Islamic Republic of Pakistan

Fiscal 2020 Ex-Post Evaluation Report

Japanese ODA Loan "Lower Chenab Canal System Rehabilitation Project"

External evaluator: Namura Ayako, Tekizaitekisho LLC

0. Summary

This project is intended to expand agricultural production by rehabilitating the existing irrigation facilities and drainage facilities in the Lower Chenab Canal (hereinafter referred to as "LCC") in the central area of Punjab Province and establish and foster farmer organizations (hereinafter referred to as "FO") that can be responsible for operating and maintaining the facilities, thus contributing to an increase in the income of farmers in the target area.

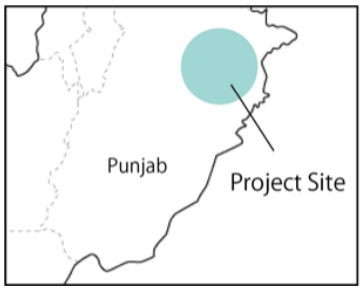
For Pakistan, where agriculture is still a key industry, the implementation of this project is sufficiently aligned with Pakistan's development plans and sector policies, the need to secure water for agriculture by establishing irrigation facilities, and Japan's aid policy. Therefore, the project is highly relevant. The project's efficiency is fair. This is because the project period far exceeded the plan, although project costs were within plans.

The area that benefited, the cropped area by main agricultural product, and the collection rate for water charges exceeded the levels set in the appraisal, and effectiveness is thus deemed to be high. Although improved income for small farmers, which had been anticipated as an impact of this project, could not be confirmed in statistical data, rehabilitation work done in this project made it possible to secure irrigation water, and the increase in the cropped area and the fact that some small farmers shifted to cash crops suggests that the project may have contributed to higher agricultural income. Moreover, other impacts were confirmed, such as the start of new businesses and education - particularly an increase in expenditures on education costs for girls. No negative impacts were confirmed. As a result, we concluded that the project effectiveness and impact are high.

This project's operation and maintenance (hereinafter referred to as "O&M") did not have any significant technical or financial issues; however, there were challenges in both institutional/organizational aspect of O&M and status of O&M, and going forward, these aspects should be further reinforced. Accordingly, the sustainability of the effects resulting from this project is fair.

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

1. Project Description



Map of Project Location

Distributary Rehabilitated by the Project

1.1 Background

The Lower Chenab Canal (LCC) in the central area of Pakistan's Punjab province is one of Pakistan's oldest water irrigation systems, developed in the 19th century during the British colonial period. It has the largest irrigation area (1,240,000 ha) in Punjab province, the center of irrigated agriculture. However, as the irrigated area expanded, the facilities' capacity shortage became increasingly obvious, and the efficiency of water use fell and agricultural productivity was damaged as channels were eroded and facilities became more decrepit. As a result, remodeling and rehabilitating the irrigation facilities were urgent issues.

Irrigation channels and drainage channels in the uppermost part of the LCC had been repaired in "the National Drainage Program Project," funded with loans from JBIC. LCC Part B, which covered the lower part of the LCC (irrigated area of 610,000 ha), needed rehabilitation work on its flow capacity, which had declined with age, following the uppermost part. In addition to remodeling and rehabilitating the water channels, fairly and efficiently distributing water and operating and maintaining the water channels were essential if agricultural productivity were to be improved. In terms of the long-term utilization of the water channels that had been built, it was essential that an appropriate O&M system be established. Since the establishment of the Punjab Irrigation and Drainage Authority (hereinafter referred to as "PIDA") in 1997, the Punjab government had promoted institutional reform, namely, Irrigation Management Transfer (hereinafter referred to as "IMT"), which centered on moving control over water management to the farmers. The project had supported this reform and also supported efforts to improve the capacity of the FOs.

1.2 Project Outline

This project is intended to expand agricultural production by rehabilitating the existing irrigation facilities and drainage facilities in the Lower Chenab Canal (LCC) in the central area of Punjab province and establish and foster farmers' organizations (FOs) that is responsible for operating and maintaining the facilities, thus contributing to the increase in the income of farmers in the target area.

Loan Approved Amount/Disbursed Amount	12,523 million yen / 11,619 million yen	
Exchange of Notes Date / Loan Agreement Signing Date	August 2005 / August 2005	
Terms and Conditions	Interest Rate Repayment Period (Grace period Conditions for Procurement	1.3 % 30 years 10 years) General untied
Borrower / Executing Agency(ies)	The President of Islamic Republic of Pakistan/ Punjab Irrigation and Drainage Authority[1]	
Project Completion	March 2018[2]	
Target Area	Lower Chenab Canal System (Part-B) in central part of Punjab province	
Main Contractor(s)[3]	-	
Main Consultant(s)	National Engineering Services Pakistan Limited (Pakistan) / National Development Consultants (REGD) (Pakistan)	
Related Studies (Feasibility Studies: F/S), etc.	-	
Related Projects	Japanese ODA Loan: "National Drainage Program Project" by World Bank, Asia Development Bank and Japan Bank for International Cooperation (March 1997) Technical Cooperation Project: "Water Management Advisor for Punjab Province" (2006-2008) "Project for Strengthening Irrigated Agriculture through Participatory Irrigation Management in the Punjab Province" (2009-2013)	

[1] This organization was disbanded in May 2019, and the work is essentially carried on by the Punjab Irrigation Department (PID).

[2] Refer to "3.2.2.2. Project Period."

[3] A contractor whose contract amount exceeds one billion yen.

2. Outline of the Evaluation Study

2.1 External Evaluator

Namura Ayako, Tekizaitekisho LLC

2.2 Duration of Evaluation Study

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

Duration of the Study: October 2020 – November 2021

2.3 Constraints during the Evaluation Study

Due to the global spread of COVID-19, the survey in Pakistan by External Evaluator was cancelled and instead, local assistant was utilized to carry out surveys in Pakistan remotely. This resulted in some constraints in collecting data. In addition, it was found that baseline data or information on data sources to examine the impact were not identified at the appraisal, and the statistical data or materials that would enable a quantitative examination of the impact in the ex-post evaluation was not compiled in Pakistan. Accordingly, the impact was assessed using qualitative information.

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

3.1 Relevance (Rating: ③[5])

3.1.1 Consistency with the Development Plan of Pakistan

At the time of the appraisal, Pakistan's government had established a water resource development strategy in its *Ten-Year Long-Term Development Plan (2001-2010)* and emphasized the importance of securing enough water to meet increased demand for water in the future. At the time of the ex-post evaluation, the government had established *Pakistan 2025: One Nation - One Vision, a long-term development plan*. The security of energy, water and food was designated as one of the pillars of this plan, and ensuring water supply through greater efficiency of water distribution, water conservation and reuse was emphasized in the plan.

In Punjab province, at the time of the appraisal, the provincial government had established *the Irrigation Development Strategy 2004 in Punjab Province*. One of the provincial government's priorities was rehabilitation of existing irrigation facilities so that they could be used long term and more efficiently. At the time of the ex-post evaluation, *the Punjab Water Policy 2018* developed by the Punjab Irrigation Department (hereinafter referred to as "PID") identified the security of water as a

[4] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[5] ③: High, ②: Fair, ①: Low

crucial issue for Pakistan, and designated "increasing the amount of usable water" as one of its goals. The government decided to secure the water supply by reducing water loss in the irrigated regions and distribute irrigation water. At the time of the appraisal, the Government of Punjab province promoted IMT, aiming to "encourage the participation of beneficiaries" and "effectively operate and maintain irrigation facilities through improving the capacity of government organizations in charge of water management and reforms of institutional systems." However, *the Punjab Water Policy 2018* laid out guidelines that questioned the effects of the reformed management system[6], and the responsibility of management of irrigation facilities was again moved to PID (for details, refer to "3.4 Sustainability") as of abolishment of PIDA in May 2019. In other words, due to the provincial government's policy reversal, the system for operating and maintaining irrigation facilities with farmers taking the main role had been discontinued although it had been the goal at the time of the appraisal. On the other hand, the provincial government promoted IMT at the appraisal and during the project implementation period, and it cannot be concluded that the provincial government's policy change hurt the relevance of this project.

