it is considered that the Project has contributed to the improvement of small farmers' income.

5) Social Systems and Norms, Human Well-being and Human Rights

No specific or direct activities from the perspective of social systems, norms, human well-being, or human rights were indicated at the time of the appraisal, and no related impacts occurred during or after implementation of the Project.

The actual value of the operation and effect indicators set at the time of the appraisal was not available. Therefore, it was not possible to accurately analyze the achievement status of the Project's effects based on the data. However, according to statistical data from the Punjab

[35] Source: Documents provided by JICA and questionnaire answers
[36] Source: Interviews with the executing agency and farmers

Province and interviews with farmers, the rehabilitation of irrigation canals and the use of water-saving technologies have made it possible to obtain water in the tail end of canals that previously did not have access to sufficient water. Accordingly, the area planted and production of major crops in each district, including the target areas, have increased compared to before the project implementation. Furthermore, it is now possible to choose crops for cultivation based on demand. As a result, farmers' incomes have increased, and impacts such as being able to purchase tractors, and appliances, and afford to pay for their children's education and medical services have been generated. On the other hand, the collection rate of irrigation water charges is low, and the status of underground water monitoring could not be confirmed. In light of the above, this Project has achieved its objectives only to a certain extent. Therefore, effectiveness and impacts of the Project are moderately low.

3.4 Sustainability (Rating: ②)

3.4.1 Policy and System

As mentioned above, with the enactment of the "PKP Act 2019", the activities of FOs responsible for the maintenance irrigation facilities were suspended. The above Act specified that the Khal Panchayat (KP) shall be established and responsible for preparing water distribution plans for the distributaries, arbitrating disputes among farmers regarding water distribution, and distributing water charge bills, while the PID would collaborate with KP and oversee the O&M of the distributaries. However, the KP was not functioning even at the time of the ex-post evaluation, and the PID is still playing its role. According to the PID, this change has not affected the O&M of the irrigation facilities or posed any challenges. On the other hand, farmers pointed out the concerns about the shortage of PID staff, leading to inadequate routine maintenance and raised worries about potential future issues related water may create disputes among farmers.

3.4.2 Institutional/Organizational Aspect

At the time of the appraisal, the main and branch canals were maintained by the PID, while the distributaries and minors were under the responsibility of FOs. However, as noted above, maintenance of the irrigation canals has now been placed under the jurisdiction of the PID, and it is carried out by their staff. PID has divided the irrigated areas into eight irrigation zones and with the Chief Engineer overseeing each zone. Each district has three to five "Circles" under the Chief Engineer. The Superintending Engineer is the head of the Circles, and below that Executive Engineers, who are the heads of Divisions, are appointed. They oversee technical staff and also monitor the O&M of the canals in their respective zones[37].

[37] Source: Questionnaire answers, Website of Irrigation Department of the Punjab Province https://irrigation.punjab.gov.pk/ (checked at August 3, 2023)

It has been pointed out that all target zones do not have sufficient staff due to budget shortfalls. For example, in the Bahawalpur Irrigation Zone, the number of staff required is 211 posts (including 73 engineers and technical staff). However, the actual number of the staff is 188 (with 53 engineers and technical staff). According to the staff of each zone, the shortage of staff has resulted in a heavy workload for staff involved in maintenance, leading to delays in maintenance tasks. This has become a significant challenge, and there are concerns about the occurrence of water theft due to inadequate management.

3.4.3 Technical Aspect

PID has been responsible for O&M of irrigation facilities for many years and has accumulated experience and know-how in its technical staff. Furthermore, there are established guidelines for each training, and engineering schools provide training to staff. However, opportunities for zone-level staff to receive training are limited, and while technical support from PID is theoretically available, the actual situation is challenging due to staff shortages. Manuals and guidelines needed for the O&M of irrigation canals are standardized across the Punjab Province and are currently in use. However, a problem has been pointed out that some of the equipment and vehicles needed for these activities were not being utilized due to budget constraints, and therefore not enough activities were being carried out.

At the time of the ex-post evaluation, the FOs were disbanded and the responsibility of O&M was shifted to the PID, therefore, there were no training opportunities for farmers. However, the farmers who constituted the FOs had received training during this Project, which emphasized the importance of canal maintenance and provided technical guidance. They continue to carry out activities such as canal cleaning and others. It is believed that the farmers benefiting the most from the project are those situated at tail end of canals, and their participation in the training provided under this Project has contributed to their understanding of the importance of O&M, to some extent, influencing their activities positively.

