



Completion Report

Project Number: 23410
Loan Number: 1311
December 2006

Nepal: Irrigation Management Transfer Project

Asian Development Bank

CURRENCY EQUIVALENTS

Currency Unit		–	Nepalese rupee/s (NRe/NRs)	
			At Appraisal	At Project Completion
			15 March 1994	12 September 2005
NRs1.00	=		\$0.020	\$0.014
\$1.00	=		NRs49.11	NRs72.92

ABBREVIATIONS

ADB	–	Asian Development Bank
BME	–	benefit monitoring and evaluation
DOI	–	Department of Irrigation
EIRR	–	economic internal rate of return
ENPV	–	economic net present value
FIRR	–	financial internal rate of return
IMD	–	Irrigation Management Division
ISF	–	irrigation service fee
MOA	–	memorandum of agreement
O&M	–	operation and maintenance
PIU	–	project implementation unit
POA	–	plan of action
RTDB	–	research and technology development branch
SMB	–	system management branch
SMC	–	subproject management committee
SMO	–	subproject management office
TA	–	technical assistance
USAID	–	United States Agency for International Development
WUA	–	water user association

NOTES

- (i) The fiscal year (FY) of the Government ends on 15 July. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2006 ends on 15 July 2006.
- (ii) In this report, "\$" refers to US dollars.

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BASIC DATA

A. Loan Identification

1.	Country	Nepal
2.	Loan Number	1311-NEP
3.	Project Title	Irrigation Management Transfer Project
4.	Borrower	Government of Nepal
5.	Executing Agency	Department of Irrigation
6.	Amount of Loan	SDR8.944 million
7.	Project Completion Report Number	NEP 954

B. Loan Data

1.	Appraisal	
	– Date Started	15 March 1994
	– Date Completed	30 March 1994
2.	Loan Negotiations	
	– Date Started	2 August 1994
	– Date Completed	3 August 1994
3.	Date of Board Approval	13 September 1994
4.	Date of Loan Agreement	20 March 1995
5.	Date of Loan Effectiveness	
	– In Loan Agreement	18 June 1995
	– Actual	14 June 1995
	– Number of Extensions	None
6.	Closing Date	
	– In Loan Agreement	30 June 2002
	– Actual	28 September 2004
	– Number of Extensions	Two
7.	Terms of Loan	
	– Interest Rate	1%
	– Maturity (number of years)	40 Years
	– Grace Period (number of years)	10 Years
8.	Terms of Relending (if any)	Not applicable
	– Interest Rate	
	– Maturity (number of years)	
	– Grace Period (number of years)	
	– Second-Step Borrower	

9. Disbursements
a. Dates

Initial Disbursement	Final Disbursement	Time Interval
25 October 1995	28 September 2004	107 months
Effective Date	Original Closing Date	Time Interval
14 June 1995	30 June 2002	84.5 months

b. Amount (\$'000)

Category or Subloan	Original Allocation	Last Revised Allocation	Amount Canceled	Net Amount Available	Amount Disbursed	Undisbursed Balance
Civil Work	5,716,000	4,450,551	1,265,449	4,450,551	4,450,551	0
Equipment and Vehicles	627,000	711,124	(84,124)	711,124	711,124	0
Survey Studies and Detailed Designs	850,000	226,530	623,470	226,530	226,530	0
Training, Incremental Administrative Cost and Incremental O&M	692,000	600,358	91,642	600,358	600,358	0
Service Charge	224,000	197,921	26,079	197,921	197,921	0
Unallocated	835,000	0	835,000	835,000	0	0
Total	8,944,000	6,186,484	2,757,516	6,186,484	6,186,484	0

() = negative, O&M = operation and maintenance.

10. Local Costs (Financed)	
- Amount (\$)	4,298,482
- Percent of Local Costs	69.4
- Percent of Total Cost	50.8

C. Project Data

1. Project Cost (\$)

Cost	Appraisal Estimate	Actual
Foreign Exchange Cost	6,556	4,156
Local Currency Cost	11,874	7,411
Total	18,430	11,567

2. Financing Plan (\$)

Cost	Appraisal Estimate	Actual
Implementation Costs		
Borrower Financed	5,520	3,113
ADB Financed	12,588	8,186
Other External Financing	0	0
Total	18,107	11,299
IDC Costs		
Borrower Financed	0	0
ADB Financed	322	268
Other External Financing	0	0
Total	18,430	11,567

ADB = Asian Development Bank, IDC = interest during construction.

3. Cost Breakdown by Project Component (\$)

Component	Appraisal Estimate	Actual
1. Establishment of Sustainable and Effective Water User Associations	16,833	10,500
2. Rehabilitation and Improvement of Irrigation and Drainage Facilities	1,275	799
3. Service Charge	322	268
Total	18,430	11,567

4. Project Schedule

Item	Appraisal Estimate	Actual
Date of Contract with Consultants		
Completion of Engineering Designs	26 October 2001	23 October 2003
Civil Works Contract		
Date of Award	25 September 1995	25 December 1995
Completion of Work	31 December 2001	28 May 2004
Equipment and Supplies		
Dates		
First Procurement	28 October 1995	29 January 1996
Last Procurement	26 June 2001	26 June 2002
Completion of Equipment Installation	22 March 2001	19 March 2004
Start of Operations		
Completion of Tests and Commissioning	23 September 2001	24 May 2004
Beginning of Start-Up	25 November 2001	12 June 2004
Other Milestones		

5. Project Performance Report Ratings

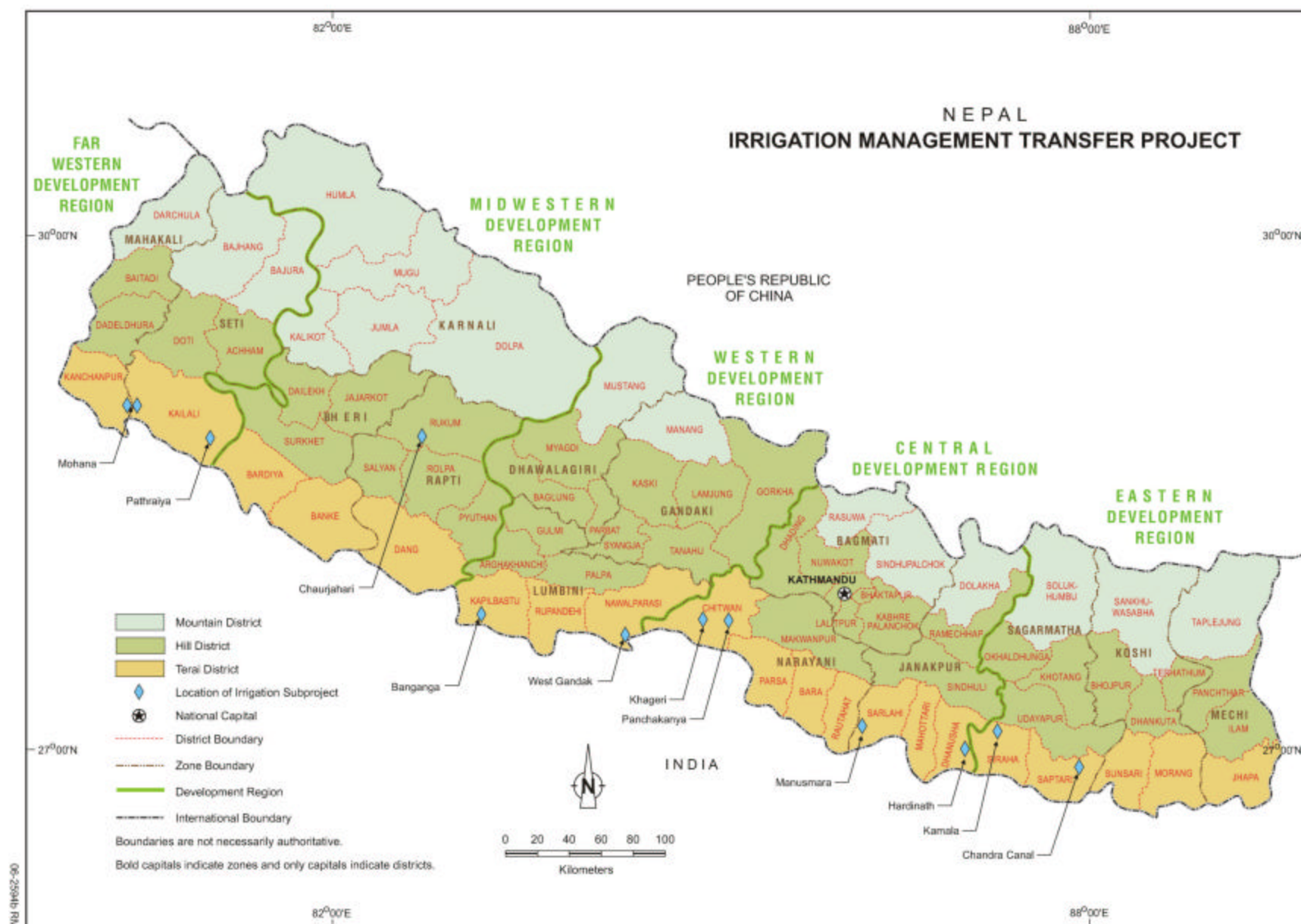
Implementation Period	Ratings	
	Development Objectives	Implementation Progress
From 14 June 1995 to 31 Dec 1995	Satisfactory	Satisfactory
From 01 Jan 1996 to 31 Dec 1996	Satisfactory	Satisfactory
From 01 Jan 1997 to 31 Dec 1997	Satisfactory	Satisfactory
From 01 Jan 1998 to 31 Dec 1998	Satisfactory	Satisfactory
From 01 Jan 1999 to 31 Dec 1999	Satisfactory	Satisfactory
From 01 Jan 2000 to 31 Dec 2000	Satisfactory	Satisfactory
From 01 Jan 2001 to 31 Dec 2001	Satisfactory	Satisfactory
From 01 Jan 2002 to 31 Dec 2002	Satisfactory	Satisfactory
From 01 Jan 2003 to 31 Dec 2003	Satisfactory	Satisfactory
From 01 Jan 2004 to 28 Sep 2004	Satisfactory	Satisfactory

D. Data on Asian Development Bank Missions

Name of Mission	Date	No. of Persons	No. of Person-Days	Specialization of Members ^a
Appraisal Mission	15–30 Mar 1995	6	90	a, b, c, d, e, f
Inception Mission	15–22 June 1995	1	8	a
Review 1	22–27 Apr 1996	1	6	g
Review 2	11–19 May 1997	1	9	g
Special Review	12–20 Nov 1997	1	9	g
Midterm Review	20 May–6 June 1998	3	40	a, f, h
Review 3	27 Sep–14 Oct 1999	3	36	i, j, f
Review 4	6–26 May 2000	2	21	i, j
Review 5	13–28 Dec 2000	1	16	i
Review 6	13–24 Aug 2001	1	12	i
Review 7	24 Dec 2001–8 Jan 2002	2	18	i, k
Review 8	13–30 Sep 2002	1	16	i
Review 9	16 Apr–7 May 2003	2	27	i, k
Review 10	6–30 July 2004	2	26	i, l
Project Completion Review ^b	22 Sep–7 Oct 2005	1	15	i

^a a – senior agronomist (mission leader), b – engineer, c – economist, d – project specialist, e – young professional, f – staff consultant, g – senior project engineer (mission leader), h – assistant project analyst, i – project implementation officer (mission leader), j – gender and development specialist, k – head of project administration unit, l – assistant disbursement analyst.

