

The logo of the Asian Development Bank (ADB), consisting of the letters 'ADB' in white serif font on a dark blue square background.

ADB

BEST PRACTICES IN IRRIGATION AND DRAINAGE

LEARNING FROM SUCCESSFUL PROJECTS

A Case Study from the 2006 Annual Evaluation Review

July 2008

Alvin C. Morales
Caren Joy Mongcopa

Operations Evaluation Department

Asian Development Bank

Abbreviations

ADB	Asian Development Bank
EA	executing agency
EIRR	economic internal rate of return
ID	irrigation and drainage
O&M	operation and maintenance
OED	Operations Evaluation Department
PCR	project completion report
PPER	project performance evaluation report
PPTA	project preparatory technical assistance
TA	technical assistance

NOTE

In this report, "\$" refers to US dollars.

Contents

	Page
I. Irrigation and Drainage Projects	1
II. Demand for Irrigation Services and Enabling Environment	1
III. Stakeholder/Beneficiary Participation	2
IV. Impacts on Beneficiaries	3
V. Quality at Entry	3
VI. Quality During Implementation	4
VII. Performance of the Executing Agency	5
VIII. ADB's Contribution to Project Success	5
IX. Exogenous Factors	6
X. Counterfactual in the Irrigation and Drainage Sector	6
XI. Summary	9

I. Irrigation and Drainage Projects

1. In 2004, the Asian Development Bank (ADB) updated the sector and thematic classification and identified irrigation and drainage (ID) as one of the subsectors under the agriculture and natural resources sector.¹ ID projects had previously been clustered with rural development projects. Based on the 120 projects rated at the end of 2005, this group had a success rate of 56%. The ID subgroup had a success rate of 55%. ADB has provided loans totaling \$4.1 billion for 105 ID projects in 18 developing member countries. This represents 4% of the total ADB loan portfolio and 26% of ADB loans to the agriculture and natural resources sector. The ID projects have been supported by 151 technical assistance (TA) activities amounting to \$66.4 million. Bangladesh, Indonesia, and Pakistan have been the main recipients of this assistance, receiving 74% of ID loans and 49% of ID-related TAs. Given that the success rates of ID projects are significantly lower than in other sectors, it is particularly important for ADB to learn lessons that result in successful ID projects.

2. The assessment of factors contributing to the success of ID projects was based on the analysis of 21 projects approved between 1969 and 1988 and rated as successful or generally successful in their respective project performance evaluation reports (PPERs) and/or project completion reports (PCRs).² The review also drew on recent literature, the Operations Evaluation Department's (OED) Post Evaluation and Information System, and selected ADB studies,³ particularly those undertaken by OED to substantiate review findings.

II. Demand for Irrigation Services and Enabling Environment

3. Irrigation projects are often needed to improve agricultural productivity and increase crop yields and cropping intensities. Based on the projects reviewed, the demand for irrigation services by developing member countries at the national level and by farmer beneficiaries at the local level was one of the prerequisites for the success of ID projects. Demand can be measured as a function of actual usage or, alternatively, by participants' willingness to pay for benefits. A high demand for irrigation services was noted among the successful ID projects. The projects often related



¹ ADB. 2004. *Updating Sector and Theme Classification at the Asian Development Bank*. Manila.

² ADB. 1980. *Project Performance Evaluation Report on Loan 479-INO: Lower Citanduy Irrigation*, approved on 13 November 1980 was included in the set of projects reviewed, as it was rated generally successful based on a re-evaluation study in November 1996.