As noted above, the development plans and policies of the State and Punjab province's governments at the time of appraisal and the ex-post evaluation specified securing irrigation water and the fair distribution of water as important issues in one of the water policies. Thus, this project is consistent with Pakistan's development policy and plans.

3.1.2 Consistency with the Development Needs of Pakistan

At the time of the appraisal, water use was inefficient due to the decrepit nature of irrigation facilities in Pakistan, and agricultural productivity was low. Accordingly, it was important to secure a stable supply of agriculture water by building irrigation facilities, efficiently use agricultural water by building a voluntary O&M system run by a farmers' organization. Even at the time of ex-post evaluation, the agricultural sector in Pakistan is still a key industry, and securing water to support agricultural production and efficiently using water remained important issues. Accordingly, remodeling and rehabilitating irrigation facilities to secure usable water is consistent with development needs in Punjab province. Small farms still account for a high percentage of agriculture and the agricultural productivity is low[7] in the project's target region; therefore, a stable

[6] This policy states that the lessons learned from a review of the results of reforms to the irrigation management system through efforts made thus far by the PIDA, AWB and FO to establish and strengthen functions should be utilized, adapted to fit social and political conditions in the Punjab province, and the system reformed so that it is easy for PID and water users to accept.

[7] A comparison of productivity for key agricultural goods in 2018-2019 shows that productivity of wheat in India's Punjab province was 5.2 t/ha, cotton was 0.8t/ha, sugarcane was 81.8 t/ha and rice was 6.2

supply of irrigation water is essential in ensuring that small farmers, who have low agricultural income, have adequate harvests of agricultural products. In this respect as well, this project addresses the need for higher income for small farmers.

3.1.3 Consistency with Japan's ODA Policy

At the time of the appraisal, Japan's *Mid-term Strategy for Overseas Economic Cooperation Operations (2005)* stated that a crucial area for Pakistan was improving access to social and economic services in rural areas and regional cities, where there was significant poverty. *Country Assistance Policy for Pakistan (2005)* identifies the development of a sound market economy as an important area for Japan's assistance for Pakistan, and decided to support the development of agricultural and rural sectors with the aim of expanding labor absorption capacity and reducing poverty.

This project has been highly relevant to the Pakistan's development plan/the Punjab province's sector policy and strategy, 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

This project targets the Lower Chenab Canal (LCC) Part-B (irrigated area of 610,000 ha) in the central area of Pakistan's Punjab province, developed in the late 19th century during the British colonial period. The project consists of four parts: 1) civil engineering work, 2) institutional reforms (support for the establishment and development of a farmers' organization), 3) on-farm research and development and 4) consulting services. The project target areas are shown in Figure 1.

t/ha (data is all from 2018-2019 data from India's Punjab provincial government: https://agri.punjab.gov.in/?=agriculture-statistics), while productivity for key agricultural goods in Punjab province in Pakistan was 2.8 t/ha for wheat, 0.62 t/ha for cotton, 62 t/ha for sugar cane and 2.1 t/ha for rice (Pakistan's Statistical Department, Pakistan Statistical Yearbook 2019).

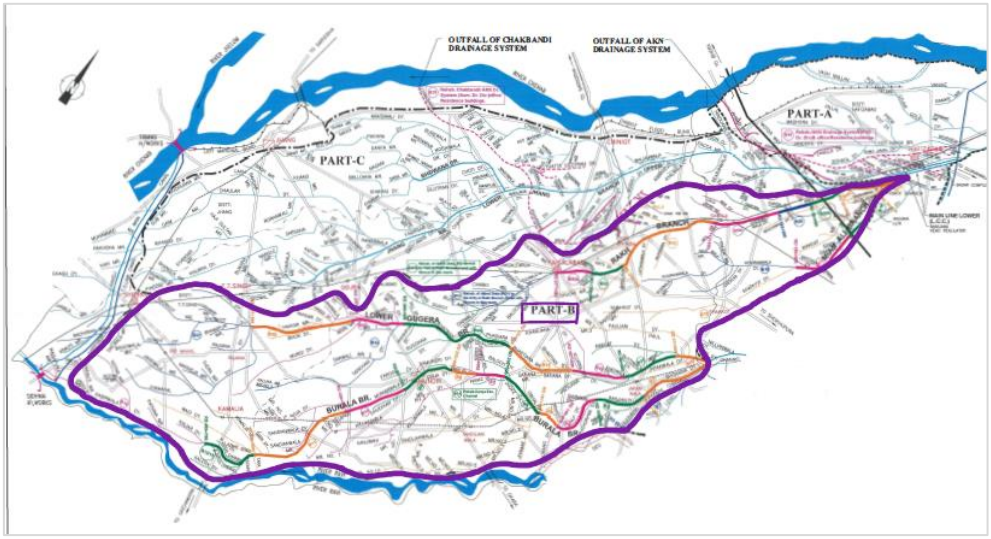


Figure1. Target Area by the Project

Source: Compiled by Evaluator based on PID related document

1) Civil Engineering Work

The civil engineering work carried out in this project consisted of four parts: i) remodeling and rehabilitating the branch canal, ii) rehabilitating distributaries/minors, iii) lining works of the distributaries/minors and iv) rehabilitating drainages. The table below compares the plans for the civil engineering work and the actual results[8].

Table 1. Comparison of Plans and Results for Engineering Work

Work	Plans			Results		
	Related document (1)*1	Related document (2)*2	PID plan*3	Results from initial plans	Results from extension works	Total
i) Remodeling and rehabilitating branch canals	375 km	402.6 km	381 km	381 km	-	381 km
ii)Rehabilitating distributaries/ minors	2,158 km	1,586.1 km	1,501 km	1,501 km	304.83 km	1,805.83 km
iii) Lining works of distributaries/ minors	321 km	342.8 km	992.06 km	992.06 km	307.84 km	1,229.9 km
iv) Rehabilitating drainage system	399 km	401.4 km	-	Rehabilitating structures		

Note *1: Related document (1) refers to JICA's documents at the time of the appraisal.
*2: Related document (2) refers to the document agreed between JBIC and PID at the time of appraisal. Since the data was given in miles, it was converted to km using 1 mile = 1.60934 km. The document did not describe the detailed work for (4), and only the full length of the drainage channels was noted.
*3: From PID.

Source: JICA related documents and PID responses to questionnaires

[8] Since several different plans were identified for the project, it was difficult to identify the reasons why these disparities occurred. Therefore, several different plans, including the plans identified in JICA related documents and perceived by PID, are shown in Table 1.

In this civil engineering work, the yen appreciated during the project period, which resulted in an extra 2.5 billion rupees in the budget. This was added to the budget for the civil engineering work, covering (ii) 304.83 km in work to rehabilitate the distributaries/minors and (iii) 307.84 km in work to line the distributaries (lining works and side protection). The extension works of civil engineering involved selecting the distributaries/minors that the supply of irrigation water was particularly failing to reach and carrying out rehabilitation, as well as carrying out the lining works. In this term, the change in scope was appropriate[9].

Information related to the civil engineering plans differs depending on the documents referenced in Table 1. A comparison of the plans (related materials (1)) and results shows that "i) remodeling and rehabilitating the branch canals" was almost entirely in line with the plan; on the other hand, the results for "ii) rehabilitating distributaries/minors" came in far below the planned figures, even when including extension works. The results for "iii) lining works of the distributaries/minors" came in well above the plans. The plans for "iv) rehabilitating the drainage systems included rehabilitation to the drainage channels, but rehabilitation work for the drainage channels by PID had not been originally planned; instead, village road bridges where the target drainage channels were located, inlet, and repairs to buildings had been planned. This section compared the plans and results for related document (1), but the planned values differ depending on the referenced documents. In particular, the plan of "related document (1)" and the one PID had perceived, which makes it difficult to determine the factors of the discrepancies between the planned values and results[10].