^b The project completion report was prepared by Govinda Gewali, project implementation officer, Nepal Resident Mission.



I. PROJECT DESCRIPTION

1. Irrigation development has received high priority in public investment in Nepal in line with its important role in agricultural development by increasing cropping intensity and crop yields and encouraging a shift to more profitable cropping patterns. As about 85% of the country's population lives in rural areas with agriculture as its main source of livelihood, increased income through irrigated agriculture directly contributes to reducing rural poverty. However, most surface irrigation systems in Nepal have been constructed and managed by the Government, and their performance has suffered for lack of proper operation and maintenance (O&M) and of beneficiary participation during design and implementation, such that the systems' performance and contribution to agricultural development has been below expectations. The Eighth Five-Year Plan of fiscal year (FY) 1992 to FY1997 and the Agriculture Perspective Plan (1996) emphasized the need to improve agricultural performance by ensuring proper O&M of the existing Government-managed irrigation systems through beneficiary participation and turning over O&M responsibilities, in whole or in part, to users whose capacity has been developed. The Government asked the Asian Development Bank (ADB) for technical assistance (TA)¹ to prepare the Irrigation Management Transfer Project (the Project). The aim was to improve the performance of selected Government-managed irrigation systems and, by turning over O&M responsibility to capable water user associations (WUAs), increase agriculture production and incomes, generate employment opportunities, reduce the incidence of rural poverty, and lower the Government's O&M budgetary requirements.²

2. ADB approved a loan of SDR8.9 million (\$12.9 million at the time) for the Project on 13 September 1994 and signed the Loan Agreement on 20 March 1995. The loan became effective on 14 June 1995. The United States Agency for International Development (USAID) cofinanced the Project with a TA grant of \$4.6 million.³ The main objective of the Project was to refine and institutionalize the processes and strategies for transferring O&M or ownership of public irrigation schemes to beneficiary farmers and transfer O&M or ownership of 11 public irrigation systems to WUAs (footnote 2). The Project had two components:

- (i) **Establishment of sustainable and effective WUAs.** This included establishing 14 sustainable and effective WUAs in 11 subprojects⁴ (3 subprojects each having two WUAs) to enable farmer beneficiaries to work collectively to operate and maintain the subprojects by mobilizing their own resources and achieve reliable, equitable, and timely water supply and distribution through effective system management.
- (ii) **Rehabilitation and improvement of irrigation and drainage facilities.** This included (a) emergency maintenance and flood damage repair, (b) essential structure maintenance, (c) catch-up maintenance, (d) system improvement, (e) system calibration and the establishment of flow-measuring networks, (f) the

¹ ADB. 1990. *Technical Assistance to the Kingdom of Nepal for the Irrigation Management Transfer Project*. Manila.

² ADB. 1994. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Kingdom of Nepal for the Irrigation Management Transfer Project*. Manila.

³ USAID administered the TA.

⁴ The subprojects included Banganga, Chandra Canal, Chaurjahari, Hardinath, Kamala, Khageri, Manushmara, Mohana, Panchakanya, Patharaiya, and West Gandak located in 10 districts. These subprojects were irrigating 32,500 ha at the time of project design. Although their gross command area was 67,800 ha, the maximum irrigable area was identified at about 50,100 ha because water in the source rivers of most of the systems was insufficient to irrigate more land.

improvement of canal service and farm-to-market roads, and (g) the repair and procurement of equipment and vehicles.

3. The Department of Irrigation (DOI) under the Ministry of Water Resources was the Executing Agency. The deputy director general in charge of DOI's Irrigation Management Division was the project director, who was supported by a full-time project coordinator for the day-to-day implementation of the Project. A subproject manager appointed for each system was responsible for project implementation and monitoring in the field. A subproject management committee chaired by the subproject manager and consisting of executive members of WUAs bore the main responsibility to plan, implement, and monitor subprojects.

II. EVALUATION OF DESIGN AND IMPLEMENTATION

A. Relevance of Design and Formulation

4. The Project's design and formulation were consistent with the Government's strategy as detailed in the Eighth Five-Year Plan (FY1992–FY1997), Ninth Five-Year Plan (FY1998–FY2003), and Agriculture Perspective Plan (1996). These accorded a priority to irrigation development through improving the efficiency of existing irrigation systems jointly with farmer beneficiaries. The Project's objectives were also consistent with the principal strategy of ADB's operations in the country.⁵ The main strength of the project design was its participatory approach to planning, implementing and managing irrigation systems to enhance users' ownership, improve O&M, and increase the amount of irrigation water delivered. However, the total funding available under the Project was way below requirements for financing the rehabilitation of essential big structures and the improvement and expansion of the canal network, which were necessary conditions for assured irrigation and farmer beneficiaries' taking over O&M responsibility. As the rehabilitation of small structures absorbed the major portion of the loan funds allocated for civil works, which was in line with the project design, limited financing was available under the Project for canal service and farm-to-market roads. Rehabilitating all essential structures would have required five times more than the current loan and sufficient counterpart funds from the Government. The project design did not adequately address O&M of the turned-over systems in the event of major damage from floods or landslides, the repair of which is often beyond what users can finance through internal resource mobilization.

5. The project design required 18% of subproject rehabilitation costs to be contributed by users. This was too high for small farmers, particularly in big subprojects with structures requiring heavy investment for rehabilitation. The 18% contribution was also higher than the beneficiary contribution of 15% required by the Irrigation Policy (1997) for irrigation systems rehabilitated through the Government's own resources or those of other development partners. The higher beneficiary contribution was not justified. Water users were confused as to why they had to contribute more than the policy required. This resulted in farmer beneficiaries' reluctance to contribute to subproject rehabilitation, particularly of medium and big structures, or to take over O&M responsibility. Also, lead time was insufficient in the project design for orientating and training users before the commencement of construction works. The project design did not address improved coordination with extension services for irrigated agriculture or markets for agricultural inputs and products. These shortcomings confirm that the project design did not fully address the primary objective of economic growth. As the Project did not exclusively target

⁵ ADB prioritized a participatory approach to sustainable irrigation development, increasing agricultural income, and reducing rural poverty in Nepal.

small and marginal farmers, the design was not fully consistent with the Project's secondary objective of poverty reduction.

B. Project Outputs

6. The project completion review mission (the mission) assessed the Project's immediate objectives against appraisal targets as far as applicable. It was estimated that the Project met about 95% of its implementation targets (Appendix 1) with extension of its closing date by 2 years. Achievements under both components were generally in line with those envisaged at appraisal as summarized below.

1. Establishment of Sustainable and Effective WUAs

7. The Project established 14 WUAs in all 11 subprojects (the Kamala, Hardinath, and Manushmara subprojects each had two WUAs). There were 6,414 executive committee members in the 14 WUAs. All WUA members received project orientation and basic training on social mobilization and organization establishment. With the exception of the Chaurjahari subproject, which was in an insecure area,⁶ the members of all WUAs received management and basic technical training during project implementation. Key areas of training included financial management, bookkeeping, keeping minutes of meetings, gender awareness, conflict resolution, resource mobilization, construction quality control, water distribution and management, and the collection of the irrigation service fee (ISF). WUA members also received training on transparency, accountability, rule of law, equity, participation, predictability, and decentralization—the six key elements of good governance for sustainable O&M of systems. All the WUAs had an office in the irrigation office complex, and users and irrigation officials interacted to resolve subproject issues. Users conducted WUA elections every 3–4 years as required by their constitutions. They were familiar with roles and responsibilities of WUA executive committees to maintain annually audited accounts, increase women's participation in WUAs, and resolve internal water distribution issues. WUAs cleaned branch and tertiary canals and repaired minor damage to canal structures. Rotational water distribution was practiced in most subprojects to provide irrigation to tail end farmers. All the WUAs were members of the National Federation of Water User Associations, which holds policy dialogue with the national Government and serves as a pressure group for the benefit of water users.

2. Rehabilitation and Improvement of Irrigation and Drainage Facilities

8. The Project improved headworks, main and branch canals and associated structures, and some irrigation service roads, as well as providing emergency support for flood damage repair and flood protection. The diversion capacity of the Banganga, Chandra Canal, Khageri, Hardinath, Manushmara, Panchakanya, Patharaiya, and West Gandak subprojects was augmented, and the conveyance capacity of their main and branch canals was increased through system improvement works. Water delivery to various parts of the systems improved through essential structure maintenance, system calibration, and the establishment of flow measuring networks in canal systems. The mission has estimated that, in the rainy season, the actual irrigated area at project completion increased from 32,500 ha before the Project to 45,563 ha (Appendix 2). The increased irrigated area was 9% below the maximum irrigable area of 50,100 ha targeted at project formulation. Out of the total irrigated area, 23,516 ha was

⁶ Chaurjahari subproject is in Rukum District of the Midwestern Development Region. As Rukum is one of the most conflict-affected districts in the country, support could not be effectively delivered to the Chaurjahari subproject from 1999.

irrigated during the winter season and 14,053 ha during spring season. Shortage of funds for rehabilitating major structures, insufficient water in the source rivers of most subprojects, and inadequate user knowledge of on-farm water management were the main reasons for the shortfall. Project outputs by subcomponent are provided below.

a. Emergency Maintenance and Flood Damage Repair

9. Emergency maintenance and flood damage repair on headworks and bank strengthening were carried out in the Kamala and Manushmara subprojects in 1996, following severe damage in the 1993 floods. The headworks and drainage structures of Chandra Canal, Khageri, Hardinath, and Manushmarawere protected. Various damaged sections of the Kamala and Manushmara subprojects were repaired and their water conveyance to head, middle, and tail sections was improved. Farmer groups were involved in maintenance and repair works to emphasize their role in the O&M of the systems. Most of the repaired and maintained structures were performing satisfactorily at the time of the mission. However, emergency repair of flood damage could not be undertaken in other subprojects for lack of funds.

b. Essential Structural Maintenance

10. Essential structures like headworks and cross regulators along the main canals were maintained in Chandra Canal, Kamala, Manushmara, and Panchakanya. Gates to head regulators, branch canals, and direct outlets from the main and branch canals, as well as the clogged siphons of the subprojects, were repaired or replaced, which improved their water-diversion capacity. Essential flow-control structures were maintained, direct outlets were replaced, and the delivery of irrigation water improved in most subprojects. In addition, headworks' guide bunds in Kamala, Hardinath, and Manushmara were reconstructed, riverbank erosion was prevented, and the major river flow in the diversion works was preserved. However, the mission found that most of the gates replaced in various subprojects were damaged and dysfunctional.

c. Catch-up Maintenance

11. Most subprojects suffered from sedimentation in their main and branch canals, with weeds growing and banks crumbling for lack of O&M. Sediment and weeds were cleared from main and branch canals of Banganga, Chandra Canal, Kamala, Hardinath, and West Gandak, using heavy equipment and beneficiary participation. Catch-up maintenance improved irrigation delivery in the middle and tail end of these subprojects. WUAs of nine subprojects cleaned 728 kilometers (km) of branch and tertiary canals during February–July 2005. However, it was found that most WUAs did not routinely undertake catch-up maintenance of branch and tertiary canals before spring, winter, or rainy seasons, which was an effective indigenous practice by which farmer beneficiaries managed irrigation systems before the Project. The mission found the USAID-supported TA consultants providing orientation and training to WUAs on the importance of catch-up maintenance to clean main and branch canals 2 or 3 times every year before the summer, spring, and winter seasons.