³ The broader evaluation studies used in this review, in addition to the PPERs and PCRs, included (i) ADB. 2004. *Special Evaluation Study on Effectiveness of Participatory Approaches in Rural Development Projects*. Manila; (ii) ADB. 2003. *Special Evaluation Study on Participatory Approaches in Forest and Water Resources Operations in Selected Developing Member Countries*. Manila; (iii) ADB. 2000. *Sector Synthesis of Evaluation Findings in the Irrigation and Rural Development Sector*. Manila; (iv) ADB. 1999. *Performance Assessment of Agriculture Projects*. Manila; (v) ADB. 1998. *Special Evaluation Study of Factors Affecting Project Performance in the Agriculture and Social Sector: A Review of Post-evaluation Reports Between 1991 and 1997*. Manila; and (vi) ADB. 1995. *Sector Synthesis of Post Evaluation Findings Report in the Irrigation and Rural Development Sector*. Manila.

to national policies and programs on water management (Pakistan) or food security policies and programs (Bangladesh, Indonesia, Philippines, and Thailand).

4. An enabling environment is needed to allow farmers to supply the demand for their produce. Examples include (i) a policy and institutional framework that promotes sound water resource management; (ii) a legal framework for water user associations that promotes cost recovery at least sufficient to finance sustainable operation and maintenance (O&M); (iii) rural infrastructure (e.g., roads that allow farmers to market their products, and farm inputs to be delivered when they are needed); (iv) efficient markets that are free of price distortions and barriers to competition for both farm products and agricultural inputs; and (v) access to information on demand, prices, and technology. To successfully capture the opportunities created by growing markets, supportive alliances must be created among upstream and downstream business partners (i.e., suppliers and service providers of agricultural inputs and implements such as farm machines, agricultural processing entities and others related to markets). Extension services must be provided; there must be access to improved seeds, fertilizers, pesticides, and technologies; and private sector merchants must be involved in marketing the incremental produce.

III. Stakeholder/Beneficiary Participation

5. A sound understanding of the roles and responsibilities of farmers and water user associations is a feature of successful ID projects. Adequate O&M is a necessary condition to sustain project benefits and ensure that ID facilities remain functional. Successful projects are characterized by the involvement of direct stakeholders and beneficiaries in all project phases, particularly O&M. This was reflected in projects in Nepal and Philippines, where farmer-managed irrigation systems and farmer/water users associations took



part in O&M activities. Globally, the collection of irrigation service fees is good practice to finance and sustain O&M activities. In the Philippines and Nepal cases, farmers themselves collected the fees. This resulted in better collection efficiency and minimal administrative and transaction costs for the executing agency (EA). Increasing the responsibility of farmer groups also conforms to good practice⁴ among ID projects. Beneficiary involvement increased the sense of ownership and responsibility among the participants. Similar patterns were evident in Indonesia and Pakistan. In general, beneficiary participation in every phase of the project cycle contributes to successful ID projects. This was substantiated by an OED Special Evaluation Study focusing on participatory approaches in forest and water sector operations.⁵ Water user associations should be formed early in the project cycle and training provided. Good participatory techniques reflect the diversity of social structures and representation of diverse interests in decision-making processes.

⁴ Hussain, Inizar. 2005. *Pro-poor Intervention Strategies in Irrigated Agriculture in Asia. Poverty in Irrigated Agriculture: Issues, Lessons, Options and Guidelines. Bangladesh, China, India, Indonesia, Pakistan and Vietnam.* Final Synthesis Report. Sri Lanka: IWMI. Also available in <http://www.adb.org/water/actions/REG/irrigation-initiatives.asp>.

⁵ ADB. 2003. *Special Evaluation Study on Participatory Approaches in Forest and Water Resources Operations in Selected Developing Member Countries.* Manila.

IV. Impacts on Beneficiaries

6. Irrigation offers a range of benefits, both direct and indirect. Irrigation plays a key role in addressing national food security concerns. In addition, successful ID projects contribute to improvements in (i) agricultural productivity; (ii) employment opportunities, particularly for marginal and landless workers; (iii) transport systems, through better farm and access roads; (iv) women's participation; and (v) institutional capabilities, specifically for projects with accompanying TAs for institutional strengthening. The analysis of beneficiaries is often limited to those who cultivate the earth. Successful ID projects result in the growth of both on-farm and off-farm activities.