2) Institutional Reform (support for establishment of farmers' organizations and capacity building)

The institutional reform, as a technical support, was carried out as planned to launch the farmers' organizations, provide training for the FO's standing committees and general body members, and conduct regular monitoring and performance evaluations of the FOs[11]. With cooperation from PID, PIDA carried out training for FO members on operations on methods for operating and maintaining channels (operation of outlet (division works), methods for checking condition of outlets, type of outlet structure),

[9] The implementation of this project improved the volume of irrigation water in the tail of the target distributaries/minors (PID questionnaire, results of FO interviews) and the change in scope enhanced the project's effect, and is thus deemed appropriate.

[10] A comparison to the plans as perceived by PID shows that work to "ii) rehabilitating distributaries/minors" and "iii) lining works of distributaries/minors" were carried out as planned when including the extension works. PID also perceived that these civil engineering works were carried out as planned.

[11] From responses to PID questionnaires.

the collection of water charge (Abiana), methods for fairly allocating irrigation water and measuring the water flow, and methods for resolving disputes, among other subjects. Almost all former FOs[12] interviewed in the survey conducted during the ex-post evaluation stated that this training had been effective.

However, the actual number of FOs established fell somewhat short of the planned number. The actual number slightly undercut plans because a lawsuit was filed during the process of establishing FO; therefore, a total of 26 FOs was not formed in LCC (East) and LCC (West). The FOs were made up of the chairs of the water user associations, known as Khal Panchayat (KP) that manages watercourses. However, disputes over the selection of KP chairs and formal objections when FO presidents were selected among the members of the FO standing committee led to court cases and FO were not established[13].

Table 2. Number of FO Established by Project

	Planned number	Actual number	
		1st Tenure	2nd Tenure / through project completion
LCC (East)	85	84	72
LCC (West)	67	65	54
Total	152	149	126

Note: LCC (East): First Tenure: April 2005 – December 2009; Second Tenure: February 2011 – February 2016
LCC (West): First Tenure: July 2007 – April 2011; Second Tenure: December 2013 – December 2016

3) On-farm Research and Development

The on-farm research and development (hereinafter referred to as "R&D") was implemented by the University Agriculture Faisalabad (UAF)[14], and as planned, trials and research on the bed-furrow planting for wheat, water analysis, drip irrigation system,

[12] Details are provided in "3.4 Sustainability." Since FO are currently disbanded, the phrase of "former FO" is used when discussing the conditions as of the ex-post evaluation in this report. In the ex-post evaluation, nine former FOs were interviewed and site surveys were carried out. For each FO, about five farmers located at the head, middle reaches and tail, respectively, were interviewed, for a total of about 15 farmers. The nine former FOs consisted of four areas in LCC (West) and five areas in LCC (East), including three areas where the former FOs did not perform very well. By branch, four FOs from the Rahk Branch, two FOs from the Lower Gugera Branch, two FOs from the Burala Branch and one I FO from the Mian Ali Branch/Upper Gugera Branch were targeted. Former FO members were chairs of Khal Panchayat, water use associations for the watercourses, and a total of 205 members from nine FOs participated in these interviews, including a chairman who had been a member of the former FO's standing committee, office managers, treasurer and committee members. Since almost all of the chairs of Khal Panchayat are male, all of the participants ended to be male, and the main profession was agriculture. Although there was some difference depending on the FOs and farmer, the average area of agricultural land owned by the farmers in the areas where the interviewed FOs were overseen was 0.5 – 2.8 ha.

[13] From responses to PID questionnaires. The distributaries that were not managed by the FOs were put under the supervision of the PID (Administrator/Executive Engineer).

[14] An agreement on the on-farm R&D component was signed between PIDA and the Pakistan Agriculture Research Council (PARC) on 15 September 2006; however, since PARC was based in Islamabad, UAF, which participates as a working group member, actually took responsibility for the on-site activities.

skimming well technology and laser land leveling were carried out in the distributaries/minors of the project target area. As initially planned, the on-farm R&D component was carried out at the three distributaries of Mongi, Killianwala and Khurianwala. As this project's duration was extended, the same activities were also carried out at the distributaries of Khikhi, Dijkot and Shahkot as the second phase (2012 – 2015). According to UAF, the objective of this project was research and development, and involved the examination of whether new technology helped to resolve farmers' issues and the collection of data. In this respect, adequate data on these agricultural management activities was collected and the research objectives were achieved. Moreover, at the targeted distributaries, cutting-edge water management technology was adopted, and contributed greatly to the improvement of productivity for key crops[15]. In particular, the laser land leveling technique was recognized by farmers as being extremely effective in conserving water and was utilized in 90% of the targeted areas. However, small farmers could not purchase the equipment as it is expensive, so after the project ended, many famers rented the equipment[16].

4) Consulting Service

A consultant in charge of construction supervision was procured, and the detailed design, preparation of bidding documents, assistance with bid evaluation, and construction work supervision were carried out as planned.

3.2.2 Project Inputs

(Refer to "Comparison of key plans/results" at the end of the report for details.)

3.2.2.1 Project Cost

Project costs were forecasted at 14,733 million yen (ODA Loan Portion: 12,423 million yen) at the time of the appraisal; however, actually totaled 13,697 million yen (ODA Loan Portion: 11,619 million yen), below plans (93% of the planned amount). As discussed below, delays with the civil engineering work led to an extension in the project period, and consulting service fees also increased significantly; however, the yen strengthened during the project implementation period, and as a result, project costs were kept below the initial planned amount. The increase in project costs in the local currency due to the effect of yen appreciation affected both the increase in output and the increase in the construction period.

[15] From responses to questionnaires given to UAF and interviews with farmers who participated in the agricultural management pilot project (about 70).
[16] From interviews with farmers who participated in the on-farm R&D component.

3.2.2.2 Project Period

The project period was initially 77 months, from August 2005, when the Japanese ODA loan was signed, to December 2011, when support for the institutional reform was complete. However, the actual project period was 152 months, from August 2005 to March 2018[17], significantly over the planned period (197% of the planned period). In particular, there were delays with the civil engineering work, and of the 56 packages[18] in this project, including the additional construction work, 25 packages were delayed. Moreover, court cases led to delays with the components for the institutional reform, which lengthened the support for FO that were slow to be formed, meaning that it took longer than planned to complete the project.

The main reasons that the project period was delayed are[19] that the civil engineering work was not carried out smoothly due to the limited number of staff members of contracted company and insufficient capacity of its supervision work. These factors resulted in the change of contractors through rebidding for six packages that initially were contracted out to two contractors. Moreover, the frequent transfer of responsible officials and staff of both PIDA and the consulting company meant that it took a long time to grasp the current status and progress of the project, leading to delays in decision making and challenges in building relationships with each other.

Moreover, the financial difficulties experienced by the provincial government led to suspending payment to companies engaged in various development projects through the second half of 2009. The price of construction-related supplies skyrocketed and contractors sued the Punjab government for this increase, resulting in delays to the construction work as well. Record-breaking flooding occurred in 2010 and 2014, causing turmoil along the supply routes for various materials, and workers from the regions that suffered the flooding could not return to work sites, which delayed progress with the construction.

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

(1) Financial Internal Rate of Return (FIRR)

The Financial Internal Rate of Return (FIRR) was not calculated for this project at the time of the appraisal.

[17] While PID recognizes that the project was completed in June 2016, it is judged that the project was completed in March 2018 since the activity for Institutional Reform was completed in March 2018 based on the PID's responses to the questionnaire.

[18] Of the 56 packages, work for six packages were bid again to change the contractor, and when excluding this overlap, the construction amounted to 50 packages.

[19] JICA related materials and responses to questionnaires given to PID

(2) Economic Internal Rate of Return (EIRR)

The Economic Internal Rate of Return (EIRR) for this project at the time of the appraisal was 16.2%. Table 3 shows the preconditions for calculating EIRR. Recalculations in the ex-post evaluation showed that the EIRR was 22.6%, higher than the EIRR at the time of the appraisal. This was primarily because the area cultivated with major agricultural crops increased as a result of this project's implementation, and production of the major crops increased over the target at the time of the appraisal. In EIRR calculations, revenue from increased agricultural crops is calculated as a benefit on the condition that the increase in agricultural production was brought by this project; however, it should be noted that the increase in agricultural production is affected by many factors.