d. System Improvement Works

12. Sediment inflow in main and branch canals was controlled by constructing and improving sediment settling structures in Chandra Canal and West Gandak. At the time of the mission, the structure in Chandra Canal was performing satisfactorily and the delivery of water throughout the canal network was improved. However, the structure in West Gandak was only partly

functional, as the inflow of sediment from the source river was much beyond the structure's capacity to control. The water sources of Khageri and Panchakanya were protected through earthen embankment construction, and canals were protected through tree plantation. These works conserved springs and prevented declines in systems' water volume. However, users of these subprojects were concerned about a possible shortage of water from increased human encroachment in their watershed. The capacity of the Banganga Reservoir was doubled, and the flow of water in the main canal was increased. However, users were unable to utilize the increased capacity because the reservoir is used by a bird sanctuary program under the Ministry of Forest and Watershed Management, which requires retaining two-thirds of the water in the reservoir. Selective canal-lining works were undertaken in Banganga, Chandra Canal, Khageri and Panchakanya and seepage loss was reduced in their main, branch, and tertiary canals. Some low drain siphons, inlets, and escape structures were constructed and improved in these subprojects, which prevented water logging. This also improved opportunities for reusing drainage water in the tail portion of Banganga. Flood protection dikes, spurs, and revetments were constructed in Banganga, Chandra Canal, Kamala, and Manushmara to reinforce drainage structures in main and branch canals. Most of the structures were functional at the time the mission. However, the improvement and construction of essential big structures were not carried out for lack of funds.

e. System Calibration and Establishment of Measuring Network

13. Flow control structures were calibrated and gauges were installed in the main and branch canals of Banganga, Chandra Canal, Khageri, and Panchakanya. The Project provided current meters, computers, and related equipment to these subprojects for use in measuring water availability and distribution. However, other subprojects were not calibrated and did not have water-measurement facilities because users lacked awareness of the importance of system calibration and network measurement, and DOI made no serious effort to demonstrate and publicize the importance of establishing the facilities.

f. Improvement of Canal Service and Farm-to-Market Roads

14. The project target was to improve 738 km of canal service roads and 339 km of farm-to-market roads. However, the Project improved only 196 km of canal service roads in Banganga, Chandra Canal, Kamala, Khageri, Hardinath, Panchakanya, and West Gandak. At the time of the mission, the service roads were in good condition, but only 11 km of farm-to-market roads were improved in Panchakanya and West Gandak. The main reasons were the lack of a clearly defined cost category for improving roads and the huge demand for funds for rehabilitating small and medium-sized structures and canal networks prioritized by the Government and users.

g. Repair and Procurement of Equipment and Vehicles

15. The Project repaired and maintained fifteen excavators, two bulldozers, two dump trucks, and two wheel loaders. Fifteen vehicles were repaired, and four excavators, one bulldozer, ten pick-ups, and eleven motorcycles were procured. About 190 items of office equipment and fixtures were also procured. All repaired and new equipment were in operation at the time of the mission.

C. Project Costs

16. At appraisal, the total project cost was estimated at \$18.4 million, of which \$6.6 million was foreign exchange cost and \$11.8 million equivalent local currency cost.⁷ ADB was to provide a loan of \$12.9 million, and the Government and farmers to provide \$5.5 million equivalent. The actual project cost amounted to \$11.57 million⁸ equivalent, of which \$4.16 million was foreign exchange cost, including \$0.27 million for service charges during implementation. Expenditure by component was about \$0.8 million (7%) for establishing sustainable WUAs and \$10.5 (93%) for rehabilitating and improving irrigation and drainage facilities. ADB financed the entire foreign exchange cost of \$4.16 million as well as \$4.3 million equivalent in local currency costs. About 73% of the total project cost was financed by ADB, slightly more than the appraisal target of 70%. The contribution of the Government rose to 18% from the appraisal estimate of 15%, while beneficiary contribution decreased from 18% to 9%, which indicates inadequate beneficiary participation and ownership of subprojects. Actual project costs by category at project completion are in Appendix 3.

D. Disbursements

17. The loan amount at appraisal was SDR8.90 million, of which SDR6.19 million was disbursed. As provided in the Loan Agreement, an imprest account was established with \$0.5 million to ensure timely disbursement and efficient project implementation. The imprest account was fully liquidated by 27 September 2004. The statement of expenditure procedure was also used for the loan. For small individual expenditures, the imprest account and statement of expenditure procedure were very useful and provided significant support for project implementation. The loan account was closed on 28 September 2004. Annual and quarterly loan disbursements are in Appendix 4.

E. Project Schedule

18. The Project was originally envisaged implemented in two phases over about 7 years, from June 1995 to December 2001. The appraisal loan account closing date was 30 June 2002. Project implementation began in July 1995 on a pilot basis for three subprojects, namely Khageri, Panchakanya, and West Gandak. Based on lessons learned in these subprojects and recommendations by the midterm review mission in May–June 1998, the Project was expanded to the remaining eight subprojects (Banganga, Chandra Canal, Chaurjahari, Kamala, Hardinath, Manushmara, Mohana, and Patharaiya,). However, as WUA capacity building took a long time, some subprojects had serious security problems, and the Government asked to use a portion of the loan to rehabilitate ADB-financed irrigation projects completed earlier,⁹ ADB approved

⁷ This does not include the TA cost of \$3.3 million, of which \$3.0 million was provided by a USAID grant and \$0.3 million by the Government of Nepal. USAID later increased the TA grant to \$4.5 million.

⁸ The first partial cancellation of \$2.5 million in April 2001 and the second partial cancellation, at loan closure in September 2004, of \$1.09 million were made possible by loan savings arising mainly from (i) steep devaluation of Nepalese rupee against dollar, (ii) low bids from civil works contractors, and (iii) low subproject cost ceilings established by the midterm review mission.

⁹ Loan 867-NEP (ADB. 1987. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Kingdom of Nepal for the East Rapti Irrigation Project*. Manila) for repair of canal structures and canal lining in 23 farmer-managed irrigation systems; Loan 1113-NEP (ADB. 1991. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Kingdom of Nepal for the Rajapur Irrigation Rehabilitation Project*. Manila) for rehabilitation of river training, spurs, small bridges, office buildings, and pontoon bridge, and procurement of an excavator; and Loan 1437-NEP (ADB. 1996. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Kingdom of Nepal for the Second Irrigation Sector Project*. Manila) for repair of critical canal structures in about 30 farmer-managed irrigation systems.

extending the loan closing date first by 1 year to 30 June 2003, and then by another year to 30 June 2004. The original and actual project implementation schedule is in Appendix 5.

F. Implementation Arrangements

19. The implementation arrangements envisaged at project design were simple, and there were no major changes during implementation. DOI was the Executing Agency with responsibility to plan and coordinate the Project, review progress, and report on overall project implementation. The deputy director general in charge of the Irrigation Management Division of DOI was the project director and was supported by a full-time project coordinator who helped with the day-to-day implementation of the Project. The project coordinator was responsible for project coordination, reporting, and overall monitoring and evaluation. A subproject manager with necessary technical and social development staff planned and implemented project activities jointly with users. Each subproject established a subproject management committee with WUA executive committee officials as members and the subproject manager as chair. Staff of each subproject management office (SMO), WUA officials, and users jointly walked through irrigation system to identify and prioritize the work. The SMO and the WUA prepared a plan of action and signed a memorandum of agreement indicating their roles and responsibilities during and after implementation. WUAs were involved in the planning, design, construction, and O&M of subprojects; joint commissioning by WUA officials and DOI representatives; and finally the turn over to WUAs full or partial responsibility for the O&M of commissioned systems. The implementation arrangements were generally followed, but there was no clear mechanism in the project design for beneficiary farmers' access to agricultural extension and marketing services. Implementation arrangements were thus incomplete, as they did not envision the role of extension services and markets in optimizing beneficiary farmers' income from irrigated agriculture.

G. Conditions and Covenants

20. The loan was declared effective following the fulfillment of the loan effectiveness conditions. Audited project accounts and the auditor's report were prepared in accordance with sound auditing standards and submitted to ADB on time.

21. The Project included 57 major loan covenants to be complied with during the project period. All five covenants linked to financial management were complied with. The two social covenants, the irrigation sector covenant, and the environmental covenant were all complied with. Of the remaining 48 covenants covering other issues, 44 were complied with and four were partly complied with. Details are in Appendix 6. The covenants only partly complied with were the (i) transfer of routine O&M responsibility of four small and medium-sized subprojects to WUAs, (ii) development of procedures for calculating water delivery records and O&M costs, (iii) design and monitoring of a benefit monitoring and evaluation (BME) system, and (iv) strengthening of coordination with agriculture support service agencies. Responsibility for routine O&M of Chaurjahari subproject, one of the four small and medium-sized subprojects, could not be transferred to the WUA for lack of security. There was a general lack of DOI commitment to establishing procedures for calculating water delivery records and O&M costs in most subprojects. The BME system was designed, but its implementation suffered from frequent transfers of staff responsible for data collection and processing. These problems hampered meeting the Project's targets for transferring O&M responsibility to WUAs, recording changes in water delivery and O&M cost requirements arising from project intervention, preparing comprehensive progress reports showing periodic project outputs, and maximizing benefits from irrigation to meet the Project's expected outputs.

H. Related Technical Assistance

22. The USAID-financed TA grant of \$3.0 million, which commenced on 1 June 1996, was an integral part of the Project. TA objective was to strengthen DOI's capacity to implement, manage, supervise, monitor, and evaluate the Project. USAID recruited CADI International, a United States-based consulting firm, which worked with APTEC Nepal, a domestic consulting firm, to provide consulting services. TA provided a team of international and domestic consultants in the field of social mobilization, institutional development, gender and development, system management, water management, and irrigation engineering and quality control. TA financed long and short-term training for twenty DOI staff abroad, master's studies for five, and short-term functional training for fifteen. However, USAID ended its TA in May 2000 as part of the US Government's policy of discontinuing support for agriculture in Nepal. TA inputs ended at a time when project activities were progressing in all eight Phase II projects. When the US Government's policy changed again to remain engaged in agriculture in Nepal, USAID provided a new TA grant of about \$1.6 million from June 2001 to September 2006 and provided TA inputs through CARE Nepal in association with RITI Consultancy as the TA consultants. The new TA provided refresher training to users on financial management, bookkeeping, keeping minutes of meetings, gender awareness, conflict resolution, resource mobilization, construction quality control, water distribution and management, and the collection of the ISF. Emphasis was placed on good governance for sustainable O&M of systems through institutional support to DOI and WUAs and training to users on transparency, accountability, rule of law, equity, participation, predictability, and decentralization. As TA support continued beyond the closure of the associated loan, it helped WUAs to become more stable and build confidence in their O&M of systems. TA provided 40.5 person-months of international consultancy and 610 person-months of local consultancy. It also supported the preparation of manuals and guidelines for training users and the implementation of approaches to irrigation management transfer. That TA was discontinued for about 13 months during the prime of project implementation constrained systematic WUA involvement in Phase II subproject rehabilitation. This resulted in extremely slow progress in project implementation during that period, which is one of the main reasons that the Project suffered poor-quality implementation and required extensions.

