



1. Project Data

Project ID P096745	Project Name PK: Punjab Barrages Improvement II Proj	
Country Pakistan	Practice Area(Lead) Water	
L/C/TF Number(s) IBRD-79000	Closing Date (Original) 30-Jun-2016	Total Project Cost (USD) 155,000,000.00
Bank Approval Date 01-Jul-2010	Closing Date (Actual) 30-Jun-2017	
	IBRD/IDA (USD)	Grants (USD)
Original Commitment	145,600,000.00	0.00
Revised Commitment	135,600,000.00	0.00
Actual	132,512,409.46	0.00

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2. Project Objectives and Components

a. Objectives

According to the Project Appraisal Document (PAD) (p. 7) the objectives of the project were “to assist the Borrower in: (i) rehabilitating and modernizing Jinnah Barrage and carrying out affiliated works to enable reliable and uninterrupted supply of water for over 2.1 million acres of farmland benefitting about 600,000 farm families for irrigation and domestic water users; and (ii) build Punjab Irrigation and Power Department’s (IPD) capacity in improved water resources and irrigation system management.”

The Loan Agreement of December 18, 2010 (p. 5) states the same PDO with a minor and insignificant difference in wording.



b. Were the project objectives/key associated outcome targets revised during implementation?

No

c. Will a split evaluation be undertaken?

No

d. Components

Component A: Rehabilitation and Modernization of Jinnah Barrage (appraisal estimate US\$111.0 million, actual US\$125.3 million): This component was to finance civil, mechanical, and electrical works such as the construction of a subsidiary weir, repairs of the downstream barrage floor, impact and friction blocks, and guide banks, alteration of the main barrage structure, construction of river training works, renovation of building and management infrastructure, and of the barrage gates and house system. Also, this component was to finance the automation of gate operation, upgrading of the barrage monitoring system and basic operation and maintenance of facilities. Furthermore, this component was to finance the implementation of social and environmental management plans and construction supervision and implementation support.

Component B: Improvement and Modernization of the Irrigation and Water Management System (appraisal estimate US\$15.0 million, actual US\$8.6 million): This component was to finance improvements in irrigation and water management systems including the development of a Water Resources Management Information System (WRMIS), monitoring systems, and a Decision Support System (DSS). Also, this component was to finance the modernization of water management equipment and facilities and the preparation of future water sector projects.

Component C: Monitoring and Evaluation of the Project Impact and Social and Environmental Management Plans (appraisal estimate US\$3.0 million, actual US\$2.3 million): This component was to finance monitoring and evaluation (M&E) activities to provide continuous feedback to the Government of Punjab (Gopunjab), Government of Pakistan (GOP), Project Steering Committee (PSC), the World Bank and implementing agencies on the project's performance, and social and environmental management plans to take corrective actions if necessary. The monitoring was to be carried out by M&E consultants.

Component D: Project Management Coordination Technical Assistance and Training (appraisal estimate US\$7.0 million, actual US\$4.0 million): This component was to support the operation of the Project Management Office (PMO) in different project management activities, build capacity in the PMO to develop into a Barrage Management Organization (BMO), and provide technical assistance. Also, this component was to finance incremental staff salaries, operating expenditures, consulting services, an independent Panel of Experts to assist with design and construction related issues, and the development of strategic studies and pilot projects.



e. Comments on Project Cost, Financing, Borrower Contribution, and Dates

Project Cost: The project was estimated to cost US\$155 million, actual cost was US\$143.3 million.

Financing: The project was to be financed by US\$145.6 million from International Bank for Reconstruction and Development (IBRD).

Borrower Contribution: The Borrower was to contribute US\$9.4 million, actual contribution was US\$10.7 million.

Dates:

- The project was restructured on May 9, 2016 to extend the closing date from June30, 2016 to June 30, 2017 to allow for the completion of activities in regards of the installation of the new operations system and strengthening of the institutional capacity of the Punjab Irrigation Department.
- On May 1, 2017 the project was restructured to cancel US\$10 million of the IBRD loan due to savings.