Table 3. Preconditions for EIRR Calculations

Costs:	Project costs (excluding taxes), O&M costs
Benefits:	Revenue from increase in agricultural crops
Project life:	30 years[20]

Although the project cost was kept within the plan and an increase in project outputs and various external factors were observed, the project period exceeded the plan. Therefore, efficiency of the project is fair.

3.3 Effectiveness and Impacts[21] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

In this project, the area benefited, the cropped area, Abiana (water charge) collection rate, and production volumes of major crops are set as indicators measuring the project's effect[22]. The increase in water volume derived from rehabilitation work to irrigation channels in this project was only noted in the rainy season (Kharif: May-September). The volume of water in rivers is extremely low in the dry season (Rabi: October to April of the following year); thus, it was considered that remodeling the channels would have a very limited effect in increasing water. As a result, indicators were limited to the rainy season[23]. The baseline and targets

[20] While the PID's related documents set the project life as 40 years, the JICA's related document at the time of the appraisal defined it as 30 years. Therefore, this report applied 30 years for project life.

[21] Sub-rating for Effectiveness is to be put with consideration of Impacts.

[22] The target was set at five years after the project's completion according to the JICA's related documents, but when the ex-post evaluation was carried out, the 2019-2020 data was the most recent. Therefore, these figures were applied.

[23] From JICA related documents at the time of the appraisal.

for operation and effect indicators as well as the actual figures as of the ex-post evaluation are shown in Table 4.

Table 4. Operation and Effect Indicators

Indicator	Baseline	Target	Actual	
	2001-2004 average	2015	2015-2016	2019-2020
		5 years after project completion	Year in which project was completed	4 years after project completion
(1) Area benefited by the project (ha) *1*2	456,684	519,694*3	497,226*4	563,926
(2) Cultivated Area by major crops (ha)*1				
Rice	45,510	67,810	193,778	80,000
Cotton	55,475	55,475	56,651	35,000
Maize	95,639	95,639	41,721	87,500
Sugarcane	103,842	103,842	70,415	173,000
Fodder	92,965	97,644	78,147	126,500
Oilseed	22,481	33,723	5,781	42,867
Other (fruit, vegetables, other)*5	40,772	65,561	50,733	19,059
(Reference) Wheat*4	-	-	384,598	570,000
(3) Abiana collection rates (%)	44*2	60	-	LCC (East) 65*6 LCC (West) 70*6
(4) Production volume of major crops (tons/year)*1				
Rice	67,241	121,602	385,380	65,960
Cotton	59,629	65,797	93,932	44,590
Maize	218,124	240,810	215,569	209,400
Sugarcane	5,078,668	5,607,241	3,932,649	4,571,660
Fodder	1,212,890	1,406,632	1,107,596	2,291,300
Oilseed	9,888	16,416	7,000	8,160
(Reference) Wheat*4	-	-	1,274,844	793,860

Source: The baseline figures and targets are from documents provided by JICA. The figures at the completion were provided by the executing organization's Project Completion Report (PC-4). The figures at the ex-post evaluation were provided by PID.

Note *1: Figures are for the rainy season.

*2: The figures for "area benefited by the project" are the figures totaling the area cultivated of major agricultural crop listed in the table (from JICA's related document at the time of the appraisal).

*3: According to documents agreed on between Japan and Pakistan at the time of the appraisal (dated 22 February 2005), both the baseline and target for the area benefited by the project is 607,573ha, the irrigated area in LCC Part-B (namely, the project's target area). This is likely because the Pakistan side felt that cropping intensity would improve through the project implementation, but the rehabilitation work would not affect an increase in the irrigated area.

*4: Since the targets for this project are only for the rainy season, wheat during the dry season is not included in the baseline.

*5: pulses, gram, fruit, vegetables (rainy season)

*6: The figure for LCC (East) is the average for 2005-2017, the period in which FOs were set up. Similarly, the figure for LCC (West) is the average for 2007-2018.

"(1) the area benefited by the project" at the time of the ex-post evaluation was 563,926 ha, above the target of 519,694 ha. Looking at "(2) the cultivated area by major crops", it is found that the cultivated area exceeded the target at the time of the

ex-post evaluation for rice, sugarcane, fodder and oilseed, but those did not reach the targets for cotton, maize, and fruit and vegetables[24]. A more detailed survey would be needed to specify the causes since the cultivated area fluctuates somewhat every year, and according to UAF's views, there are many factors behind the changes in the acreage under cultivation and possible factors are the increase in production costs and the shift to other crops as a result of higher temperatures. In addition, interviews with former FO members carried out during the ex-post evaluation showed that the acreage under cultivation increased for sugarcane and wheat (dry season) due to an increase in the amount of irrigation water in the watercourses thanks to the project, as well as higher market prices. The same conditions may have occurred in the areas targeted by the project.

"(3) the Abiana collection rates[25]" in LCC (East) and LCC (West) were 65% and 70%, respectively, and both exceeded the target of 60%. A contributing factor is that the irrigation water was supplied through the project and farmers have to pay Abiana. In addition, the training for Abiana collection provided to FO members may contribute to achieving the target[26]. Depending on the period, the Abiana collection rate undercut 60%, but this was primarily because i) when the supply of irrigation water was disrupted, farmers refused to pay Abiana[27], ii) there were farmers who were inveterate non-payers of Abiana, and iii) there was no legal actions to Abiana defaulters so effective countermeasures cannot be taken[28].

Regarding "(4) Production volume of major crops", a comparison of the planned production volume by major agricultural crop and the figures at the time of the ex-post evaluation shows that production volume for crops other than fodder undercut the plan. According to UAF, multiple factors are at play in fluctuations of production volume for agricultural crops, similar to acreage under cultivation, and thus a more detailed survey and document research are needed to specify the factors behind the fluctuation. Possible factors are changes in cropping patterns due to fluctuations in production costs, a rise in temperature, difficulties in obtaining good seed, and the status of pest extermination, among others. However, according to interviews with

[24] In JICA's related documents at the time of the appraisal, the context or reason for setting these targets was not noted; however, given that the targets for cotton and maize are set with the same cultivated area as the baseline, it was likely assumed that the cultivated area would increase more for rice, fodder and oilseed than for cotton and maize.

[25] The Abiana collection rate fluctuated somewhat depending on the year; therefore, the average during the rainy season from the year when FO were first set up to the most recent year was used as the actual value for LCC (East) and LCC (West). Depending on the period, the collection rate for Abiana undercut 60%. One of the reasons may be farmers refused to pay water use fees when the supply of irrigation water was disrupted, according to interviews with FO members.

[26] Response to PID/PKPA questionnaires and interview with former FOs members.

[27] When the amount of irrigation water supplied from watercourses was low, water use fees were reduced in some cases (response to PKPA questionnaire).

[28] This was according to responses to questionnaires given to PID and PKPA and interviews with FO members.

former FO members, as with the cultivated areas, the increase in the amount of irrigation water in the watercourses due to the project and higher market prices increased the production volume for sugarcane and wheat (dry season), and farmers in some areas shifted from cotton to sugarcane. As shown in Figure 2 to Figure 5, if we look at the cultivation patterns over the years in the Punjab province, cotton has been on the decline in recent years, but cultivation of sugarcane has gone up and down in recent years, and rice remained at the same level around the completion of the project but has been increasing in recent years. Since production volume for agricultural crops fluctuates in this way, more detailed surveys are needed to identify the causes[29].