I. Consultant Recruitment and Procurement

23. DOI recruited local consulting firms and individual consultants to undertake short-term assignments required for project implementation. The consultants were recruited to (i) carry out surveys and investigations, (ii) prepare detail design and tender documents, (iii) organize and train WUAs, (iv) control the quality of design and construction of civil works, and (v) prepare the Borrower's project completion report. DOI engaged local contractors to undertake civil works for rehabilitating and improving subprojects. DOI procured spare parts for heavy construction equipment, including 15 excavators and two bulldozers. It also procured one bulldozer, two dump trucks, two wheel loaders, four excavators, one low bed trailer, three survey instruments sets, ten auto pick-ups, eleven motorcycles, eleven bicycles, fifteen computer and printer sets, six photocopiers, six fax machines, and other essential office fixtures and research equipment.

24. Local consulting firms and individual consultants were recruited following local competitive bidding and individual consultant recruitment procedures acceptable to ADB. Local contractors were engaged by local competitive bidding procedures acceptable to ADB. Spare parts for heavy equipment and other equipment and vehicles were procured following international shopping procedures according to ADB's guidelines on procurement. Office, training, and survey equipment and bicycles were procured through local payment procedures

as provisioned in the Loan Agreement. The mission observed that the vehicles and equipment were in good condition and generally used for their intended purposes and that they have enhanced DOI's institutional capacity. However, improved and rehabilitated structures were deteriorating for lack of O&M budget from the Government and of WUA capacity to fund O&M through local resource mobilization.

J. Performance of Consultants, Contractors, and Suppliers

25. The performance of the USAID-financed grant TA inputs was rated only partly satisfactory, mainly because they were interrupted for 13 months during the prime of project implementation. The performance of DOI-recruited consulting firms and individual consultants was rated satisfactory. The mission observed poor quality in the civil works in Khageri, Panchakanya, and West Gandak. In Khageri and Panchakanya, there were cracks in boulder wall linings due to side seepage, structures lacked backfill, and sealing materials were not used in joints. In West Gandak, neither the sediment settling basin nor the cross drainage structures functioned properly. The performance of local contractors was therefore rated only partly satisfactory. The poor quality could also be attributed to inadequate attention from DOI to civil works design and construction supervision. The performance of suppliers was rated satisfactory.

K. Performance of the Borrower and the Executing Agency

26. The performance of the Borrower and DOI was rated only partly satisfactory. Although decisions were generally made on time, and adequate counterpart funds were provided, the Project lacked continuity in key project staff in the project coordination office and SMOs. Three project directors (DOI class I officers) and four project coordinators (DOI class II officers) served on the Project. Project monitoring by the project coordination office and other DOI central officials was infrequent but improved during the Project's last 2 years following the appointment of a competent project director. Subproject management staff monitored field programs despite the difficult security situation. At times, DOI was insufficiently committed to involving users in project implementation and monitoring, particularly in keeping expenditures transparent, which resulted in friction between DOI staff and WUAs. In some years, delays were experienced in annual program approval by the National Planning Commission and budget release by the Ministry of Finance. DOI did not help farmer beneficiaries establish links with agricultural extension and marketing services providers partly because of weak project design in terms of coordination and linkages with other stakeholders.

L. Performance of the Asian Development Bank

27. ADB's performance was rated satisfactory. Project supervision was regular with visits to subproject sites. In 1999, the Project suffered slow disbursements following the midterm review mission's recommendation not to reimburse expenditures incurred in rehabilitating the Khageri and Panchakanya subprojects because of the Government's unexpected resettlement of people in their watershed area and the risk of lower subproject water delivery because of reckless use of forests and groundwater. This problem was resolved after project administration was delegated to the Nepal Resident Mission, which allowed closer interaction with DOI and the Ministry of Local Development (which then looked after resettlement issues), more intensive field monitoring, secure planned resettlement, and proper use of groundwater. ADB disbursed the withheld claim in 2001. ADB fielded 12 missions, including appraisal, inception, and midterm review missions. Each mission provided a time-bound action plan that could be readily monitored. ADB was flexible and agreed to adjustments to overcome problems arising from

changing circumstances. ADB agreed to 2 years of extension for the loan closing date to allow components delayed by insurgency and other factors beyond DOL's control to be substantially completed and also to rehabilitate three ADB-supported projects completed earlier, which was expected to improve their efficiency and effectiveness.

III. EVALUATION OF PERFORMANCE

A. Relevance

28. The Project was consistent with the Government's and ADB's development strategies, at the time of approval, of improving irrigation to increase agricultural production and farmers' income and reduce rural poverty. Current Government and ADB development strategies continue to support promoting the active participation of beneficiary farmers in irrigation development to ensure ownership, proper O&M, the sustainability of benefits, the generation of employment opportunities, reduced rural poverty, and a lower Government O&M budgetary requirement. Although institutional and management arrangements were generally well designed, linkages with service providers were not addressed to maximize benefits from irrigated agriculture. Project outputs were generally relevant to achieving goals and purpose, both at the time of approval and now.

B. Effectiveness in Achieving Outcomes

29. The Project was less effective in achieving its outcomes on top of requiring 2 years of extensions to meet its objectives. The Project's indirect benefits included the social and economic empowerment of small and marginal farmers and women through their participation in executive committees of water user groups and WUAs. Appraisal estimated that the Project's key quantifiable benefits would be an increase in irrigated area and agriculture production during the project period. The mission found irrigated area increased by 40% to 45,563 ha, which was less than the appraisal target increase of 54% to 50,100 ha. Achievement was low because poor security prevented the improvement of the Chaurjahari subproject and because big structures could not be rehabilitated in Chandra Canal, Kamala, Mohana, and West Gandak to provide irrigation as targeted, as the huge funding requirement was outside the scope of the Project. The mission found cropping intensity increased by 18%, which was less than the appraisal target of 30%. Average crop yields increased by 18%, within the appraisal expectation of 10%–30%. The high crop yield was recorded because of the increased cultivation of vegetables, particularly potato, in most subproject areas, with average yields of about 15 metric ton (t)/ha. Annual total farm output increased by 31% to 273,854 t, which was slightly less than the appraisal target of a 34% increase to 275,000 t. Significant declines in the water volume of the source rivers of some subprojects during the spring and winter seasons limited the cultivation of diversified crops, and the lack of project support for farmer beneficiaries' access to agricultural extension and marketing services were the main reasons for the shortfalls.

C. Efficiency in Achieving Outcomes and Outputs

30. The Project was found to be less efficient in achieving its outcomes and outputs on the bases of financial and economic analyses following the same methodology used at appraisal (Appendix 7). The financial internal rate of return (FIRR) for the Project as a whole was 13.23%, compared with the appraisal target of 21% (Table A7.12). The main reason for the FIRR being below the appraisal target was that the incremental production of spring and summer crops was below the appraisal target for lack of water in the irrigation systems in these seasons. However, total production and area under winter paddy, summer maize, and between-season vegetables

and potatoes exceeded appraisal targets. The cropping intensity was 185%, compared with the appraisal target of 197%. Cereal crop yields increased by 10%–16%, which is within the appraisal estimate range of 10%–20%. Total farm output had increased to 273,854 t by project completion, which is slightly below the appraisal target of 275,000 t.

31. The overall economic internal rate of return (EIRR), based on cost and benefit streams for the Project, was 15.30%, which was less than the appraisal target of 22% (Table A7.13). The main reasons for the lower EIRR were (i) that the total irrigated area increased by about 14% less than the target, (ii) the cultivated area under wheat and pulses remained low at 17,350 ha and 4,850 ha against the appraisal target of 27,540 ha and 6,355 ha, (iii) higher production costs arising from increases in chemical fertilizer use and labor costs, and (iv) weak performance of some medium and large irrigation systems for lack of proper O&M and beneficiary ownership. Net incremental income from agriculture ranged between 4% and 70%, with most farm families seeing income increase by less than 15%, which was lower than the 20%–30% net increase targeted at appraisal (Table A7.10). However, the Project has potential to increase the EIRR and household income if the Government provides financial support to repair major structural damage and arranges refresher training for WUAs on routine canal O&M and the collection of the ISF. If benefits accrued from flood protection, control of water logging, and women empowerment are accounted, the Project may meet the EIRR target.

D. Preliminary Assessment of Sustainability

32. The Government and water users were less likely to sustain the project outputs, as many of the key sustainability indicators—capacity of WUAs, users' assumption of full or partial responsibility for system O&M, and proper funding of system O&M through the collection of the ISF and other local resource mobilization—were less effective in most subprojects at the time of the mission. Although WUAs were established in all subprojects and provided capacity-development training, the operational status of the WUAs across the subprojects differs significantly. The mission found that WUAs from Chandra Canal, Panchakanya, Patharaiya, and Khageri were operational because these systems were delivering irrigation water and were being maintained through the collection of the ISF and other local resource mobilization. The WUAs in Banganga, Hardinath, Kamala, Manushmara, and West Gandak were not fully functional because the systems were delivering irrigation only during the rainy season, with limited irrigation in the spring and winter seasons mainly for lack of proper O&M and Government and user ineffectiveness in promoting on-farm water management practices during the two seasons.

33. The WUA in Mohana almost ceased functioning after floods in 2002 washed out the headworks and main canal, and new structures could not be constructed for lack of about \$4 million in additional funds. The WUA in Chaurjahari was not functioning at the time of the mission because poor security prevented the Project from providing effective support. Except in Panchakanya, the collection of the ISF was much lower than required for O&M. On average, only about 30% of the irrigation users paid the ISF in 2004, and the ISF rate was far too low, at NRs60/ha, to cover the minimum O&M cost. Although most WUAs set up their offices, conducted elections for of executing committee members, and undertook audits in public meetings, they may have difficulty funding operations with the end of the USAID-supported TA, which has been providing their institutional support. Although the Irrigation Policy requires Government finance for repairing damage to canal structures beyond the financial capacity of users, the Government contribution has not been assured for lack of funds. Bigger subprojects suffer water shortages as the O&M of their intakes, headworks, and main canals is the

responsibility of the Government. Evidence is limited of the Government's replicating the irrigation management transfer approach effectively in newly rehabilitated subprojects.

34. The mission found the WUAs in Hardinath, Khageri, and Kamala, and West Gandak unsatisfied with rehabilitation works, as they were not in compliance with plans of action or memoranda of agreement. There were complaints that SMOs were not transparent with WUAs regarding project expenditures, which damaged users' ownership of the subprojects and made them reluctant to assume O&M responsibilities as agreed in the memoranda of agreement. In particular, WUAs in Kamala further added that if agreed structures had been rehabilitated by the Project, they would have taken over system O&M responsibility. The Government should provide necessary financial support to these subprojects along with refresher training for all 14 WUAs on subproject O&M, on-farm water management, and cultivation methods.