3. Relevance of Objectives & Design

a. Relevance of Objectives

Even though the share of agricultural production is declining in Pakistan's economy, it remains a key sector and a major source of livelihood. The sector produces 21 percent of the country's Gross Domestic Product (GDP), 45 percent of the jobs, and about 80 percent of indirect and direct export earnings. Irrigated land accounts for over 90 percent of agricultural production. The Indus Basin Water System (IBWS) serves over 18 million hectares of land. Barrages are critical for raising the water levels in the rivers, flood management, and water supply for all sectors of the economy. Barrages, which were built in the 1960s, are still in adequate condition, however, older barrages require rehabilitation to be safe and ensure continuous water supply.

The project's objective is in line with Pakistan's Vision 25 strategy pillars to achieve sustained and inclusive higher growth, private sector-led growth, and modernization of existing infrastructure. Also, the project supports the government's poverty reduction strategy which includes the objective to restore stability and maintain growth for sustainable development.

At appraisal, the project was in line with the Bank's Country Assistance Strategy (2010-2014) which aimed to sustain growth recovery and build resilience to shocks. Also, the objective was in line with the Bank's most recent Country Partnership Strategy (2014-2019) which, under one of its results areas, aims to support private sector development by providing stable water distribution and supporting sustainable agricultural



production in the barrage command area.

Rating

Substantial

b. Relevance of Design

The project's activities were mostly logically and plausibly linked to achievement of the project's objective. The project's Theory of Change linked the rehabilitation and modernization of the Jinnah Barrage to an increase in water supply and the building of institutional capacity to improving management of water resources and the irrigation system. Activities to rehabilitate and modernize Jinnah Barrage and carry out affiliated works to enable reliable and uninterrupted supply of water for over 2.1 million acres of farmland benefitting about 600,000 farm families for irrigation and domestic water users included a large amount of civil, mechanical, and electrical works. Also, the Irrigation and Water Management System was to be improved through the development of a Water Resources Management Information System (WRMIS), monitoring systems, and a Decision Support System (DSS). Activities to build IPD's capacity in improved water resources and irrigation system management included the installation of a Real Time Flow Measurement (RTFM) system for data acquisition, storage and transmission, and training of staff to use modern tools and equipment to manage all the water/irrigation systems in the province. However, one shortcoming is that activities under component A to construct social infrastructure are not clearly linked to the PDO. While the Bank team stated that these activities were to help to promote ownership of the local communities, this aspect is not reflected in the PDO statement. Also, the project design did not take the external risk of new major floods that impact project implementation into account. Design was substantial overall.

Rating

Substantial

4. Achievement of Objectives (Efficacy)

Objective 1

Objective

Rehabilitating and modernizing Jinnah Barrage and carrying out affiliated works to enable reliable and uninterrupted supply of water for over 2.1 million acres of farmland benefitting about 600,000 farm families for irrigation and domestic water users:

Rationale

Outputs:



- A sub-weir to improve energy dissipation and stop downstream retrogression was constructed.
- A modern Supervisory Control and Data Acquisition (SCADA) system was installed.
- New barrage gates were installed and can be operated manually, mechanically through local controls at the barrage and remotely through the SCADA control room.
- Detailed Operation and Maintenance Manuals were developed.
- Operators were trained in Operation & Maintenance of the improved facilities in accordance with various updated manuals.
- A software application for WRMIS developed and integrated with a DSS model.
- Hardware and software was procured and a Data Centre established.
- A Geo-database and web-GIS interface of WRMIS was developed.
- A tool for near real-time crop water requirement monitoring through remote sensing data was developed. The model enables seasonal planning and determination of Punjab's share of water as per provisions of the Water Apportionment Accord (WAA) of 1991.
- The WRMIS was linked with DSS through hydrological and hydraulic modeling.
- 20 staff of PID were trained in the operation of WRMIS.
- A hydrological model for the forecast of water availability in Chenab River at Marala was developed.
- Social Infrastructure: Two schools, a mosque, a public park, tool plaza, 20 quarters for PID staff, two officer houses, one basic health unit, 36 water supply schemes, and three access roads were constructed. The Kalabagh bridge and a mosque were rehabilitated. In addition, wheat seeds (172,185 bags of 40 kg each) and, canola oil seed (4,730 bags one kg each) were distributed.