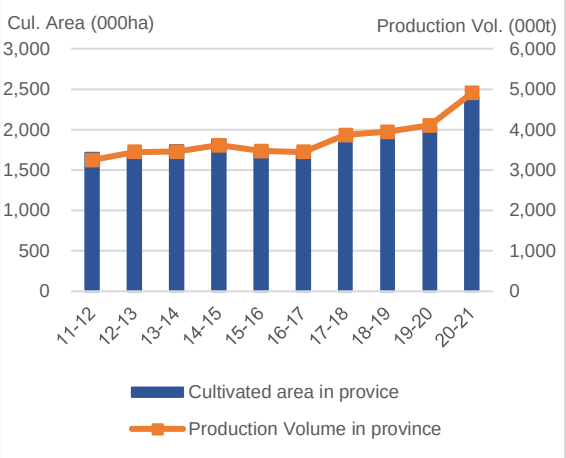


Figure 2: Trend of Cultivated Area and Production Volume of Rice in Province

Source: Statistical data provided by Punjab Agriculture Crop Reporting Service

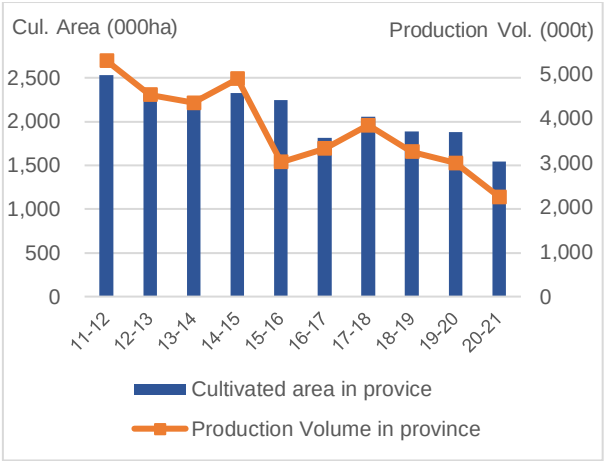


Figure 3: Trend of Cultivated Area and Production Volume of Cotton in Province

Source: Statistical data provided by Punjab Agriculture Crop Reporting Service

[29] The Pakistani government continues to view rice as its main agricultural product for the acquisition of foreign currency, and there has been no major change in government policies (website for the Agriculture Department of the Government of the Punjab: http://www.agripunjab.gov.pk/strategy; accessed on 24 July 2021). The decrease in acreage under cultivation and production volume for rice in the area targeted by the project cannot be due to the impact of government policy. Moreover, there were no major changes observed in the cropping patterns in the Punjab province, so a more detailed survey is necessary to explore the decrease in cultivated areas and production volume for rice in the areas targeted by the project.

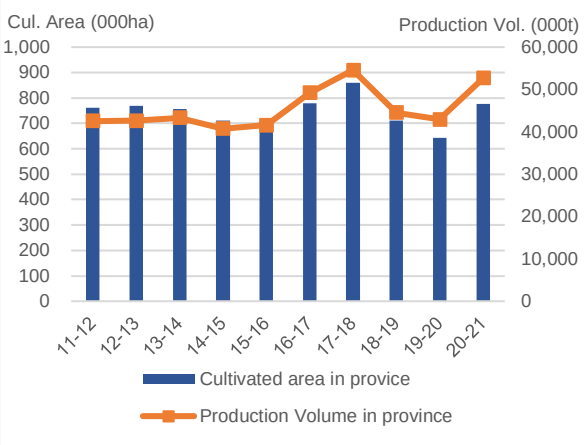


Figure 4: Trend of Cultivated Area and Production Volume of Sugarcane in Province

Source: Statistical data provided by Punjab Agriculture Crop Reporting Service

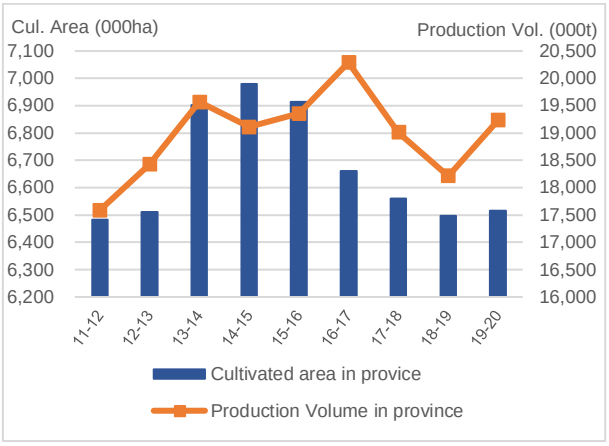


Figure 5: Trend of Cultivated Area and Production Volume of Wheat in Province

Source: Statistical data provided by Punjab Agriculture Crop Reporting Service

3.3.1.2 Qualitative effect (Other effects)

(1) Reduction in salinity

At the time of the appraisal, it was expected that lining work on the channels in this project would reduce salinity in areas targeted by the project. According to PID, the lining work on channels carried out in this project did lead to a reduction in salinity and water logging in the targeted area, and former FO members also confirmed that there was no salinity. Moreover, this project minimized seepage and percolation losses, and thus, increase the availability of irrigation water at the tail.

3.3.2 Impact

3.3.2.1 Intended Impacts

The impacts expected in this project were improvements in the living standards of local residents, and an increase in the income of small farmers (landholdings of 5 ha or less) in particular. Statistical data on the increase in farmers' income (including data on the incomes of small farmers [landholdings of 5 ha or less] in the areas targeted by the project) was difficult to obtain as the relevant organizations in the Punjab had not compiled the information. The PID and Punjab Khal Panchayat Authority (hereinafter referred to as "PKPA") believe that the project's impacts included improvements in the income level of farmers in the areas targeted by the project due to higher production volumes for agricultural crops and an increase in agricultural income, an increase in farmland prices and a resulting rise in tax

revenue[30], the start of new businesses such as livestock raising, an increase in fruit cultivation and a rise in farmers starting aquafarming[31].

According to interviews with former FO members, agricultural income increased, land values rose, farmers started new businesses such as livestock raising, fisheries, and dairies, spending on education increased (in particular, spending on the education of girls increased), buildings were enlarged, and it became possible to purchase tractors and motorcycles. According to interviews with former FO held in the ex-post evaluation, the average monthly revenue of farmers is 25,000-35,000 rupees. Since data on the average monthly income of farmers at the time of appraisal was not available[32], it is difficult to compare this to the situation before the start of the project. Also, the improvement of agricultural income involves multiple factors such as rising prices of agricultural products. Given these factors, however, interviews with former FO members and the views of PID/PKPA suggested that there is a possibility that the implementation of this project may have had some effect on the revenue of small farmers, although the extent of this project's contribution cannot be clearly laid out.

In addition, interviews with FOs confirmed that the participation of women in farmer organization activities did not increase as a result of the implementation of this project[33].

3.3.2.2 Other positive and negative impacts

This project, at the time of the appraisal, was classified as Category B because it did not fall into the sensitive sectors, sensitive characteristics and sensitive areas, and it was judged that the undesired impact on the environment would not significant, according to JBIC Guideline for Confirmation of Environmental and Social Considerations (April 2002). Resettlement and land acquisitions did not occur due to this project. However, when the construction was carried out, part of a forest was logged to clear land. This was because when the lining work was designed, the need to cut down trees and forests on the berm[34] of channel was confirmed. Also, work had to be done so that vehicles could pass on the roads alongside the canal bank. Trees

[30] However, the fixed asset tax only applies to landowners with 5 ha or more in land, so the impact was likely limited in the project's targeted area, where many farmers own less than 5 ha in land.
[31] Questionnaires to PID and PKPA
[32] At the time of the appraisal, the JICA's related document simply noted that "an increase in the income of small farmers, many of whom are categorized as poor, is expected" with no specific data. The ex-post evaluation also attempted to obtain the statistical data of agricultural income; however, such data does not seem to have been compiled in the province.
[33] There were cases in which women's work in agriculture exceeded due to changes in cultivation patterns, but there were also cases in which their work decreased (when the amount of vegetables cultivated increased, agricultural work opportunities for women increased, but in other cases, there was either no change or their work decreased). In this case as well, this project's implementation and the impact on women were not confirmed.
[34] A flat strip of land, raised bank, or terrace bordering a river or canal (https://languages.oup.com/google-dictionary-en/: access on 14 September 2021.)

were replanted along the canals by the provincial government in line with the regulations of the Forestry Department. Therefore, there was no impact on the environment[35].