7. Irrigation impacts vary across countries and among beneficiaries. In most cases, benefit distribution of ID projects is proportional to the amount of irrigated land worked by a farmer. Farmers with larger landholdings have benefited more relative to small and marginal farmers, particularly irrigation tail-end users.⁶ In some successful ID projects in Pakistan, efficient irrigation facilities minimized the gap by ensuring that adequate water supply reached tail-end users, which are usually small farmers. In addition, the focus on on-farm irrigation and drainage for small farmers enabled them to directly benefit from such projects, which turned-out to be a high-return venture, considering the small incremental investment requirements. However, based on the review, the actual economic internal rates of return (EIRRs) of successful ID projects were significantly lower than their appraised values. The average EIRR at appraisal was 32% in contrast to a still highly successful 18% at postevaluation.⁷ ID projects have benefited many poor farmers who did not have a stable water supply prior to the project.



8. The successful irrigation projects reviewed revealed no significant adverse environmental and resettlement impacts. In some instances, negative externalities were avoided through project reformulation and policy dialogue. In Nepal, for instance, the East Rapti Irrigation Project was reformulated to prevent possible negative environmental impacts on a national park.

V. Quality at Entry

9. Successful ID projects tended to have good quality at entry, including the quality of the project preparatory technical assistance (PPTA) or feasibility study, project design, incorporation of lessons from prior projects, and level of stakeholder participation.

10. There is a direct linkage between the quality of the feasibility study and eventual project success. For most (95%) of the successful ID projects, the PPTA did a good job identifying potential implementation problems, assessing institutional capabilities, and exploring various design alternatives. In the case of Bangladesh, PPTA was instrumental in promoting the use of indigenous technology and methods of good design. This was significant in reducing the project cost. Important aspects of good

⁶ This observation was corroborated by an ADB-funded International Water Management Institute (IWMI) study and was evident in South Asian countries, where resource endowments were skewed in favor of a few.

⁷ The figures are higher relative to the combined EIRR average of partly successful and unsuccessful projects at appraisal (18%) and after evaluation (7%).

design include a sound sector diagnosis covering policies and institutions, a good assessment of the whole value chain, and a sound understanding of national/river basin natural resources management opportunities and constraints. A sound planning process includes a careful assessment of market opportunities, input and output value chains, and realistic targets in terms of crop intensities and yields. Appropriate water distribution arrangements must be developed with the water user associations, and the project design must ensure that water actually reaches the tail end of the canal systems and individual water users.

11. The design of irrigation systems needs to be appropriate and flexible to reflect local needs and conditions. The project design stage provides the opportunity to identify potential problems and appropriate solutions based on a set of alternatives. The consideration of alternatives was important in the eventual success of projects in Bangladesh, Republic of Korea, and Pakistan. An appropriate design needs to be based on local conditions and previous experience. Flexibility in designing projects to reflect local conditions and avoid negative environmental impacts is also good practice. For instance, the Nepal and Philippine experiences of strengthening water user/farmer institutions can be replicated in areas where small irrigation systems are a priority. In Bangladesh and Pakistan, the incorporation of lessons in the design of projects that have a successful precedent are examples of good practice that contributed to eventual project success.

12. A good design is usually a product of extensive stakeholder consultations. Participatory approaches were utilized in most of the successful ID projects reviewed. The fundamental lesson is that the participation of local communities from project inception contributes to project success. One of the benefits of employing participatory techniques that have contributed to project success is the acceptance of more responsibilities (commitments) and improved ownership by project beneficiaries.⁸ Participation in all phases of the project cycle involved consultants, beneficiaries, the EA, local organizations, and other stakeholders. The consultative process facilitated the assessment of the relevance and suitability of the project design, including the capability of the EA. As a caveat, however, the quality and the extent of participatory approaches should also be assessed, as this practice was also observed in not so successful projects. An OED study⁹ revealed that reflecting local realities in the design of the intervention is far more important than relying on a standard package of participatory approaches with no clear purpose.