Outcomes:

- The number of days the canal was closed decreased from 32 days in 2010 to 18 days in 2016.
- The average flow at head of Thal Canal increased from 4,895 cubic feet per second in 2010 to 6,595 cubic feet per second in 2016. However, the amount of water diverted to the Thal canals depends on several factors, of which some are outside the control of the project. Only interruptions caused by problems related to the functionality of the barrage can be attributed to the project. In addition, after the completion of the sub-weir the retrogression downstream of the main barrage stopped. The target of "no reduction to water supplies in the Thal Canal area; retrogression is stopped; and operation of gates is smooth" was achieved.
- The Delivery Performance Ratio (DPR), which measures the reliability of water and is the ratio of actual water supplies as a fraction of the designed water supplies, increased from 0.58 in 2009 to 0.72 in 2017. This indicator did not have a specific target. The target was set as "less interruption in water supplies to the Thal Canal area".

Rating
Substantial



Objective 2

Objective

Build IPD's capacity in improved water resources and irrigation system management:

Rationale

Outputs:

- A Real Time Flow Measurement (RTFM) system for data acquisition, storage and transmission was installed on all main canals and staff was trained in operating the system. A Decision Support System and Water Resource Management Information System (WRMIS) were developed and operationalized. A SCADA system was commissioned at Jinnah Barrage and other major barrages. Flow monitoring systems have been installed on all main canals. Staff was trained in the operation of these systems. Therefore, the target to develop a water accounting system was achieved.

Outcomes:

- Installing RTFM system improved the reliability and accuracy of water accounts.
- The PID's capacity to manage all the water/irrigation systems in the province using modern tools and equipment was strengthened. The water allocation system is now implemented in the entire irrigation system.

Rating

Substantial

5. Efficiency

Economic Efficiency:

Both, the PAD and the ICR conducted a with-and without-project analysis. In the without scenario, based on the prediction that the flow in the Thal Canal would be reduced to 6,000 cusecs over a ten-year period, it was assumed that the cropping intensity, which was in 2009 at 103 percent, would decrease to 87 percent within this period. In the with-project scenario, it was assumed that the Thal Canal would obtain water supply at its designed capacity and that the cropping intensity would increase by 10 percent, to 113 percent over a ten-year period. The analysis applied a discount rate of 12 percent and estimated the Economic Rate of Return (ERR) at 21.7 percent, the Net Present Value (NPV) at Rupees 6,180 million and the Financial Rate of Return (FRR) at 17.7 percent. Losses due to a catastrophic failure of the barrage and loss of power production at the JHPP were not estimated. The ICR used the same approach but due to lower project costs the ERR was



estimated at 26.4 percent, the NPV at Rupees 17,350 million, and the FRR at 21.8 percent. These estimations indicate that the project was a worthwhile investment.

Operational Efficiency:

Despite implementation delays and extension of the closing date by one year, which all may indicate an inefficient use of project resources, the cost of the project was lower than originally estimated, indicating an efficient project implementation.

In light of the foregoing performance indicators, efficiency is rated Substantial.

Efficiency Rating

Substantial

a. If available, enter the Economic Rate of Return (ERR) and/or Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:

	Rate Available?	Point value (%)	*Coverage/Scope (%)
Appraisal	✓	27.10	100.00 <input type="checkbox"/> Not Applicable
ICR Estimate	✓	26.40	100.00 <input type="checkbox"/> Not Applicable

* Refers to percent of total project cost for which ERR/FRR was calculated.

6. Outcome

The relevance of the objective is rated Substantial given the importance of Punjab Barrage for flood management and water supply in the area. The relevance of design is rated Substantial. Achievement of each of the project's two objectives is rated Substantial. Efficiency is rated Substantial. The overall outcome rating is Satisfactory.

a. Outcome Rating

Satisfactory

7. Rationale for Risk to Development Outcome Rating

The project implemented several activities to decrease the probability of a barrage failure and to strengthen institutional capacity. The Punjab Irrigation Department (PID) developed an Operations & Maintenance (O&M) plan for ensuring sufficient staffing, equipment, and operational budget for the period after project closing.