In terms of production volume by major agricultural product, production was lower than the level anticipated at the time of the appraisal in the case of some crops; however, the area benefited by the project, cultivated area of major agricultural crop, and the Abiana collection rate exceeded the level anticipated at the time of appraisal. Therefore, effectiveness is considered high. The expected impact of this project was "improvement in income for small farmers." The results of interviews with PID and former FOs confirmed impacts such as an increase in the supply of irrigation water as a result of the rehabilitation work carried out in this project, which led to an increase in the cultivated area, possible contributions to an increase in agricultural revenue, the start of new businesses, an increase in spending on education (particularly for girls), the expansion of buildings, and the purchase of new tractors and motorcycles. In addition, negative impacts from the project were not confirmed. Given the above, this project has mostly achieved its objectives. Therefore, effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ②)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

(1) Punjab government's shift in policy on operation and management systems

PIDA was established as a result of the Punjab Irrigation and Drainage Authority Act 1997. The Area Water Board (AWB) under the jurisdiction of PIDA was set up as an organization to operate and maintain branch canals under the IMT pursued in the Punjab from 2005, while FOs and Nari Panchayat[36] were established with responsibility over distributaries/minors and KP with responsibility over watercourses. Thus, the framework for operating and maintaining irrigation channels was set up with the participation of farmers. However, PIDA were disbanded under the Punjab Khal Panchayat Ordinance, issued on 22 May 2019 (issued as the Punjab Khal Panchayat Act on 13 December 2019), and at the same time, the activities of AWB, FO, Nari Panchayat and KP were also suspended, and subsequently these organizations were essentially disbanded.

The reasons for dismantling PIDA were that (1) the inadequate O&M of irrigation facilities, (2) the low Abiana collection rate[37], (3) increasing incidences of water theft,

[35] Response to PID questionnaire and collection of follow-up information

[36] This word is used as is since there is no set English translation. Nari Panchayat is water use associations set up for minors and are made up of the chairmen of Khal Panchayat in the area. Their main functions were to approve rehabilitation plans of minors, participate in the construction bidding process of channels, supervise the work, formulate warabandi (water rotation plans), and support FOs.

[37] The target Abiana collection rate was set at 60% for this project; however, responses to questionnaires given to PID indicated that the Abiana collection rate needed to be maintained at 80% if FOs were to

(4) elite capture in PIDA and FO managed areas, (5) the number of FOs involved in misappropriation of Abiana or unable to perform their duties, (6) inadequate record keeping which was indicated in Auditor's report, and (7) there were FOs that had significant water theft due to falsification of records on outlets and the management committees were ordered to cease operations[38].

Since PIDA's dismantling, irrigation facilities were constructed, operated and maintained under the systems shown in the table below. The O&M of irrigation facilities was under the jurisdiction of PID from the main canal to the distributaries/minors. Abiana was collected by FOs and a certain percentage was paid to PIDA/AWB. However, after PIDA was disbanded, Abiana was collected by the province's Revenue Department.

Table 5. Construction, O&M Systems for Irrigation Facilities

	2005 - May 2019		From June 2019	
	Construction	O&M	Construction	O&M
Main	PIDA/PID	PIDA/PID	PID	PID
Branch		AWB		
Distributaries/ Minors		FO/Nari Panchayat		
Watercourse	Punjab Agriculture Department	Khal Panchayat	Punjab Agriculture Department	Khal Panchayat
Drainage	PID	PID	PID	PID

Source: JICA related documents, responses to PID questionnaires

The Punjab Khal Panchayat Act 2019 (hereinafter referred to as "PKP Act 2019"), established in December 2019, stipulated the establishment of Khal Panchayat (KP)[39] to operate and maintain watercourses and the establishment of the Punjab Khal Panchayat Authority (PKPA). This Act stipulates the roles and responsibilities of KP and PKPA, as well as the O&M of irrigation facilities at the local level as shown below.

- The role and responsibility of KP is to prepare warabandi (water rotation plans) and mediate disputes between farmers concerning water distribution.
- PKPA conducts election of the chairman of KP, mediates disputes over water between farmers, supports the implementation of rotation plans for water distribution, distribute Abiana bills and encourage farmers to make timely payments.

be financially independent. According to Pakistan's newspaper reports (*Dawn*), the average Abiana collection rate carried out by FOs was 45%, which was lower than 70%, the average when collections were carried out under PID's jurisdiction. This corroborates one of the reasons that the PIDA was dismantled.

[38] Responses from PID's Strategic Planning/Reform Unit

[39] The Khal Panchayat set up under IMT policy through 2019 were dismantled and Khal Panchayat with the same name need to be newly established.

- PID's Canal Officer (in reality, PID's Executive Engineer, Sub-Divisional Officer and Sub-Engineer overseeing each district) is responsible for operating and maintaining distributaries/minors and coordinating with KP.

While the new system was announced as described above, as of the time of the ex-post evaluation, the system was still in a transition period. Although PKPA was established, there had been little progress in appointing PKPA field officers. Moreover, the KP established under IMT policy had been dissolved, and at the time of the ex-post evaluation, KP mandated under the PKP Act 2019 had not yet been established. In other words, O&M of the watercourses is not being carried out in a systematic way, and at the time of the ex-post evaluation, farmers were doing the O&M on a volunteer basis[40].

(2) PID's O&M system

PID has divided the irrigated area into eight irrigation zones, with the Chief Engineer overseeing each zone. The regions targeted by this project is under the control of the Faisalabad Irrigation Zone, and the LCC (East) Circle and LCC (West) Circle account for two of the five "Circles" making up this irrigation zone. 1,216 employees are assigned to the LCC (East) Circle (of which 461, or 38%, are engineers) and 1,124 to the LCC (West) Circle (of which 541, or 48%, are engineers)[41]. In the Faisalabad Irrigation Zone, the Chief Engineer has the top position, the Superintending Engineer is the head of the Circles, and below that Executive Engineers, who are the heads of Divisions, are appointed. They supervise technical staff as well as monitor the O&M of the channels in the zone that they supervise.

(3) Current issues with staffing for operations and maintenance

As such, engineers who oversee the organization are appointed and run the organization, while the current challenge of human resources is that there are not enough technical staff, in particular the staff known as "Beldars", who are responsible for daily maintenance of channels (i.e., cutting/trimming berms, desilting channels, removing hindrances [such as trees that have fallen in the channels] and other). There are areas in which daily maintenance is insufficient[42]. In the site survey implemented in the ex-post evaluation, farmers, in all nine zones in which interviews were carried out, stated that current O&M is insufficient, and that water theft is increasing[43].

[40] From interviews with former FO members.
[41] About 35,000 employees are assigned in the PID overall.
[42] For example, in the Lower Gugera Canal Division of the LCC (East) Circle, 114 Beldars are appointed, but there about 3-4 Beldar appointed to each distributary, which are 9 km to 36 km in length. Therefore, the number needs to be increased if the channels are to be properly managed.
[43] According to PID, the fines and criminal cases have been registered against culprits involved in water theft.

At the same time, PID recognizes that the number of staff assigned to the organization, which is approved by the provincial government, is sufficient, and after PIDA was dismantled, there was no significant change in the number of PID staff. Staff at the field level are assigned from within the approved number and deal with situations within the current system[44].

As such, there are some issues with the current O&M of facilities.

3.4.2 Technical Aspect of Operation and Maintenance

Before PIDA was dismantled, FOs were responsible for the O&M of distributaries/minors; however, in cases in which FO's skills and knowledge were insufficient for operating and maintaining them, PID would offer technical support and help solve issues. Thus, no specific technical challenges were observed[45].

PID, at present in charge of operating channels from the main canals to distributaries/minors, has been responsible for operating and maintaining them for many years. Therefore, its technical staff have built up experience and knowledge about construction, O&M of irrigation facilities. In this respect, there are no major issues on the technical side with operating and maintaining main canals, branches and distributaries/minors. Even in the period in which FOs were responsible for operating and maintaining distributaries/minors, the engineers of PIDA and PID provided the technical support for O&M to FOs. Therefore, the PID has kept the capacity to operate and maintain distributaries/minors. Moreover, the PID stipulates the training that new hires and junior, senior and upper-level engineers should take, and engineering schools offer training[46]. In light of this, there are no issues with sustainability on the technical aspect of O&M.