VI. Quality During Implementation

13. A distinct feature of successful ID projects was the flexibility of allowing appropriate design changes during implementation. Most projects reviewed had modified their project scope in response to actual site conditions and implementation challenges. Project reformulation facilitated and improved project implementation. For instance, the Pulangi River Irrigation Project in the Philippines adopted a process approach that allowed flexibility in project implementation. Making changes in project designs during implementation that contribute to achieving good project outcomes was an important contribution made by project administration staff associated with successful projects.

⁸ This result is consistent with the findings of ADB. 2000. *Special Evaluation Study on Participatory Approaches in Forest and Water Resources Operations in Selected Developing Member Countries*. Manila.

⁹ ADB. 2004. *Special Evaluation Study on Effectiveness of Participatory Approaches in Rural Development Projects*. Manila.

14. Since many ID projects are undertaken in remote areas, effective quality control systems for civil works and internal and external audit systems must be in place. Water user associations can be trained to help monitor progress in implementation and the quality of civil works.

15. In successful projects, continuous attention was paid during implementation to build the systems needed for O&M. OED findings in Nepal pointed to the critical need for commitment, ability, and leadership for sustainable O&M on the part of water user associations. Careful planning and institutional development are needed to build sustainable O&M systems.

VII. Performance of the Executing Agency

16. A high level of commitment and involvement of the EAs in all phases of the project cycle is essential for project success. Based on the projects reviewed, the EAs exhibited project ownership by (i) establishing a project office near the actual project sites (site-based) to monitor project implementation and management, and, accordingly, to respond to immediate project concerns (Bangladesh and Pakistan); (ii) employing well-qualified staff, particularly project managers; (iii) selecting EA personnel involved in earlier projects (Pakistan); and (iv) financing a considerable share of project cost and assigning specific responsibilities to concerned agencies (Indonesia). The other qualities of EAs that may have contributed to good project performance were (i) the ability to address implementation problems; (ii) the quality of staffing, both technical competence and the number of staff involved in the project; (iii) the effective use of participatory techniques; and (iv) appropriate devolution of responsibilities to lower levels of government.

VIII. ADB's Contribution to Project Success

17. ADB allotted 142 and 147 person-days, respectively, for project processing and project administration of successful ID projects. Long-term ADB involvement in the ID sector and building up effective partnerships with EAs over a decade or more contributes to project success, policy reform, and the development of institutional capacity. A contribution of ADB to the success of ID projects reviewed was its proactive stance in solving problems and making required approvals. Fielding regular missions to address specific concerns facilitated this. ADB exercised flexibility by supporting project reformulation as necessary. The active involvement of resident missions in project implementation also contributed to the success of some projects. In one project in Bangladesh, ADB contributed value added to the project design through the installation of a benefit, monitoring, and evaluation system.



IX. Exogenous Factors

18. Favorable prices and the absence of natural disasters are the primary exogenous factors that influenced project success. Generally, increased access to irrigation facilitated multiple cropping and allowed farmers to shift to high-yielding crops, which translated to higher returns. For instance, the good price of cotton at the time of project implementation in Pakistan provided an incentive for farmers to intensify cotton production and utilize irrigation facilities efficiently. Likewise, favorable prices for secondary crops enabled Indonesian farmers to adjust their crop calendars and raise secondary crops. The absence of natural disasters facilitated the continuity of project operations and avoided possible damage to existing infrastructure.

X. Counterfactual in the Irrigation and Drainage Sector

19. Comparing some key indicators for successful ID projects with those for partly successful/unsuccessful projects provides some insights into the counterfactual case in this sector (see Table). There were clear differences in the average ex-ante and ex-post EIRRs for the two groups of projects. The ex-ante EIRRs for ID projects that turned out to be successful were high, averaging 32%. The corresponding figure for projects that were not rated as successful was about half of this figure (18%). The average ex-post EIRRs were considerably lower for both groups—18% for the successful projects and 6.8% for the partly successful/unsuccessful projects. The ex-post EIRRs for successful projects were clearly acceptable, bordering on highly efficient and well above ADB's 12% estimated economic cost of capital.