E. Impacts

35. As the Project rehabilitated and improved existing irrigation systems, it had no negative impact on the environment. The key construction activities undertaken under the Project aimed to strengthen intakes and headworks, prevent canal bank erosion and downstream bank damage from floods, improve drainage systems, and line canals. These helped avoid water logging, control soil erosion and flooding, and improve drainage systems and the overall efficiency of irrigation systems, contributing to an improved environment in the subproject areas. There were no complaints from farmers regarding reduced downstream river flows. The use of chemical fertilizers and pesticides in the subproject areas was much lower than recommended ceilings and is unlikely to damage aquatic ecosystems and wildlife. The mission did not note any adverse environmental impacts from the Project.

36. The Project's social impacts were encouraging. It promoted the role of women in irrigation development and management. Out of 6,414 members of 14 WUAs in 10 subprojects, 20% were women and 8% were low cast Dalits. The executive committees of user groups and WUAs were about 9% female and 3% Dalit. About 20% of the training participants were women. These activities helped women to play active roles in planning, implementing, and managing irrigation systems, which improved their confidence in local resource mobilization and strengthened their social status.

IV. OVERALL ASSESSMENT AND RECOMMENDATIONS

A. Overall Assessment

37. The Project was rated only partly successful in its relevance, effectiveness, efficiency, and sustainability. Appendix 8 provides a quantitative assessment of project performance using ADB criteria to determine the Project's rating. The Project was designed and implemented virtually in isolation from agricultural extension and market service providers, which limited the benefits to farmers of irrigated agriculture and the sustainability of project impacts. The project framework was deficient in terms of its goal as it did not refer to the Project's primary classification of economic growth and secondary classification of poverty reduction. Despite the extension of the closing date by 2 years, the Project managed to turn over to WUAs the O&M of only 91% of the target area of 50,100 ha. However, the Project impact was visible in terms of increasing production, improving the productivity and income of farm households, socially empowering poor households and women, and preserving the environment. The capacity of DOI to implement a participatory irrigation development program improved, though evidence is limited of the Government's replicating this approach effectively countrywide in other projects.

B. Lessons

38. Establishing and strengthening WUAs and planning and rehabilitating systems with the active participation of users instills beneficiary ownership of subprojects. However, before users take over responsibility for O&M, systems should be functional and able to deliver irrigation water to farmers fields with key structures rehabilitated and the canal network intact. This would also ensure the collection of the ISF and the undertaking of routine O&M through local resource mobilization.

39. In larger irrigation systems, WUAs at different tiers (main, secondary, tertiary canal) with clearly defined roles and functions could secure more effective beneficiary participation and system ownership. Efforts could be made to turn over secondary and tertiary canals in the larger systems.

40. The formation and basic capacity building of user groups and associations require sufficient lead-time before planning and rehabilitation are started. User capacity needs to be further developed by involving users in project implementation with clearly defined roles and skills-development training to ensure that they possess the necessary capacity to manage the system after completion.

41. Small and medium systems with independent intakes or headworks have considerable potential for rehabilitating structures and reestablishing canal networks in collaboration with users and for transferring management responsibility to WUAs. Lack of DOI capacity to mobilize huge numbers of users constrains users' intensive involvement in planning and implementation, which limits their interest in contributing to effective system O&M.

42. At times, the quality of project design and implementation suffered as (i) some design was inappropriate, (ii) proper mechanisms for quality control were lacking, and (ii) construction supervision by senior, experienced technicians was lacking. These shortcomings can be avoided by obtaining independent consultant services to supervise and maintain quality control of design and construction works and by effectively involving users in monitoring subproject implementation at different stages.

43. Experience has shown that WUAs should be established first at the lowest control unit, the tertiary canal, and then established moving upward to branch and main canals. This makes each user familiar with the potential and constraints of the system and the WUAs representative and effective.

C. Recommendations

1. Project Related

44. Farmers have been using irrigation water virtually free of charge for centuries. This is the first project under which the Government has piloted ISF collection for replication countrywide. Only about 30% of the ISF target was collected in 2004, against the country average of 2% of ISF collected in agency-managed irrigation systems. Full ISF collection requires first improving infrastructure and canal networks and delivering irrigation water to the full potential of systems. WUAs need water distribution and financial management training from the Government to optimize the collection of the ISF.

45. Given the high volume of water in source rivers during the rainy season, some structural damage from floods is to be expected, and repair becomes essential in each subproject after every rainy season. This is different from routine O&M. To optimize benefits from the rehabilitated subprojects, the Government should allocate a budget to cover such costs, which is in line with the Government's Irrigation Policy. WUAs should receive refresher training on water distribution, on-farm water management, financial management, and methods for efficient ISF collection.

46. Medium-size and less-complicated subprojects such as Hardinath and Patharaiya should have been turned over to WUAs for routine O&M with backstopping support from DOI in case of major damage to canal structures and follow-up institutional support to WUAs.

47. The Project lacked coordination among users and staff of the SMOs in most subprojects. The lack of transparency in project expenditure or clearly defined roles and responsibilities of WUAs in subprojects implementation, monitoring, and O&M were the main reasons. For timely completion of subproject rehabilitation, transparency in expenditure to all stakeholders should be mandatory, and WUAs should clearly understand in advance their roles during implementation and thereafter.

48. WUA members' terms of office are 3–4 years, and many new members join the executive committee, making it difficult to retain the acquired knowledge of the outgoing members. WUA constitutional provision for the election of two-thirds of the members and the retaining of one-third of the members can address this problem.

49. To ensure sustainable O&M, the DOI should monitor and report to ADB (i) changes in irrigated area, cropping intensity, and production; (ii) estimated annual O&M requirements and allocation and the ISF collection target and achievement; (iii) the functional status of WUAs and institutional support provided; and (iv) DOI's contribution to sustaining the systems. These could be made conditions for future support to the Government for irrigation management transfer. Compliance with these conditions should be monitored by ADB during review missions for the ongoing Community Groundwater Irrigation Sector Project and the Community Managed Irrigated Agriculture Sector Project.¹⁰

50. As the Project was extended by 2 years, its implementation ended in June 2004. As project benefits are expected to be realized until 5 years following completion, it is suggested that the project performance evaluation report be prepared in 2009.

2. General

51. There should be at least 1 year lead-time available for forming, strengthening, and building the capacity of user groups before construction starts. This period should be used to clarify the users' role during implementation and regarding O&M. This will facilitate joint planning and implementation and assure the quality and completeness of design and implementation.

52. Project staff should be assigned only after they receive training on such principles and approaches for successful irrigation management transfer as (i) working with users, (ii) transparency in expenditure, (iii) joint implementation and monitoring, and (iv) joint

¹⁰ ADB. 1998. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Kingdom of Nepal for the Community Groundwater Irrigation Sector Project*. Manila. ADB. 2004. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Kingdom of Nepal for the Community Managed Irrigated Agriculture Sector Project*. Manila.

commissioning after construction works are completed. This will help smooth the transfer of subprojects to users for O&M.

53. Every subproject should prepare annual technical and financial progress reports that should be available for succeeding staff when there are transfers. Documentation of progress and lessons will improve design strategies and approaches for replication in other projects and for incorporation into national policy.

54. Irrigation management transfer succeeded in small and medium-sized subprojects, while big subprojects experienced difficulties due to the requirement for huge investment in rehabilitating essential structures and DOI's lack of capacity in beneficiary mobilization. The Government should give priority to rehabilitating and transferring small and medium-sized systems to users whose capacity has been developed, which will reduce stress on the Government exchequer from the ever-increasing O&M budget requirement.

55. Project design should be conflict sensitive and follow flexible implementation modalities. Experience has shown that small contract packages involving local contractors and community groups have minimal conflict risks. There should be provision for public auditing of project expenditure and work quality.

56. Irrigation projects should be designed with strong components to support irrigated agriculture and promote access to input and output marketing. There should be provision to deliver services not only through government organizations but also through other service providers like nongovernment organizations and the private sector.

57. As most source rivers are short of water during the spring and winter seasons, irrigation projects should have strong on-farm water management component to optimize benefits from available water.

PROJECT FRAMEWORK

Design Summary	Performance Indicators/Targets	Achievements	Remarks
Goal			
1. Increase agricultural production	1.1 Irrigated area to increase from 32,500 ha to 50,100 ha by 2001. 1.2 Cropping intensity to increase from 167% to 197% by 2001. 1.3 Crop yields to increase by 10–20% at full development. 1.4 Farm output to increase from 205,000 t to 275,000 t at full development.	1.1 Irrigated area expanded from 32,500 ha to 45,563 ha at project completion. 1.2 Cropping intensity increased to 185%. 1.3 Cereal crops increased by 10–16% and cash crops increased by 42%. 1.4 Farm output increased to 273,854 t by project completion.	
2. Improve farm income	2.1 Net income per family to increase by 20–38% at full development. 2.2 The economic internal rate of return of the Project will be 22%.	2.1 Net income per family increased by 4–70%, averaging 15%. 2.2 The economic internal rate of return of the Project was 15% at project completion review mission (the mission).	
3. Generate employment opportunities in rural areas	3.1 At full development, 7,000 person-years of direct employment generated during implementation and 15,000 person-years generated by agricultural development	3.1 At mission, an estimated 5,400 person-years of direct employment generated during implementation and 10,500 person-years during agricultural development	
Purpose			
1. Refine and institutionalize a process and strategy for transferring O&M responsibility of public irrigation schemes to farmers	1.1 Processes and strategies for transferring O&M responsibility to WUAs tested and developed by DOI by 1997. 1.2 Proven processes and strategies incorporated in DOI's administrative guidelines and instructions to staff by 1997. 1.3 At least one subproject has been turned over to farmers completely or partially by 1997. 1.4 All the required staff will be engaged and trained by DOI. 1.5 At least 70% of all households in each Phase I subproject are WUA members by 1997. 1.6 At least 50% of the	1.1 Process and strategy (action plan, MOA, and handover) tested and modified by DOI by 1998. 1.2 Process and strategies incorporated in DOI guidelines (action plan, MOA, handover documents, and post turnover guidelines) 1.3 Panchakanya and West Gandak completely turned over to WUA by 1997 1.4 Necessary staff were engaged but not all of them were trained. 1.5 About 75% of all households in Phase I subprojects were WUA members by 1998. 1.6 About 60% of the	WUA of West Gandak was willing to return O&M responsibility of headworks and main canal to DOI because of its big size and complex structures.