3.4.3 Financial Aspect of Operation and Maintenance

(1) Before PIDA's abolishment

Before PIDA's abolishment, PIDA, AWB and FOs were mainly responsible for operating and maintaining branch canals and distributaries/minors; therefore, this section describes the financial conditions of AWB and Abiana collection at FOs. PKPA took over this part of PIDA's responsibilities; the PKPA's financial condition will be explained later, together with that of PIDA, in the next section.

According to AWB's financial materials[47], approximate 30% of the total expenditure allocated for the channel maintenance, which cover costs such as desilting, bank

[44] Responses to PID questionnaires
[45] Responses to PID questionnaires and interviews with FO members
[46] Responses to PID questionnaires
[47] Provided by PID/PKPA

strengthening, repair of outlets in FY2016-2017; on the other hand, the percentages had declined to 10% around in FY2018-2019. Every year a certain percentage, 33-50% of the Abiana collected, are paid to the PIDA. As noted above, it has been pointed out that the collection rate for Abiana was low although financial materials indicate that the income from Abiana collected within AWB were managed to balance between income and expenditures.

Table 6. Financial Conditions in AWB (East) (West)[*1]

(Unit: Million Rs.)

	AWB LCC (East)			AWB LCC (West)		
	FY 16-17	FY17-18	FY 18-19	FY 16-17	FY17-18	FY 18-19
Income						
Opening Balance	0.092	3.947	21.525	7.326	5.923	4.491
Recovery of Abiana	136.924	128.646	112.926	86.679	64.003	53.975
Total	137.016	152.163	134.451	94.005	69.926	58.466
Expenditure						
Paid To PIDA (Abiana Share)	44.971	50.39	48.926	32.047	36.218	27.049
Salary of staff	21.917	21.515	19.124	23.982	16.221	12.396
Office Expenditure	7.506	5.58	1.709	7.559	1.516	0.99
POL Expenditure	1.346	1.722	1.364	6.104	1.469	0.811
Repair of Vehicle	2.238	1.003	0.451	1.301	0.079	0.208
Repair of Assets	2.959	0.107	0.032	0	0.008	0.01
Other Expenditure	4.541	0.207	1.987	0.005	1.302	0.377
Desilting	19.839	10.152	4.984	4.983	2.786	2.564
Bank Strengthening	11.834	6.421	5.879	10.316	4.644	1.924
Repair of Outlets	15.918	13.971	1.74	1.784	0.938	0.631
Others	-	-	-	-	0.064	0.502
Total	133.069	111.068	86.196	56.034	29.028	47.462
Closing Balance	3.947	21.525	48.255	5.923	4.491	11.003

Source: PID
Note *1: Portion for three years before PIDA was dissolved.

The important issue to examine the FO's financial condition is Abiana collection rate. In order to ensure the financial independence of FOs, 80% of Abiana needed to be secured, but the collection rate for Abiana has averaged 61% thus far, and the collection rate for each of the five districts under AWB's jurisdiction (with the Faisalabad irrigation district seen as one district) only exceeded 80% for one district. This indicates that most FOs are not financially independent.

Table 7. Average Abiana Collection Rate of FOs by AWB Jurisdiction Wise

AWB	Abiana Collection rate
LCC (East) Faisalabad (Dry season 2004-05 to dry season 2018-19)	63%
LCC (West) Faisalabad (Rainy season 2007 to dry season 2018-19)	69%
LJC Sargodha (Rainy season 2007 to dry season 2018-19)	89%
Derajat, DG. Khan (Rainy season 2007 – dry season 2018-19)	33%
Bahawalnagar (Rainy season 2000 – dry season 2018-19)	65%
LBDC, Sahiwal (Dry season 2011-12 to dry season 2018-19)	52%
Overall average	61%

Source: Responses to PKPA questionnaire

(2) After PIDA abolishment

To grasp the situation after PIDA dismantlement, the financial conditions of PIDA and PKPA (partially PIDA) were examined. Income and expenditures for the past three years for the PID Faisalabad Irrigation Zone, which has jurisdiction over the area targeted by the project, is shown in the table below. Of this, O&M costs for irrigation facilities in the LCC Part B, which were rehabilitated in this project, reached 83 million rupees in FY2018-2019 (4% of total expenditures for the Faisalabad Irrigation Zone) and 60 million rupees (3%) in FY2019-2020. After the PIDA was dismantled in May 2019, there was little fluctuation in the total budget for PID's Faisalabad Irrigation Zone; however, according to the PID, the current budget for O&M is sufficient to cover the cost of operating and maintaining the irrigation facilities.

Table 8. Income and Expenditures for PID Faisalabad Irrigation Zone

(Unit: million Rs.)

	FY 18-19	FY 19-20	FY020-21
Income	2,307	2,015	1,855
Expenditures	2,263	1,993	1,118*
(of which operating and maintenance costs for LCC Part B)	83	60	-

Source: Responses to PID questionnaire
Note*: Through middle of fiscal 2021

PIDA/PKPA's budget (income) and expenditures are shown in the table below. In the last fiscal year before the PIDA was dismantled, the budget was not approved by the government,[48] and as a result, expenditures exceeded income from Abiana and a loss of about 30 million yen was posted. Income from Abiana was no longer available from FY2019-2020, when the PKPA was newly established, and PKPA's only revenue source was the budget provided by the government. Personnel costs accounted for about 90% of the spending, followed by travel costs (5%).

[48] According to PKPA, the reasons for this are not known.

Table 9. PIDA/PKPA's budget and expenditures

(Unit: million Rs.)

	PIDA	PKPA	
	FY 18-19	FY 19-20	FY20-21
Budget	(264[*1])	249	287
Income from Abiana[*2]	124	-	-
Expenditures (actual)	163	174	116[*3]

Source: Response to PKPA questionnaire

Notes *1: For various reasons, the government did not approve a budget (PKPA questionnaire).

*2: Revenue from the collection of water use fees was posted through FY18-19, when PIDA was dismantled.

*3: Actual figures through August 2021.

The Punjab Water Policy 2018 pointed out that the Rs.135/acre in annual Abiana only covers about 10-12% of the O&M costs; however, as of the ex-post evaluation, annual Abiana had doubled to Rs.270/acre. Although this level is still not sufficient for Abiana alone to cover the cost of O&M, all-out efforts were made to increase Abiana to secure funds for O&M of irrigation facilities in Punjab province. Moreover, the shortfall in O&M costs for the irrigation channels is made up for from the province's budget[49]. In light of this, the PID has committed to securing the budget for the O&M of irrigation facilities from the main canal to distributaries/minors, and there are no issues with sustainability on the financial aspects.

3.4.4 Status of Operation and Maintenance

In the ex-post evaluation, a site survey of nine sites under the jurisdiction of former FO was carried out. The results showed that the O&M condition of the channels was not good overall, and confirmed that irrigation water is not reaching the farmers at watercourse[50]. While conditions differ depending on the channels, the following issues were found.

- Desilting and weed removal from channels, which is part of the maintenance work for distributaries/minors, is not being appropriately carried out by Beldars, PID's technical staff.
- Irrigation water is not being adequately supplied to the watercourses at tail due to water theft at head of distributaries/minors, damage and failure to perform repairs on structures and channel banks, and lack of cleaning, among factors.

[49] From PID responses

[50] Of the nine FOs visited during the ex-post evaluation, irrigation water did make it to farmers at the tail in four cases, and in the remaining five cases, farmers at the tail were unhappy with the amount of irrigation water supplied. Moreover, eight FOs stated that the system for operating and maintaining the irrigation facilities during the PIDA era resulted in better O&M conditions for the channels, and wanted the farmer participation-type O&M system to be restored.

- PID staff are confirming the status of damage to channels and breakage of structures, but there are cases in which repairs take time[51].
- When PDA/FO managed the distributaries/minors, in the event of issues such as the suspension of the supply of irrigation water, water theft and problems with facilities, information was immediately passed on to the FO president, who represented the farmers, and the issues were address promptly. Under the current system, farmers often hesitate to contact the PID Engineers who are in charge of the districts and physically the PID's office is 100 km or more away from farmers, which makes it difficult to communicate conditions on the ground and issues to PID employees[52]. Accordingly, even when problems do occur, PID staff are unable to respond promptly, which results in poor maintenance and management conditions.
- There are cases in which farmers at head use political connections to (illegally) obtain priority in receiving water.