However, due to the remote location of the Jinnah Barrage and other facilities that support critical systems such as the Water Resources Management Information System, the Real Time Flow Monitoring System, and the Decision Support System, the PID might find it challenging to maintain trained staff to implement the O&M plan. In order to address this issue, the PID awarded service contracts for the O&M of the Real Time Flow Monitoring system and the Supervisory Control & Data Acquisition system to contractors. However, experience from previous Bank projects including institutional strengthening components showed that reforms were not sustained after project closing and the PID resisted changes and adoption of modern tools, equipment and systems. This behavior might change in the near future due to PID's introduction of new and young staff.

a. Risk to Development Outcome Rating

Modest

8. Assessment of Bank Performance

a. Quality-at-Entry

The project design included lessons learned from infrastructure rehabilitation projects in Pakistan and the world. Especially, the Bank's experience in implementing the Taunsa Barrage project was incorporated in the design and operation and construction plans.

The Bank team developed a Social Development Action Plan and an Environmental and Social Management Monitoring Plan as well as a robust and adequate Results Framework to measure progress towards the PDO.

The Bank identified relevant risk factors. The risk of interrupting water supply in project areas during construction, and the lack of transparency and accountability in procurement of contracts and their implementation were rated as Substantial. Mitigation efforts were not sufficient and the project experienced procurement related implementation delays. Also, the risk of potential flooding was not identified. Major floods in 2010 resulted in damages to the downstream apron of the barrage and the river training works and protective bunds upstream, requiring repairs.

Also, the project design did not combine civil works and mechanical/electrical works in a single contract and planned to refurbish old gates instead of installing new ones, resulting in implementation delays.

Quality-at-Entry Rating

Moderately Satisfactory

b. Quality of supervision

The Bank team consisted of members with the expertise relevant for project implementation. The Bank conducted a total of 14 supervision missions, which mostly also included visits of project sites. Bank supervision aimed to identify implementation bottlenecks and provide solutions to overcome them. The Bank



team supported the PMO in critical areas such as procurement, disbursement and financial management issues. At the beginning of project implementation, the Bank made useful adaptations to the project such as including in the project scope repair of damages caused by the 2010 floods, installing new gates instead of renovating old gates, combining civil works and electrical/mechanical works in one contract, and improving the specifications of stones used for the downstream apron, filter and flood fighting.

Quality of Supervision Rating

Satisfactory

Overall Bank Performance Rating

Moderately Satisfactory

9. Assessment of Borrower Performance

a. Government Performance

The government was committed to the objectives of the project throughout implementation and fulfilled its three main responsibilities: i) obtaining the approval for the project by the Executive Committee of the National Economic Council, the highest government forum; ii) negotiating with the Bank and processing the Bank loan; and iii) processing the request by the Punjab's government to extend the closing date.

Also, the government completed the feasibility study in a timely manner and conducted an Environmental Impact Assessment.

The Government of Punjab participated in the project through the Planning & Development Board (P&D). The P&D was responsible for processing the project on the provincial level, chairing the Project Steering Committee to monitor progress and address any implementation issues which could not be solved at the PMO level. All these tasks were performed satisfactorily. During the fiscal year 2011/2012 the government of Punjab did not release counterpart funds as agreed. With delay, the funds were released but were smaller than planned. The precise reasons for allocating inadequate counterpart funds could not be ascertained with the Government as it requires considerable formalities and time to access archived records. The PMO had to use loan funds to pay for the government's share of contractor costs. Also, the key staff position of director of finance with the PMO remained not fulfilled for more than half-way through project implementation.