3.4.4 Financial Aspect

For O&M cost for irrigation canals, each zone office submits an annual plan to the province and budgets are distributed based on urgency. The budgets and expenditures for each zone are shown below, with all zones reporting budget shortfalls. The factors are attributed to low tariffs and high non-development expenditures (salaries and pensions). The collection of water charges, originally handled by PIDA, was transferred to the Land Revenue Department after the dismantling of PIDA in 2019, during which time PID did not have information and records regarding collection rates, etc. In 2021, an electronic system for collecting water bills (e-Abiana Billing) was launched in the Punjab Province, which marked a shift back to a system managed by PID once again. According to each zone office, the collection rates of water charge at the time of

the ex-post evaluation are low and considered to be at a similar level observed at the time of the appraisal. However, the unit cost of water charge remains inexpensive, at 275 rupees (about 137 yen) per acre during the rainy season and 165 rupees (about 82 yen) per acre[38] during the dry season, making it difficult to cover the O&M costs even with the collection rate is 100%[39]. Furthermore, the irrigation facilities developed under this Project have been in operation for more than three years, and considering that more repairs and maintenance will be required as time passes, the budget constraints faced by PID are a significant concern in terms of upkeep and maintenance.

Table 6 Budget and Expenditure for Each PID Zone

(Unit: million rupees)

Zone		2018/19	2019/20	2020/21
Bahawalpur	Budget	3,242	2,884	2,193
	Expenditure	2,937	2,609	1,356
DG Khan	Budget	2,635	2,458	1,598
	Expenditure	2,619	2,431	1,197
Faisalabad	Budget	2,309	2,017	1,839
	Expenditure	2,260	1,990	1,234
Sargodha	Budget	3,596	3,340	2,391
	Expenditure	3,344	3,246	1,617

Source: PID Website https://irrigation.punjab.gov.pk/

3.4.5 Environmental and Social Aspect

As explained in "3.3.2.2 Other Positive and Negative Impacts 1) Impacts on the Environment", mitigation measures were implemented for potential negative impacts, and no negative impacts occurred. Furthermore, it has been confirmed by the executing that there will be no anticipated negative impacts on the environmental and social aspects at the time of the post-evaluation.

3.4.6 Preventative Measures to Risks

At the time of the appraisal, it was assumed that factors such as security issues and climate change affecting agricultural production activities, fluctuations in agricultural input costs and commodity prices as well as coordination among relevant agencies, and also internal conflicts within FOs could act as potential risks to the project's effectiveness. According to the executing agency, the anticipated risks have not particularly affected the implementation of the Project, and no serious impacts are expected in the future at the time of the ex-post evaluation.

[38] Source: Documents provided by the executing agency
[39] Source: Interviews with the JICA Pakistan office. It has been pointed out that in the *Punjab Water Policy 2018*, water charges at 135 rupees per acre only cover 10-12% of the required maintenance costs.

3.4.7 Status of Operation and Maintenance

Through the ex-post evaluation, site surveys were conducted at 17 locations in the targeted areas. As a result, it was confirmed that the maintenance status of the canals was generally in good condition and the canals are almost 100% utilized in all zones. Through interviews with farmers during the site visit, the following concerns were reported at the time of the ex-post evaluation and in the future.

- Water quality in some canals in the target area in the suburbs of the city has been affected by garbage dumping by neighboring habitants.
- Since the transfer of canal maintenance to the PID, some areas have become more prone to water disputes, which were previously monitored and handled by the FOs.
- Although it is mandatory to conduct the O&M based on a uniform maintenance plan in the Punjab Province developed by the PID, there are cases where O&M is not conducted on regular basis due to lack of personnel and funds.

Distributaries in Peri Urban area (Faisalabad zone) (Source: taken by the local assistant)

In light of the above, the O&M status is generally good, however, there are some areas where necessary maintenance activities have not been carried out, indicating some challenges.

No issues have been observed in the preventative measures to risks in the O&M of the Project. On the other hand, some minor issues have been observed in the policy/system, institutional/organizational due to lack of budget, technical, and financial aspects, and including the current status of O&M. They are not expected to be improved/resolved. Therefore, sustainability of the Project effects is moderately low.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Project aimed to improve agricultural productivity by rehabilitating irrigation facilities centered on distributaries and water resource management related facilities, supporting the formation and capacity building of FOs, and providing support for the management and preservation of underground water in the Punjab Province, thereby contributing to poverty reduction. In connection with this Project, “Strengthening Irrigation Management System Including Agriculture Extension through Farmers’ Participation in the Punjab Province” (the Associated TC Project) was also executed to improve the efficiency of irrigation systems and support the policy of devolution of irrigation management through the formation of FOs and strengthening of their activities.