20. Project size does not appear to be a key driver of successful ID projects. On average, the successful projects cost \$44.7 million, slightly less (about \$10 million) than the less successful ID projects. This may suggest that smaller projects are more likely to be successful than larger projects, but the evidence is not strong. Cost overruns were experienced for both the successful (38%) and partly successful/unsuccessful (21%) ID projects. Cost overruns were a particular problem in unsuccessful projects, for which they averaged 68%. The successful projects found ways to manage cost overruns so that project outcomes were not compromised.



Table: Characteristics of Successful Irrigation and Drainage Projects

Item	Generally Successful or Successful		Partly Successful or Unsuccessful		Total	
	No. of Projects	Average	No. of Projects	Average	No. of Projects	Average
Project Characteristics						
Size of Project (\$ million)	21	44.7	16	56.5	37	49.8
Economic Internal Rate of Return at Appraisal (%)	20	32.0	15	18.0	35	25.9
Economic Internal Rate of Return at Postevaluation (%)	20	18.0	10	6.8	30	14.0
Planned Implementation Period (years)	21	4.7	16	5.1	37	4.8
Actual Implementation Period (years)	20	7.3	16	9.6	36	8.3
Implementation Delay (years)	20	2.7	16	4.5	36	3.5
Cost Deviation (%)						
Cost Overrun (%)	21	38.3	16	21.2	37	30.7
Cost Underrun (%)						
ADB Inputs						
Project Processing Missions	20	2.3	15	2.0	35	2.2
Project Processing Person-Days	20	141.8	15	159.7	35	151.1
Project Administration Missions during Implementation	20	11.3	15	12.9	35	12.0
Project Administration Missions per Year of Implementation	20	1.5	15	1.3	35	1.4
Project Administration Person-Days during Implementation	20	146.9	15	211.8	35	174.7
Project Administration Person-Days per Year of Implementation	20	20.1	15	22.1	35	21.0

ADB = Asian Development Bank.

Notes:

"Average" refers to simple mean (i.e., unweighted).

Project size refers to the actual cost of the project, which includes funding from ADB, the government, and other sources.

Implementation period refers to the length of time taken to implement a project (from original date of effectiveness to completion).

Implementation delay is the difference between planned and actual implementation period.

Processing missions comprise fact-finding and appraisal missions.

Administration missions are supervision missions carried out from inception to project completion, excluding PCR missions.

Sources: Project completion reports and project performance evaluation reports of irrigation and drainage containing a rating circulated as of 31 December 2005.

21. Changes in project scope affect the implementation period. Nonetheless, given that most of the design changes in successful ID projects were geared towards improving project performance, implementation delays did not affect overall project quality. While time overruns were common for successful ID projects, they fared better relative to unsuccessful projects. The average implementation delay for successful projects was only 2.7 years, in contrast with the 8-year and 4-year average delays for unsuccessful and partly successful projects, respectively.

22. ADB staff inputs varied somewhat between the two groups of projects. Processing the unsuccessful and partly successful projects required more staff time (an average of 160 person-days) than did successful projects (142 person-days). This may indicate that ADB staff realized that there were risks associated with the projects that were ultimately not rated successful and tried to compensate by devoting more staff time. Significantly more staff resources were devoted to the administration of the partly successful/ unsuccessful projects (an average of 212 days over the life of the project) than to successful projects (147 days). However, when these figures are adjusted to reflect the number of years that the projects were under implementation, there was not a significant difference in the average number of days spent on review missions per year, about 21. Thus, ADB does not appear to allocate more intensive staff resources to ID projects that turn out to be less successful than expected.