Government Performance Rating

Satisfactory

b. Implementing Agency Performance

The Punjab Irrigation and Power Department (IPD) of the Government of Punjab was responsible for the execution and implementation of the project through the Project Management Office (PMO). The already existing Project Management and Implementation Unit (PMIU) of IPD was responsible for the implementation of component B1.1, which focused on the improvement in irrigation and water management



in the province. The Public Health Engineering Department (PHED) was responsible for implementation of water supply schemes under component A3.

Overall, the PMO had sufficient capacity and conducted its M&E function satisfactorily. At the beginning of project implementation, the PMO encountered some issues in regards to financial management. Also, as stated above, the position of Director of Finance was unoccupied half-way through implementation. Also, the PMO had not transitioned to a Barrage Management Organization as originally planned due to internal delays. The Social Development Action Plan was adequately implemented by the PHED. Also, the PHED successfully followed the participatory approach when it organized Community Based Organizations to establish drinking water supply schemes.

Implementing Agency Performance Rating

Moderately Satisfactory

Overall Borrower Performance Rating

Moderately Satisfactory

10. M&E Design, Implementation, & Utilization

a. M&E Design

The project's objectives were clearly specified and well reflected in the indicators included in the Results Framework. The Results Framework only included two PDO and four intermediate outcome indicators. The selected indicators were specific, measurable, relevant and time bound. Most indicators measured the achievement of outputs. The Project Management Office (PMO) was responsible for the overall M&E activities and assigned M&E related tasks to consultants.

b. M&E Implementation

The PMO produced reliable data. The PMO had access to the Management Information System (MIS) maintained by the contractor and the PIC and used these in conjunction with its own database to monitor progress. The contractor for the main civil and electro-mechanical works that included installation and initial operation of the SCADA system maintained a comprehensive MIS to monitor and report on overall progress and management of activities related to the project. Besides the main works, the MIS also covered social and environmental aspects related to implementation of this large contract. Monitoring reports on the implementation of the Social Development Action Plan and the Environmental and Social Management Monitoring Plan were submitted on a quarterly basis and provided useful feedback.

The PMO carried out day-to-day monitoring to assess the project's progress and operation & maintenance (O&M) of the barrage. These monitoring activities included inter alia, management of upstream pond levels, monitoring river inflows upstream and flows released downstream of the barrage, water diversions to the Thal Canal, and surveys of downstream floor of the barrage and river bed that had experienced erosion and



retrogression prior to the project, endangering the safety of the barrage.

Even though the preparation of a comprehensive MIS for the Project by the M&E consultants was delayed, the PMO could closely monitor physical and financial progress, address implementation issues as they arose, and manage day-to-day barrage operations based on reliable data from the MIS maintained by the contractor and the PIC and its own database of river and canal flows and river bed survey data. After the completion and commissioning of the SCADA system, the PMO also had access to real-time data on upstream pond levels, diversions to the Thal Canal and flows released for downstream uses.

c. M&E Utilization

M&E data was used to track progress towards the project's objective and informed decision making. The indicators included in the Results Framework were successfully institutionalized as part of the service contract awarded by the PMO to a contractor.

M&E Quality Rating

Substantial

11. Other Issues

a. Safeguards

The project was classified as Category A and triggered the Bank's safeguard policies OP/BP 4.01 (Environmental Assessment), OP/BP 4.12 (Involuntary Resettlement), OP/BP 4.37 (Safety of Dams), OP/BP 7.50 (Projects on International Waterways). The project produced an Environmental Assessment including an Environmental and Social Management and Monitoring Plan (ESMMP). An independent panel of experts was established, which was responsible for reviewing the engineering designs and providing advice on implementation issues. The project also developed a Land Acquisition Resettlement Framework, which included an entitlement matrix for the unlikely scenario that any private land had to be bought due to design changes during project implementation. The project's compliance with the ESMMP was monitored by the Bank team during periodic site visits as well as by the Project Management Organization (PMO), Project Implementation Consultants (PIC) and M&E consultants. According to the final monitoring conducted by the World Wide Fund, the project did not have any significant adverse impacts on the flora and fauna of the area.