This Project has been consistent with Pakistan’s development plans and development needs

both at the time of the appraisal and ex-post evaluation. Furthermore, the Project's purpose was consistent with Japan's aid policy at the time of the appraisal. The collaboration with JICA supported technical cooperation and grant aid projects, and a certain degree of output were also confirmed. Therefore, its relevance and coherence are high. While the outputs increased with the addition of the target zone, the Project cost was within the plan because of fluctuations in the exchange rate and use of existing equipment. On the other hand, the Project period largely exceeded the plan. Therefore, efficiency of the Project is moderately low. According to relevant data in the irrigation zones as a whole including the target areas and beneficiaries, the area planted and production of major crops increased compared to before the Project was implemented. This has, in turn, led to higher incomes for farmers, enabling them to afford amenities like tractors, household appliances and invest in their children's education. However, the lack of comprehensive operation and effect indicator data prevents a precise evaluation of the achievement of the project's effectiveness. Therefore, effectiveness and impacts of the Project are moderately low. Regarding the O&M of the Project, there are no particular issues in the policy/system aspect and preventative measures to risks, however, there are some issues in the institutional/organizational and technical aspects, and status of O&M. Therefore, the sustainability of the Project effects is moderately low.

Based on the above, the Project is evaluated to be partially satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

- In the peri urban area, cases of water quality deterioration in canals have been observed due to the dumping of garbage. It is desirable that PID's maintenance staff should ensure regular cleaning, and collaborate with local authorities. It is advisable to engage with the local community through awareness campaigns and dissemination of messages through posters and bulletin, and using print, electronic and social media towards improving the situation.
- The shortage of PID personnel is becoming a growing concern for the continued proper maintenance of irrigation canals in the future. While staff shortages due to budget constraints are common issue in many public institutions and are not problems that can be immediately solved, PID needs to urgently consider a system that would enable it to conduct appropriate maintenance activities. This could include the use of PKPA staff (former PIDA staff) who have acquired knowledge and experience through training from the Associated TC Project.
- In all target zones of this Project, a shortage of O&M cost has been reported. The collection rate of irrigation water charges at the time of the ex-post evaluation is low, and given the low unit price of irrigation water charges, covering O&M costs even with a 100% collection rate is challenging. On the other hand, the irrigation facilities developed under the Project have been in operation for more than three years, and it is expected that additional repairs and maintenance

will be necessary in the future. Therefore, it is desirable for PID to promptly develop an effective plan for setting appropriate irrigation water charges and increasing the collection rate to ensure adequate budgeting and sustainability in terms of financial aspect.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

Project formation based on an understanding of the implementation structure and capacity of the executing departments for both the ODA loan and the Associated TC Projects

This Project was delayed due to a lack of experience and other issues with the executing agency responsible for supporting the institutional reform of FOs, and activities were implemented with the support of the Associated TC Project. However, this required the experts from the Associated TC Project to dedicate significant time to the Project, thereby affecting their own progress. Since both projects were expected to unfold their activities while reinforcing the outputs of each other's projects. Accordingly, they had an impact on the overall schedules of both projects. For Projects that are expected to implement activities in cooperation with each other, it's essential during the formulation stage for all stakeholders, including experts, JICA offices, and executing agencies, to thoroughly assess the capacity of each project's responsible departments. This understanding will help in planning activities to ensure that resources are allocated appropriately. It is also desirable to plan schedules to prevent delays or issues in one project from impeding the progress of activities in the other project.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

None

5.2 Additionality

None

(End)

Comparison of the Original and Actual Scope of the Project

Item	Plan		Actual	
1. Project Outputs				
1) Civil works	Lining (km)	Rehabilitation (km)	Lining (km)	Rehabilitation (km)
Bahawalpur	Approx.190	Approx.150	194	142
D.G. Khan	Approx.540	Approx.140	529	157
Faisalabad	Approx.430	Approx.600	455	516
Total	Approx.1,160	Approx.890	1,178	815
(Add) Sargodha	—	—	Widening and rehabilitation of feeder: Approx.105 km, Escape: Approx.18 km	
2) Institutional reform of FO	- Formulation and capacity building of FO at the target area - Irrigation management transfer of distributaries to FO - Training on the role of FO in irrigation facility management, necessary skills and equitable irrigation water supply and distribution		As planned - A total of 254 FO was established. - Irrigation management transfer to the representatives of FO - Training for trainers (TOT) (195 in total)/ FO training (357 in total)	
3) Groundwater management	- Awareness-raising on ground-water status and use through farmers' participatory approach. - Continuous groundwater monitoring (400 points assumed) Analysis of field for water balance models		As planned - Implementation of awareness activities: A total of 19 times and 2,306 participants - Setting of 499 groundwater monitoring points Data collection and analysis of field for water balance models	
4) Consulting services	- Detailed design, assistance for the tendering, supervision of the construction, etc.		- As planned	
2. Project Period	March 2008-December 2013 (70 months)		May 2008-December 2019 (140 months)	
3. Project Cost Amount Paid in Foreign Currency Amount Paid in Local Currency Total ODA Loan Portion Exchange Rate	 470 million yen 12,362 million yen (6,405 million rupees) 12,832 million yen 11,382 million yen 1 rupee = 1.93 yen (As of January 2008)		 9,598 million yen 1,573 million yen (1,588 million rupees) 11,171 million yen 10,328 million yen 1 rupee = 0.99 yen (Average between May 2008 and December 2019)	
4. Final Disbursement	March 2020			