Design Summary	Performance Indicators/Targets	Achievements	Remarks
2. Transfer the management and ownership of public irrigation schemes to farmer beneficiaries, in part or full, in accordance with their capacity to mobilize local resources.	<p>registered members of WUA in the Phase I subprojects to pay the ISF by 1997.</p> <p>2.1 Four irrigation schemes to be turned over completely to WUAs and seven schemes jointly managed by DOI and WUAs by 2001.</p>	<p>registered members of WUA in Phase I subprojects had paid ISF by 1998.</p> <p>2.1 Panchakanya and West Gandak were completely turned over to WUAs. With the exception of Chaurjahari, the remaining eight subprojects have been jointly managed by DOI and WUAs.</p>	Management of other subprojects could not be fully turned over to WUAs because the Project could not rehabilitate structures that were necessary to secure irrigation water delivery.
<p>Outputs</p> <p>1. A WUA in each subproject established, strengthened, and made functional</p> <p>2. Physical infrastructure of irrigation schemes rehabilitated and improved</p> <ul style="list-style-type: none"> - Essential flow-control structures and flood-damaged areas repaired or improved - Canal network improved - System operation of subprojects improved - System calibration completed - O&M plans formulated - Civil works 	<p>1.1 14 WUAs to be established and registered by 1997.</p> <p>1.2 WUAs to conduct regular meetings to discuss O&M and other matters by 1997.</p> <p>1.3 WUAs to keep records, manage finances, and mobilize resources by 1997.</p> <p>1.4 WUAs to collect ISF and other contributions from their members by 1999</p> <p>1.5 WUAs to maintain water flow records in the project area by 1999</p> <p>1.6 WUAs to prepare an O&M plan and improve water delivery performance by 2001.</p> <p>2.1 Written action plans and MOAs between DOI and 14 WUAs to be executed by 1997.</p> <p>2.2 Six headworks, 215 km of main canals, 560 km of branch or secondary canals, and 163 outlets to be repaired by 2001.</p> <p>2.3 209 km of existing main drains to be improved by 2001.</p>	<p>1.1 14 WUAs have been established and registered.</p> <p>1.2 Monthly meetings and other necessary meetings conducted by WUAs.</p> <p>1.3 All WUAs visited by the mission were keeping records of finances and ISF and minutes registers.</p> <p>1.4 All WUAs were collecting ISF with varying success; average ISF collection in 2004 was 30% of the target.</p> <p>1.5 WUAs of four subprojects were found maintaining water flow records.</p> <p>1.6 Only three subprojects have prepared O&M and water delivery plans for winter season.</p> <p>2.1 Written action plans and MOA executed with 13 WUAs (excepting Chaurjahari)</p> <p>2.2 Headworks of Chandra Canal, Hardinath, Kamala, Khageri, Panchakanya, and Patharaiya subprojects repaired. 194 km of main canals, 266 km of branch canals and 120 outlets also repaired</p> <p>2.3 Only limited main drains were repaired for lack of WUA contribution.</p>	<p>The status of the Chaurjahari WUA could not be ascertained for lack of reporting and communication with DOI.</p> <p>Necessary equipment and facilities were not installed in other subprojects.</p>

Design Summary	Performance Indicators/Targets	Achievements	Remarks
commissioned - Existing equipment and vehicles repaired and new ones procured - Canal service and farm-to-market roads rehabilitated and expanded	2.4 Sediment and weeds in main canals and major branches to be removed by 2001.	2.4 Sediment and weeds in main and branch canals cleaned in five subprojects covering 728 km.	Mohana and Kamala could not deliver water to the tail for lack of water in source rivers or proper structures.
	2.5 Supply and abstraction of water to be improved by 2001.	2.5 Water supply and abstraction were improved in nine subprojects.	
	2.6 About 2,857 km of tertiary canal network to be rehabilitated and improved by 2001.	2.6 About 160 km of tertiary canals were improved in Banganga and Kamala.	
	2.7 20 km of main canal in Chaurjahari subproject will be protected from soil erosion and landslides.	2.7 Only 50% of the targeted physical works could be completed due to conflict.	
	2.8 Rotational system of water distribution to be established and implemented by 2001.	2.8 Rotational water distribution system is practiced in main and branch canals during spring and winter.	
	2.9 Water users at head, middle, and tail sections to be satisfied with water delivery, adequacy, and reliability by 2001.	2.9 Except in Kamala and Mohana, water users at head, middle, and tail receive irrigation water.	
	2.10 Flow-measuring devices to be established in 11 subprojects in 2001.	2.10 Flow measuring in terms of water level gauges established only in five subprojects.	
	2.11 36 units of existing construction equipment and 24 existing vehicles to be repaired by 1997.	2.11 17 units of existing construction equipment and 10 existing vehicles were repaired by 2000.	
	2.12 72 new items of equipment, 15 new vehicles, and 11 new motorcycles to be procured by 1997.	2.12 187 new items of office and technical equipment, five new heavy construction units, 10 new vehicles, 11 motorcycles, and one low bed trailer procured by 2004.	
	2.13 738 km of canal service roads to be graded and 310 km graveled by 2001.	2.13 196 km of canal service road graded and graveled in 7 subprojects by 2004.	
	2.14 339 km of farm-to-market roads to be improved and expanded by 2001.	2.14 11 km of farm-to-market roads improved in two subprojects by 2004.	
	3.1 11 subproject implementation offices to be established, staffed, and equipped by 1995.	3.1 11 subproject implementing offices were established, staffed, and equipped by 2000.	
3. Capacity of DOI strengthened - existing equipment and vehicles repaired and new ones			

Design Summary	Performance Indicators/Targets	Achievements	Remarks
2.1 Repair of essential flood control structures and flood damage areas	<ul style="list-style-type: none"> - Survey and detail design - Preconstruction activities - Civil works 	2.1 Flood damage repairs were carried out Chandra Canal, Hardinath, Khageri, Manushmara, and Mohana subprojects.	The field office in Chaurjahari could not be continued due to insecurity and staff were stationed in the regional office in Surkhet.
2.2 Improvement of canal network in the command area	<ul style="list-style-type: none"> - Improvement of water supply and abstraction - Removal of sediment and weeds in irrigation canals - Improvement of tertiary canal network 	2.2 Water supply and abstraction, sediment and weed removal, and improvement of tertiary canals were undertaken in Banganga, Chandra Canal, Hardinath, Kamala, Khageri, Manushmara, Panchakanya, and West Gandak subprojects.	
2.3 Operation of irrigation schemes improved	<ul style="list-style-type: none"> - Establishment of flow measuring network - O&M plans prepared, periodically reviewed, and finalized - Civil works commissioned 	2.3 Flow-measuring gauges established in Banganga, Chandra Canal, Kamala Khageri, and Panchakanya subprojects, but no O&M plan was found prepared, reviewed, or finalized by any subproject. Completed civil works were commissioned Khageri and Panchakanya subproject only.	
2.4 Equipment and vehicles repaired and procured	<ul style="list-style-type: none"> - 36 units of existing construction equipment and 24 vehicles to be repaired - 72 new items of equipment and 15 new vehicles to be procured 	2.4 17 existing units of construction equipment and 11 vehicles were repaired. 192 new items of equipment and 10 new vehicles were procured.	
2.5 Improvement of canal service and farm-to-market roads	<ul style="list-style-type: none"> - Survey and detailed design - Right of way acquired - Preconstruction activities such as tendering - civil works 	2.5 196 km of canal service roads and 11 km of farm-to-market roads were improved	
3. Capacity of DOI strengthened	<p>3.1 Field offices established, staffed, and equipped</p> <ul style="list-style-type: none"> - newly assigned staff reoriented and trained <p>3.2 Consultant services</p> <ul style="list-style-type: none"> - consultants shortlisted and proposals evaluated and engaged <p>3.3 BME system strengthened</p> <ul style="list-style-type: none"> - DOI staff assigned and 	<p>3.1 DOI established field offices and staffed and equipped them</p> <ul style="list-style-type: none"> - most new staff reoriented and trained <p>3.2 Consultants engaged jointly by USAID in consultation with DOI and ADB</p> <p>3.2 DOI assigned and trained necessary</p>	

Design Summary	Performance Indicators/Targets	Achievements	Remarks
Inputs 5.1 Finance 5.2 Consulting Services	trained - WUA officers trained on data collection - baseline surveys conducted - midterm and project completion surveys conducted 3.4 Other subprojects identified, prepared, and included in the turnover and joint management program	project staff - DOI and consultants trained WUA officials on data collection - data collected for midterm and project completion surveys 3.4 After the midterm review, another eight subprojects identified for turnover and joint management	
	Source of financing: ADB \$12.9 million, Government and beneficiary farmers \$5.5 million, technical assistance \$3.0 million	Actual project cost at completion: ADB \$8.73 million, Government and beneficiary farmers \$3.24 million, technical assistance \$4.6 million	
	International 56 person-months Domestic 410 person-months	International 40.5 person-months Domestic 610 person-months	

BME = benefit monitoring and evaluation, DOI = Department of Irrigation, ha = hectare, ISF = irrigation service fee, km = kilometer, MOA = memorandum of agreement, O&M = operation and maintenance, t = metric ton, USAID = United States Agency for International Development, WUA = water user association.

Sources: ADB. 1994. *Report and Recommendations of the President to the Board of Directors on a Proposed Loan to the Government of Nepal for the Irrigation Management Transfer Project*, Manila; DOI. 2004. *Borrower's Project Completion Report for the Irrigation Management Transfer Project*, Kathmandu; Project Completion Review Mission, September–October 2005.

IRRIGATED AREA BEFORE AND AFTER THE PROJECT
(hectare)

Subprojects	Gross Command Area	Actual Irrigated Area at Project Formulation	Maximum Irrigable Area after Project Formulation	Actual Irrigated Area at Project Completion by Season		
				Rainy	Spring	Winter
Banganga	6,100	4,500	5,200	5,100	3,060	2,040
Chandra Canal	8,700	4,200	6,800	6,400	3,300	1,980
Chaurjahari	600	400	600	300	210	150
Hardinath	2,000	900	1,200	1,250	750	500
Kamala	25,000	6,500	13,000	10,513	4,205	2,103
Khageri	3,900	2,100	3,500	3,500	2,450	1,400
Manushmara	5,200	4,300	6,900	6,700	3,350	2,010
Mohana	3,500	1,900	2,300	1,800	900	540
Panchakanya	600	400	500	600	480	360
Patharaiya	2,100	1,300	1,800	2,100	1,260	840
West Gandak	10,100	6,000	8,300	7,100	3,550	2,130
Total	67,800	32,500	50,100	45,363	23,515	14,053

Sources: Department of Irrigation. 2004. *Borrower's Project Completion Report for the Irrigation Management Transfer Project*. Kathmandu; Project Completion Review Mission, September–October 2006.

ACTUAL PROJECT COSTS
(\\$)

Category	Item	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
01A	Civil Works (Emergency Flood Damage Repairs)										
	Government	12.40	48.34	0.00	0.00	0.00	11.94	6.35	125.31	38.05	134.22
	ADB	17.85	69.56	0.00	0.00	0.00	17.18	9.14	180.32	54.75	193.15
01B	Civil Works (Rehabilitation and Upgrading)										
	Government	106.83	51.90	133.77	18.00	0.00	146.75	328.59	190.09	3.18	407.97
	ADB	427.30	207.58	535.08	72.00	0.00	586.98	1314.36	760.35	12.72	1631.88
02	Equipment and Vehicles										
	Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ADB	0.66	155.47	143.88	248.75	13.41	229.29	23.73	0.90	141.82	17.84
03	Survey Study and Detailed Designs										
	Government	4.80	2.24	11.35	6.07	0.00	15.51	7.12	0.60	0.00	2.29
	ADB	29.47	13.90	69.69	37.32	0.00	95.28	43.75	3.70	0.00	14.07
04	Training and Incremental Administration Cost										
	Government	6.18	10.31	16.84	21.44	0.13	36.35	34.62	39.77	15.45	22.24
	ADB	24.72	41.24	67.37	85.74	0.51	145.39	138.48	159.10	61.80	88.96
06	Service Charge										
	Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ADB	0.00	5.08	10.14	17.94	23.13	27.16	35.76	50.79	64.76	33.47
	Total	630.20	605.62	988.12	507.25	37.17	1311.82	1941.91	1510.93	392.54	2546.08

Source: Loan Financial Information System, Asian Development Bank.