The project also developed a Social Development Action Plan (SCAP). All objectives stated in the SCAP were achieved through the implementation of several activities such as maintaining adequate flow in the river to meet downstream water requirements, keeping all stakeholders informed about any foreseen or unforeseen changes in the canal closure program, or providing detailed advance construction planning that included the preparation of detailed daily work schedules.



In case of any land acquisition or resettlement, a grievance redress mechanism was established to receive and address the concerns of stakeholders during project implementation.

b. Fiduciary Compliance

Financial Management:

At the beginning of project implementation, the PMO's financial performance was weak but improved over time. The financial management systems and internal controls at the PMO were appropriate. Quarterly and annual interim financial reports were submitted to the Bank on time and were found to be adequate. However, a key position of Director of Finance remained empty more than half-way through project implementation. This had a negative impact on project implementation for several reasons: First, ineligible expenses were incurred, possibly because the internal controls were inadequate in the absence of a Director of Finance. Second, a loan covenant that called for full staffing of the PMO, including the position of Director of Finance remained unfulfilled. And third, for a brief period the Financial Management rating in the Implementation Status and Results (ISRs) reports had to be downgraded to Moderately Unsatisfactory because of the inadequate internal controls and ineligible expenses.

Another shortcoming was that outstanding audit observations were still not settled at the time the ICR was written. The project's Financial Management also experienced an issue in regards to weak contract management and payments made beyond approved variation order amounts. However, the variation orders were approved on an ex-post basis by the competent authority. While there were audit paragraphs (Government parlance for auditor's observations, comments and instructions for corrective/remedial actions in the future), the overall auditor's opinions were not qualified.

Procurement:

The PMO had adequate procurement staff who, in general, diligently and promptly addressed the Bank's review comments. The PMO had a website with access to project procurement plans, procurement notices, bid opening, award data and a complaint mechanism. Only one complaint was submitted during implementation and was addressed adequately. Consultants were hired to conduct annual reviews of procurement falling below the Bank's prior review threshold. No major issues were identified. A Dispute Review Board was established at the beginning of project implementation. The ICR (p. 15) states that at the time of the ICR mission, no disputes were awaiting settlement.

The project experienced several procurement-related delays due to changes in the scope of activities and lengthy biddings for contracts. The Bank addressed these delays by providing training to the PMO's procurement staff, holding pre-bid conferences, allowing flexibility in the procurement method and consultants' expertise requirements to reflect availability of skilled personnel in the market.



c. Unintended impacts (Positive or Negative)

NA

d. Other

12. Ratings

Ratings	ICR	IEG	Reason for Disagreements/Comment
Outcome	Satisfactory	Satisfactory	---
Risk to Development Outcome	Modest	Modest	---
Bank Performance	Satisfactory	Moderately Satisfactory	There were shortcomings for quality at entry.
Borrower Performance	Moderately Satisfactory	Moderately Satisfactory	---
Quality of ICR		Substantial	---

Note

When insufficient information is provided by the Bank for IEG to arrive at a clear rating, IEG will downgrade the relevant ratings as warranted beginning July 1, 2006. The "Reason for Disagreement/Comments" column could cross-reference other sections of the ICR Review, as appropriate.

13. Lessons

The ICR (p.26-27) includes lessons learned:

- **Establishing an independent panel of experts to review designs and provide advice on implementation issues can be useful for project implementation.** In this project an independent panel of experts provided guidance on design, construction and safety issues through periodic consultations allowing to take timely corrective actions and ensuring quality.
- **Ensuring implementation readiness through a thorough preparation allows for a timely completion of project activities.** In this project the project preparation phase included detailed planning for the construction phase such as determination of location for contractor's camp site and development of a daily



construction schedule. This detailed planning had a positive impact on addressing environmental and social issues adequately and avoiding delays in project implementation.

14. Assessment Recommended?

No

15. Comments on Quality of ICR

The ICR provides a good overview of project preparation and implementation. The ICR includes a traditional economic analysis. Also, the ICR is results-based and internally consistent. However, the ICR does not include sufficient information in critical areas such as Financial Management and Procurement. Overall, the quality of the ICR is rated Substantial.

a. Quality of ICR Rating Substantial