[Attachment 1 (for reference) Crop area planted (ha)]

		Before the Project	Actual		Actual
		2007/08	2020/21	2021/22	/Baseline
Bahawalpur	Rice	65,550	129,890	159,840	2.4
	Cotton	515,160	488,060	467,840	0.9
	Maize	7,600	20,421	28,627	3.8
	Sugarcane	33,990	35,200	38,850	1.1
	Wheat	602,580	728,010	720,730	1.2
				Average	**1.9**
DG Khan	Rice	37,240	100,550	129,080	3.5
	Cotton	245,230	186,960	123,020	0.5
	Maize	1,200	N.A.	400	0.3
	Sugarcane	18,620	53,410	64,750	3.5
	Wheat	602,580	434,220	431,790	0.7
				Average	**1.7**
Faisalabad	Rice	138,810	241,590	254,950	1.8
	Cotton	129,490	26,700	15,780	0.1
	Maize	93,100	84,400	108,100	1.2
	Sugarcane	284,900	181,720	202,340	0.7
	Wheat	794,790	683,500	631,700	0.8
				Average	**0.9**
Sargodha	Rice	37,640	50,580	55,850	1.5
	Cotton	7,280	2,020	1,620	0.2
	Maize	26,000	31,200	22,800	0.9
	Sugarcane	69,600	59,890	69,750	1.0
	Wheat	206,380	195,050	207,600	1.0
				Average	**0.9**

Source: documents provided by JICA, Crop Reportting Sevice, Agriculture Depertment, Punjab: *Kharif & Rabi Crops Estimates 2007-08, Kharis Crops Estimates2021-22, and Rabi Crops Estimates 2021-22*

Note: The operation and effect indicators set at the time of the appraisal represent data for the area covered by the Project. The data in this table shows the one for entire zone (district) which include the target area of this project from the Crop Reporting Service's statistical information.

[Attachment 2 (for reference) Production Volume (ton/year)]

		Before the Project	Actual		Actual
		2007/08	2020/21	2021/22	/Baseline
Bahawalpur	Rice	112,980	309,700	378,500	3.4
	Cotton	2,009,380	1,895,040	1,854,850	0.9
	Maize	34,700	42,765	35,280	1.0
	Sugarcane	1,631,460	2,623,160	2,526,720	1.5
	Wheat	1,548,510	2,590,060	2,565,950	1.7
				Average	**1.7**
DG Khan	Rice	79,750	231,400	391,000	4.9
	Cotton	1,066,910	537,560	465,150	0.4
	Maize	34,700	200	3,103	0.1
	Sugarcane	984,700	4,604,160	4,358,570	4.4
	Wheat	1,548,610	1,442,790	1,427,670	0.9
				Average	**2.2**
Faisalabad	Rice	246,300	573,700	604,100	2.5
	Cotton	369,890	89,260	59,250	0.2
	Maize	529,300	647,800	739,800	1.4
	Sugarcane	13,368,540	12,898,360	14,339,840	1.1
	Wheat	2,117,240	2,289,340	2,050,760	1.0
				Average	**1.2**
Sargodha	Rice	73,420	91,300	113,480	1.5
	Cotton	11,010	3,260	2,670	0.2
	Maize	78,400	88,400	57,400	0.7
	Sugarcane	3,248,430	4,641,280	4,761,600	1.5
	Wheat	468,810	616,630	545,620	1.2
				Average	**1.0**

Source: documents provided by JICA, Crop Reportting Sevice, Agriculture Depertment, Punjab: *Kharif & Rabi Crops Estimates 2007-08, Kharis Crops Estimates2021-22, and Rabi Crops Estimates 2021-22*

Note: The operation and effect indicators set at the time of the appraisal represent data for the area covered by the Project. The data in this table shows the one for entire zone (district) which include the target area of this project from the Crop Reporting Service's statistical information.