ANNUAL AND QUARTERLY LOAN DISBURSEMENT

Table A4.1: Annual Loan Disbursement

(\$)

Category	Description	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
01A	Emergency Flood Damage Repairs	17,845	69,564	0	0	0	17,180	9,142	180,319	54,753	193,145
01B	Rehabilitation and Upgrading of Irrigation Facilities	427,303	207,580	535,082	71,996	0	586,982	1,314,357	760,346	12,724	1,631,875
02	Equipment and Vehicles	661	155,466	143,878	248,745	13,405	229,289	23,732	903	141,823	17,838
03	Survey, Studies, and Detailed Design	29,474	13,898	69,694	37,316	0	95,276	43,751	3,704	0	14,072
04	Training and Incremental Administrative Cost	24,717	41,242	67,371	85,742	505	145,390	138,477	159,096	61,795	88,962
06	Service Charge	0	5,081	10,139	17,929	23,134	27,162	35,763	50,789	64,763	33,465
Total		500,000	492,831	826,164	461,728	37,044	1,101,279	1,565,222	1,155,157	335,858	1,979,357

Source: Loan Financial Information System, Asian Development Bank.

Table A4.2: Quarterly Loan Disbursement
(\$ million)


































































































































Year	Quarter	Contract Awards		Disbursements	
		Projected	Actual	Projected	Actual
1995	III	0.000	0.000	0.235	0.000
	IV	0.125	0.000	0.235	0.500
	Subtotal	0.125	0.000	0.470	0.500
1996	I	0.125	0.000	0.060	0.000
	II	0.200	0.047	0.250	0.003
	III	0.125	0.304	0.140	0.219
	IV	0.300	0.170	0.250	0.271
	Subtotal	0.750	0.521	0.700	0.493
1997	I	0.300	0.036	0.280	0.052
	II	0.150	0.226	0.140	0.244
	III	0.200	0.365	0.150	0.142
	IV	0.150	0.269	0.140	0.388
	Subtotal	0.800	0.896	0.710	0.826
1998	I	0.250	0.014	0.140	0.104
	II	0.310	0.152	0.250	0.048
	III	0.220	0.158	0.370	0.125
	IV	0.220	0.021	0.170	0.185
	Subtotal	1.000	0.345	0.930	0.462
1999	I	0.080	0.001	0.010	0.001
	II	0.650	0.000	0.060	0.011
	III	0.070	0.000	0.400	0.013
	IV	0.020	0.262	0.350	0.012
	Subtotal	0.820	0.263	0.820	0.037
2000	I	0.400	0.166	0.100	0.262
	II	2.000	0.904	0.400	0.100
	III	1.500	1.669	1.200	0.114
	IV	1.700	0.006	0.900	0.625
	Subtotal	5.600	2.745	2.600	1.101
2001	I	0.033	0.000	0.110	0.000
	II	0.161	0.366	0.370	0.345
	III	0.194	0.156	0.310	0.877
	IV	0.027	0.000	0.710	0.343
	Subtotal	0.415	0.522	1.500	1.565
2002	I	0.200	0.385	0.400	0.165
	II	0.550	0.000	0.500	0.133
	III	0.000	0.000	0.100	0.500
	IV	0.000	0.000	0.100	0.357
	Subtotal	0.750	0.385	1.100	1.155
2003	I	0.100	0.000	0.000	0.000
	II	0.100	0.248	0.000	0.031
	III	0.000	0.000	0.000	0.000
	IV	0.000	0.000	0.000	0.305
	Subtotal	0.200	0.248	0.000	0.336

Year	Quarter	Contract Awards		Disbursements	
		Projected	Actual	Projected	Actual
2004	I	1.240	1.509	0.000	0.000
	II	0.730	0.546	0.675	0.033
	III	0.000	0.209	0.970	1.946
	IV	0.000	0.000	0.000	0.000
	Subtotal	1.970	2.264	1.645	1.979
Total		12.430	8.189	10.475	8.454

Source: Loan Financial Information System, Asian Development Bank.

ORIGINAL AND ACTUAL PROJECT IMPLEMENTATION SCHEDULE

Activity/Fiscal Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
I. Phase1										
A. Preparatory works in all subprojects										
1. Establish PIU; assign, train, and orient staff	■	■	■	■						
2. Recruit and deploy consultants	■	■	■	■						
3. Establish and strengthen WUAs	■	■	■	■	■	■	■	■	■	■
4. Establish subproject management committees	■	■	■	■	■					
5. Develop action plans	■	■	■	■	■			■		
6. MOAs prepared and signed by DOI and WUAs	■	■	■	■	■	■				
7. Undertake flood damage repair, emergency maintenance works, and other essential minor works	■	■	■	■		■	■			
8. Prepare detail design and tender documents	■	■	■	■	■	■				
9. Procurement and repair of equipment and vehicles	■	■	■	■	■	■	■	■	■	■
B. In the Khageri, Panchakanya, and West Gandak Subprojects										
1. Test and refine processes and strategies for O&M transfer	■	■	■	■	■					
2. DOI to adopt proven processes and strategies			■	■	■					
3. Implement agreed improvement works	■	■	■	■	■	■				
4. Prepare system calibration and O&M			■	■	■	■				
5. Train WUA officials and members on O&M	■	■	■	■	■	■				
6. Commission system improvement			■	■	■	■				
7. Turnover the subprojects completely or partly to farmers			■	■	■	■				

Activity/Fiscal Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
II. Phase II Subprojects										
1. Continue deployment of consultants				                      						
2. Implement agreed improvement works				                      						
3. Prepare system calibration and O&M plans				                      						
4. Train WUA officials and members on O&M				                      						
5. Commission system improvement							            			
6. Turnover systems in part or whole to farmers							            	      	   	
III. Review mission (RM), midterm review mission (MRM) and project completion review (PCR)		?	?	?	?	?	?	?	?	?
		RM	RM	MTR	RM	RM	RM	RM	RM	PCR

DOI = Department of Irrigation, MOA = memorandum of agreement, O&M = operation and maintenance, PIU = project implementation unit, WUA = water user association.

Sources: ADB. 1994. *Report and Recommendations of the President to the Board of Directors on a Proposed Loan to the Kingdom of Nepal for the Irrigation Management Transfer Project*. Manila; Project Completion Review Mission, September–October 2005.

 Planned

 Actual

STATUS OF COMPLIANCE WITH LOAN COVENANTS

Serial No.	Covenant	Reference in Loan Agreement	Status of Compliance
1.	The Borrower shall utilize the loan proceeds for financing project activities in accordance with the provisions in the Loan Agreement.	Section 3.01	Complied with.
2.	All goods and services to be financed out of the loan proceeds shall be procured in accordance with the provision in the Loan Agreement.	Section 3.03	Complied with.
3.	The Borrower shall use the loan proceeds exclusively for carrying out the Project.	Section 3.04	Complied with.
4.	The Borrower shall procure goods produced in and supplied by ADB's member countries.	Section 3.05 (a)	Complied with.
5.	The Borrower shall carry out the Project with due diligence, efficiency, and sound administrative, financial, engineering, agriculture, irrigation, drainage, and environmental practices.	Section 4.01	Complied with.
6.	The Borrower shall promptly make available required funds, facilities, services, land, and other resources to carry out the Project and for operation and maintenance (O&M) of Project facilities.	Section 4.02	Complied with.
7.	The Borrower shall use competent and qualified consultants and contractors acceptable to and upon terms and conditions satisfactory to the Borrower and ADB.	Section 4.03 (a)	Complied with.
8.	The Borrower shall carry out the Project in accordance with plans, design standards, specifications, work schedules, and construction methods acceptable to the Borrower and ADB.	Section 4.03 (b)	Complied with.
9.	The Borrower and its departments and agencies shall carry the Project and operate the Project facilities in accordance with sound administrative policies and procedures.	Section 4.04	Complied with.
10.	The Borrower shall insure the Project facilities against risks and amounts consistent with sound practices.	Section 4.05	Complied with.
11.	The Borrower shall maintain records and accounts adequate to identify the goods and services and other items of expenditure financed out of the loan proceeds.	Section 4.06 (a)	Complied with.

Serial No.	Covenant	Reference in Loan Agreement	Status of Compliance
12.	The Borrower shall submit to ADB audited project accounts and financial statements and the report of the auditors not later than 12 months after the end of each related fiscal year.	Section 4.06, b	Complied with.
13.	The Borrower shall furnish ADB all project-related reports and information.	Section 4.07 (a)	Complied with.
14.	Promptly after completion of the Project, the Borrower shall submit to ADB a report on initial operation of the Project, including its cost, compliance with the Borrower's obligations in line with the Loan Agreement.	Section 4.07 (c)	Complied with.
15.	The Borrower shall enable ADB representatives to inspect the Project, goods, relevant records, and documents financed out of the loan proceeds.	Section 4.08	Complied with.
16.	The Borrower shall ensure that Project facilities are operated, maintained, and repaired in accordance with sound administrative, financial, engineering, agricultural, irrigation, drainage, environmental, and O&M practices.	Section 4.09	Complied with.
17.	No other external debt owed a creditor other than the ADB shall have any priority over the Loan by way of a lien on the assets of the Borrower.	Section 4.10	Complied with.
18.	Department of Irrigation (DOI) shall be the Project Executing Agency responsible for the overall supervision, control, and executing of the Project	Schedule 6, para. 1	Complied with.
19.	Within the DOI, the Irrigation Management Division (IMD) shall be directly responsible for the planning, supervision, coordination, monitoring, and evaluation of Project activities.	Schedule 6, para. 2	Complied with.
20.	The Deputy Director General in charge of IMD shall be Project Director with responsibility for overall management and supervision of the Project. Within three months of loan effectiveness, DOI shall designate a suitably qualified and experienced Project Coordinator, who shall work on a full-time basis.	Schedule 6, para. 3	Complied with.
21.	Within three months of the effectiveness, DOI shall establish a Project Implementation Unit headed by the Project Coordinator.	Schedule 6, para. 4	Complied with.

Serial No.	Covenant	Reference in Loan Agreement	Status of Compliance
22.	Within three months of effectiveness, DOI shall appoint a suitably qualified and experienced subproject manager to work on a full-time basis in each subproject.	Schedule 6, para. 5	Complied with.
23.	Each Subproject Manager shall be responsible for supervising establishment of WUAs, conducting surveys and studies, organizing training for WUAs, reaching agreement with WUAs, and coordinating with relevant agencies.	Schedule 6, para. 6	Complied with. However, coordination with agriculture extension service providers remained weak throughout project implementation.
24.	After formation and registration of a water user association (WUA) in a subproject, the relevant subproject manager shall establish a subproject management committee (SMC) consisting of subproject manager and WUA members. Subproject manager shall chair the related SMC.	Schedule 6, para. 7	Complied with. However, SMC could not function effectively in some subprojects due to lack of coordination between project staff and WUA.
25.	Within one year of effectiveness, DOI shall fill all staff positions in system management branch (SMB), research and technology development branch (RTDB), and human resources development and training branch and each subproject with appropriately trained personnel.	Schedule 6, para. 8	Complied with.
26.	The Project shall adopt flexibility to respond according to special characteristics of each subproject and approaches refined by the Midterm Review as needed.	Schedule 6, para. 10	Complied with. However, the loan funds were way below requirement for rehabilitation of big structures in many subprojects.
27.	After appointment of subproject manager, DOI shall assign qualified and experienced sociologist, or person with suitable qualification and experience.	Schedule 6, para. 11	Complied with.
28.	Sociologists and Subproject Managers shall conduct baseline survey to assess socioeconomic status of farmers and general condition of irrigation facilities in subproject areas.	Schedule 6, para. 12	Complied with. However, the baseline surveys were not comprehensive to reflect conditions in subproject areas.
29.	The sociologists shall recruit suitable farmer organizers to assist in organizing WUAs.	Schedule 6, para. 13	Complied with.
30.	The sociologist, association organizer, and subproject manager will assist farmers in organizing themselves into WUA.	Schedule 6, para. 14	Complied with.