23. A review of the PPERs and PCRs of partly successful and unsuccessful ID projects identified a number of factors that typically contributed to disappointing project performance:

- (i) **Inadequate project design.** Quality at entry was a problem. ID projects are, by nature, complex and difficult to prepare, implement, and evaluate. The projects are people-centered and, because of the importance of local conditions, solutions that work in one country may not work in another. In some cases technical problems contributed to less than successful outcomes. For example, in some less than successful irrigation projects the command area serviced by the project was considerably smaller than anticipated. In other cases the quality of economic analysis on which project approval was based was suspect. Unrealistic assumptions were made, and the project benefits were sometimes significantly overestimated.
- (ii) **Project complexity.** Many projects that experienced difficulty covered large areas, had multiple components, and involved several institutions.
- (iii) **Complex institutional structure involving weak institutions.** Many organizations are involved in agriculture and rural development in all countries. Institutional weaknesses were particularly evident at the local level. Problems included human resource weaknesses and limited budgets.
- (iv) **Inadequate beneficiary consultation during the design phase.** Poor community consultation/involvement during the initial stages of designing less than successful projects led to inadequate O&M, thereby contributing to ineffective water user associations and nonpayment of irrigation service fees.
- (v) **Ineffective water user associations.** Effective water user associations were often not developed for projects that were rated as partly successful or unsuccessful. Participatory processes were not effectively used to strengthen project design, implementation, and operations or to develop effective water user associations.
- (vi) **Poor O&M.** Often the less than successful ID projects were not effectively operated and maintained, thus reducing the sustainability of benefits. Problems in this area included lack of funds for O&M and poor revenue collection from beneficiaries.
- (vii) **Inadequate ADB supervision.** The “blueprint” approach to project design is not always appropriate for ID projects. A process approach is often needed, with the flexibility to adapt project design to incorporate lessons learned during implementation. The process approach requires strong project administration. In addition to undertaking a sufficient number of missions, the quality of supervision is also important. ADB staff must be able to identify and work proactively to solve problems.

- (viii) **Adverse impact of external factors.** During most of the 1980s and 1990s, farm-gate market prices for primary commodities generally fell, adversely affecting the outcomes of some projects. Some ID projects were adversely affected by drought and a lack of water.

XI. Summary

24. The following Box summarizes the characteristics of successful ID projects.

Box: Characteristics of Successful Irrigation and Drainage Projects

1. Elements of an enabling environment that allowed farmers to supply the demand for their produce included (i) a policy and institutional framework that promotes sound water resource management; (ii) a legal framework for water user associations that promotes cost recovery at least sufficient to finance sustainable O&M; (iii) rural infrastructure (e.g., roads that allow farmers to market their products, and farm inputs to be delivered when they are needed); (iv) efficient markets that are free of price distortions and barriers to competition for both farm products and agricultural inputs; and (v) access to information on demand, prices, and technology.
2. Long-term ADB involvement in the sector and building up effective partnerships with EAs over a decade or more contributes to project success, policy reform, and the development of institutional capacity.
3. Indicators of project ownership by EAs include (i) establishing site-based project offices; (ii) well-qualified staff; (iii) selecting EA personnel involved in earlier projects; and (iv) financing a considerable share of project cost.
4. Good quality at entry reflected the quality of the feasibility study and project design, incorporation of lessons from prior projects, and the level of stakeholder participation.
5. Direct stakeholders and beneficiaries were involved in all project phases, particularly O&M. Participatory techniques were used to develop a sound understanding of the roles and responsibilities of farmers and water user associations and to create a climate in which participants were willing to pay irrigation fees.
6. Adequate water supply reached tail-end users, which are usually small farmers.
7. Making changes in project designs during implementation contributed to achieving good project outcomes.
8. Effective quality control systems for civil works and internal and external audit systems were in place, even in remote areas.
9. During implementation, continuous attention was paid to building the systems needed for effective O&M.
10. Effective ADB project administration includes regular review missions, proactively helping to solve problems and making required approvals in a timely manner.