Due to COVID-19, lockdowns were temporarily imposed in Lahore, and PID and PKPA employees worked on a shift schedule. They were unable to carry out O&M at the regular level, but overall there was no major impact. Under the current system, the Punjab province's Revenue Department is in charge of Abiana collection. In light of the impact of COVID-19, steps were taken to lower Abiana, and revenue from Abiana may decline[53].

Figure 6. Irrigation Water Reaching Watercourses from Lukhuana Distributary

Figure 7. Good O&M Conditions at Padhyara Distributary

Figure 8. Insufficient Water Supply at Minor

[51] In particular, the cross-regulator cables set up at the Burala Branch's head works, which was repaired in this project, was broken, and the regulator stops midway, unable to move further, which restricts the flow volume. As a result, irrigation water is not delivered to the tail. At present, PID is arranging for repairs and repairs are urgently required.
[52] Interviews with former FO members
[53] From PID responses

Figure 9. Damaged Side Protection at Tulwala Distributary

Figure 10. Damaged Cross-regulator Cable at Burala Branch

Only two years have passed since the O&M system was moved to a new system; therefore, the system is still being established in this transition period. Since the appointment of staff by PID and PKPA at the field level needs to be expedited, it was determined that there are some challenges for O&M of irrigation facilities in terms of institutional/organizational aspect. There were no technical issues with operations and maintenance, and on the financial aspect, PID is committed to securing a budget for the O&M of irrigation facilities; therefore, no major problems in the financial aspect. On the other hand, some minor problems have been observed in term of the institutional/organizational aspect and current status. Therefore, sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project is intended to expand agricultural production by rehabilitating the existing irrigation facilities and drainage facilities in the Lower Chenab Canal (LCC) in the central area of Punjab Province and establish and foster farmer organizations (FO) that can be responsible for operating and maintaining the facilities, thus contributing to an increase in the income of farmers in the target area.

For Pakistan, where agriculture is still a key industry, the implementation of this project is sufficiently aligned with Pakistan's development plans and sector policies, the need to secure water for agriculture by establishing irrigation facilities, and Japan's aid policy. Therefore, the project is highly relevant. The project's efficiency is fair. This is because the project period far exceeded the plan, although project costs were within plans.

The area that benefited, the cropped area by main agricultural product, and the collection rate for water charges exceeded the levels set in the appraisal, and effectiveness is thus deemed to be high. Although improved income for small farmers, which had been anticipated as an impact

of this project, could not be confirmed in statistical data, rehabilitation work done in this project made it possible to secure irrigation water, and the increase in the cropped area and the fact that some small farmers shifted to cash crops suggests that the project may have contributed to higher agricultural income. Moreover, other impacts were confirmed, such as the start of new businesses and education - particularly an increase in expenditures on education costs for girls. No negative impacts were confirmed. As a result, we concluded that the project effectiveness and impact are high.

This project's O&M did not have any significant technical or financial issues; however, there were challenges in both institutional/organizational aspect of O&M and O&M status, and going forward, these aspects should be further reinforced. Accordingly, the sustainability of the effects resulting from this project is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) PID should review the condition of the current system for O&M, identify issues and respond appropriately. PID recognizes that the O&M of irrigation facilities with the number of employees authorized is sufficient; however, the results of interviews of former FOs and site surveys show that there are issues with the O&M of irrigation facilities. In particular, the status of maintenance and management at the field level should be ascertained and the issues outlined. The results of the ex-post evaluation indicate that the issues likely to be identified are 1) the shortage of Beldars should be resolved to the extent possible, and efforts are made to appropriately operate and maintain distributaries/minors (including training of Beldars), 2) support for farmers should be augmented at the field level by assigning employees at PKPA's field level, and 3) efforts should be made to set up Khal Panchayat (KP) to manage the watercourses. As regards the establishment of KP, the PKP Act 2019 does not stipulate whether it is the PID, PKPA or the Punjab Agriculture Department that has authority or the responsibility of setting up KP. As a result, discussions need to be held with the related organizations to confirm the process for setting up KP.

(2) The results of the site survey carried out in the ex-post evaluation indicated that the parts of the cross-regulator remained broken. This should be addressed quickly and efforts need to be made to ensure that irrigation water reach the watercourses.

(3) After this project was implemented, the O&M system for irrigation facilities was returned to the system led by government administrators that had been in place through 2005. Going forward, PID should examine the effects of a system with

farmer participation and a system led by government administrators and reach ideas about a better O&M system for irrigation facilities.

4.2.2 Recommendations to JICA

When the PID examines the effects of an O&M system with farmer participation and a system led by government administrators, the results should be used to build up knowledge about the O&M of irrigation facilities for use in project plans for other projects.

4.3 Lessons Learned

Grounds for identification/calculation of important figures when planning and confirmation of agreements with executing agency

In this project, the content of the civil engineering work (length of target canals/distributaries/minors) and figures for operation indicators at the time the project was planned differed in the Japanese documents prepared at the time of the appraisal and the agreement with Pakistan (English). Moreover, the planned values[54] as perceived by Pakistan differed from the figures noted in these related documents, which made it difficult to compare the planned values and actual values and analyze the disparities. Similarly, the information sources and conditions for calculations that formed the basis for the calculation of baseline figures and targets for the indicators used to measure the project's effect were not laid out. Thus, this made it difficult to determine whether the figures obtained at the time of the ex-post evaluation could be compared. Accordingly, it is important to confirm output and values for indicators with the partner country at the time of the plan and to identify the conditions for the figures set, grounds for calculations, and the source of the data so that before-and-after comparisons can be accurately made.

End

[54] In Pakistan, a project document designated by the government, called PC-1, is prepared, but the full length of the rehabilitated canal/distributary/minor and other data is not provided here, and the length of the repaired channels according to Pakistan was the figure noted in the project completion report submitted by the consulting company which worked on the project. This figure was referenced in bid documents and civil engineering work specifications.

Comparison of key plans/results

Item	Plan	Actual
(1) Project Output 1) Civil engineering work	(1) Remodeling and rehabilitation of branch canal: 375 km (2) Rehabilitation of distributaries/minors: 2,158 km (3) Lining works of distributaries/minors: 321 km (4) Rehabilitation of drainage: 399 km	(1) Remodeling and rehabilitation of branch canal: 381 km (2) Rehabilitation of distributaries/minors:1,805.83 km (3) Lining works of distributaries/minors: 1,229.9 km (4) Rehabilitation of drainage: village road bridges VRC (12), inlets (30), building repairs (7)
2) Institutional Reform	• Support for launch of organizations • Establishment of FO standing committee • Training for management committee members • Regular monitoring of FOs • Performance evaluation • Number of FO established LCC (east) 85 LCC (west) 67	• In line with plan • Number of FO established LCC (east) 72 LCC (west) 54
3) On-farm R&D	Tests and research as described below • Bed-furrow planting for wheat • Analysis of agricultural water • Drip irrigation system • Skimming well technology • laser land leveling Carried out in the distributaries in Mongi, Killianwala and Khurianwala	• In line with plan In addition to Mongi, Killianwala, and Khurianwala, this was implemented in the distributaries in Khikhi, Dijkot and Shahkot.
4) Consulting services	• Detailed design • Preparation of documents related to bids • Assistance with bid evaluations • Supervision	• In line with plan
(2) Project Period	August 2005 – December 2011 (77 months)	August 2005 – March 2018 (152 months)

Item	Plan	Actual
(3) Project Cost		
Amount Paid in Foreign Currency	500 million yen	Unknown
Amount Paid in Local Currency	14,233 million yen (8,133 million rupee)	Unknown
Total	14,733 million yen	13,687 million yen
ODA Loan Portion	12,523 million yen	11,619 million yen
Exchange Rate	1 rupee ＝1.75 yen (as of February 2005)	1 rupee＝1.23 yen (2005-2016 average)
(4) Final Disbursement	February 2016	