Serial No.	Covenant	Reference in Loan Agreement	Status of Compliance
31.	After WUAs are registered, the sociologists shall assist formation of executive committees who will act as members of subproject management committees (SMCs).	Schedule 6, para. 15	Complied with.
32.	Promptly after formation of SMC, training program shall be prepared for WUA officials.	Schedule 6, para. 16	Complied with.
33.	After formation of SMC, members of SMC shall conduct a “walkthrough” of the entire irrigation system, and prepare a detailed and prioritized list.	Schedule 6, para. 17	Complied with.
34.	After completion of necessary surveys and studies, the SMC shall prepare a draft plan of action (POA).	Schedule 6, para. 18	Complied with.
35.	On the basis of final POA approved by general membership of WUA and DOI, the subproject manager shall propose to the SMC a Memorandum of Agreement to be entered into by DOI and the related WUA.	Schedule 6, para. 19	Complied with.
36.	WUAs in each subprojects shall be encouraged to contribute substantially to the construction cost.	Schedule 6, para. 20	Complied with. On average, WUAs have contributed 18% of the total cost.
37.	Civil works are started only after WUAs are formed and registered; preliminary POAs are agreed between WUA and DOI; a walkthrough has been conducted by SMC; WUA has adequate bookkeeping and data collection procedures; WUA has prepared initial O&M plan; and WUA has established irrigation service fee (ISF) and started collection of ISF.	Schedule 6, para. 21	Complied with. However, most WUAs established ISF and started collection of ISF after rehabilitation works significantly completed.
38.	For small and medium-sized subprojects (including Panchakanya, Hardinath, Pathraiya and Chaurjahari), routine O&M responsibility is transferred to WUAs.	Schedule 6, para. 22	Partly complied with. Routine O&M responsibility of Chaurjahari subproject could not be transferred due to insecurity.
39.	For large-scale subprojects (including Kagheri, West Gandak, Manusmara, Kamala, Chandra Canal, Banganga, and Mohana), routine O&M responsibility of specified canals shall be transferred to WUAs.	Schedule 6, para. 23	Complied with. However, canal structures and networks in these subprojects were big, and the WUAs were unable to undertake routine O&M works.

Serial No.	Covenant	Reference in Loan Agreement	Status of Compliance
40.	Each memorandum of agreement (MOA) between the subproject management office and WUA shall provide for frequent consultations between the WUA executive committee and general members.	Schedule 6, para. 24	Complied with. However, frequency of consultations remained limited in big subprojects where number of general members was very high.
41.	No construction work (except for emergency maintenance) shall be financed under the Loan unless an MOA is signed between the EA and concerned WUA.	Schedule 6, para. 25	Complied with. However, not all conditions in the MOA were met before commencement of construction work.
42.	Each SMC shall supervise procurement and construction activities for the relevant subproject in accordance with the related POA and MOA.	Schedule 6, para. 26	Complied with. However, SMCs' involvement in procurement decisions was not adequate.
43.	Each WUA shall develop procedures to maintain accurate water delivery records and calculate O&M costs.	Schedule 6, para. 27	Partly complied with. Most WUAs did not have procedures for calculating water delivery records and O&M costs.
44.	Upon completion and commissioning of the repairs and improvements to irrigation facilities, and upon satisfaction by concerned WUA of conditions specified in relevant MOA, DOI shall take all steps to transfer subproject O&M responsibility to WUA.	Schedule 6, para. 28	Complied with. However, as selective irrigation structures were rehabilitated, which was much less than WUAs' expectations, DOI steps could not be effective.
45.	Within three years of effectiveness, the Borrower, TA donor, and ADB shall conduct a comprehensive midterm review.	Schedule 6, para. 31	Complied with.
46.	Based on midterm review findings and recommendations, the Project activities shall be expanded to the remaining eight subprojects. The midterm review shall also recommend any appropriate adjustments in the design or implementation of the Project.	Schedule 6, para. 32	Complied with.
47.	SMB, with the assistance of RTDB and the subproject managers, shall design and implement a benefit monitoring and evaluation (BME) system.	Schedule 6, para. 34	Partly complied with. Although BME was established, it was not implemented effectively.

Serial No.	Covenant	Reference in Loan Agreement	Status of Compliance
48.	The Borrower shall ensure that all construction work carried out under the Project is conducted in compliance with applicable environmental laws and regulations.	Schedule 6, para. 35	Complied with.
49.	The Borrower shall cause DOI to take all necessary steps to encourage women farmers in the project area to participate in the design and implementation of the Project.	Schedule 6, para. 36	Complied with.
50.	The Borrower shall amend the Irrigation Regulations by 31 December 1994 in conformity with Water Resources Act, Water Resources Regulations, and Irrigation Policy, 1992.	Schedule 6, para. 37	Complied with.
51.	The Borrower shall take necessary actions to make available on time all land and rights of land required for carrying out the Project.	Schedule 6, para. 38	Complied with.
52.	The Borrower shall strengthen the coordination between DOI and agricultural support service agencies.	Schedule 6, para. 39	Partly complied with. The project design did not provide mechanisms for farmers to access agriculture extension and market services. No enough initiative was taken by the EA to improve coordination with service agencies.
53.	The Borrower shall ensure that there is full communication and coordination at all times between project staff and the TA consultants.	Schedule 6, para. 40	Complied with.
54.	DOI shall ensure before 15 January 1995 in each Phase 1 subproject (i) formation and registration of WUAs, and (ii) negotiation on plan of action and MOA.	Schedule 6, para. 41	Complied with.
55.	The Borrower (through DOI) shall monitor at all times the quality of construction work completed by the contractors and WUAs under the Project.	Schedule 6, para. 42	Complied with. However, construction quality was found weak in some subprojects.
56.	The Borrower shall ensure that the Project and the TA grant are designated as core development projects for the purpose of adequate budgetary support.	Schedule 6, para. 43	Complied with.
57.	The Borrower shall finance at least 15% of the total cost of the Project.	Schedule 6, para. 44	Complied with.

FINANCIAL AND ECONOMICAL ANALYSIS

A. Impact on Beneficiary Communities

1. The Irrigation Management Transfer Project (the Project) has directly benefited 39,428 farm families through increased agriculture production, against the appraisal estimate of 38,105 farm families. Average annual net income per farm family in the project area is estimated to have increased to NRs35,186. This does not include the Chaurjahari subproject because project support could not be effectively delivered due to poor security. It is estimated that the Project provided 5,400 person-years of employment during implementation and 10,500 person-years of on-farm employment in 2004.¹¹ The Project contributed to environmental protection through the construction of structures for controlling water logging and soil erosion and improving drainage systems. The Project also promoted the role of women and disadvantaged communities in irrigation development and management, as 20% of the water user association (WUA) members were women and 8% were low cast Dalits.

B. Main Assumptions of the Financial and Economic Analysis

2. As far as practicable, all quantifiable benefits were included in the financial and economic analysis. The economic reevaluation presented in this report was carried out using the same methodology as applied at project formulation. Benefits accrued through support during the Project's last year to the three ADB-financed projects completed earlier are not counted.

1. General Methodology

3. The economic analysis was undertaken in accordance with the Asian Development Bank's Guidelines.¹² Quantifiable project benefits were evaluated by comparing the situation with and without the Project, applying actual costs and benefits in the field. These costs and benefits were expressed in constant 2004 prices. Illustrative farm models were developed for the situation with and without the project, and input and output prices were used for both situations. The analytical procedures were subsequently weighted according to the project period.

2. Economic Life of the Project

4. The assumed economic life of the Project was 20 years from the start of implementation in 1996, including the 9-year project implementation period up to 2004. Thus, the net economic life of the Project is considered to be 11 years from the time of completion (2005–2015).

3. Project Costs

5. Costs for civil works, survey and detailed designs, procurement of vehicles and spare parts and their operating costs, the formation and strengthening of WUAs, training for Department of Irrigation (DOI) staff and WUAs, and administrative expenses were taken as

¹¹ Source: Strengthening Actions for Governance in Utilization of Natural Resources (SAGUN). 2005. *Cumulative Progress on Income, Employment Generation and Capacity Building through the Irrigation Management Transfer Project*. Kathmandu.

¹² ADB. 1997. *Guidelines for the Economic Analysis of Projects*. Manila.

costs for the financial and economic analysis. The annual breakdown of Government and beneficiary contributions was taken from various sources, so the figure may vary slightly. The mismatch of ADB's and the Government's accounting years also limited accuracy. Nevertheless, due care was taken to be as accurate as possible. ADB's costs were considered as project investment, but the Government's costs were assumed to be recurrent costs. The actual project cost began in 1996 and ended in 2004¹³ and thereafter assumed a constant annual recurrent cost of 5% of the sum total expenditure of the project implementation period.

4. Economic Prices and Costs

6. All costs and benefits were adjusted to constant 2004 prices using (i) a gross domestic product deflator for all local currency costs and benefits and (ii) the G-5 manufacturer's unit value index for all foreign exchange costs. Local values were expressed in dollars at an exchange rate of \$1.00 = NRs72.92, the average of the Government's exchange rate for 2005. To calculate the net present value and reach a cut-off point for the economic internal rate of return (EIRR), a discount rate of 12% was used.

7. The World Bank Commodity Price Projections¹⁴ with actual commodity price data for 2003 and 2004 were used to derive the economic prices for major tradable commodities including both outputs (paddy, wheat, and maize) and inputs (urea, diammonium phosphate, and potash), taking into account the quality adjustment, international freight charge for border pricing, and local transport and handling costs to the project area (Tables A7.1a and A7.1b). Similarly, the economic prices of non-traded goods and other costs were derived from local financial prices and adjusted by the standard conversion factor of 0.9. The economic price for labor was calculated using the standard conversion factor of 0.8, the same as applied at project formulation. Transfer payments such as taxes and duties were excluded from economic costs. The financial prices for various farm inputs and outputs and local wage rates were collected during the field survey. No conversion factor was applied for non-traded goods such as manure, planting material, and crop residues. Financial and economic prices used for the analysis are in Table A7.2.

C. Project Benefits

a. Quantified Benefits

8. During project preparation, the major anticipated benefits included in the analysis were those derived from incremental agriculture production comparing the situation with and without the Project. Increased irrigated area from 32,500 ha to 45,563 ha, which is about 91% of the appraisal target of 50,100 ha, particularly for rainy season crops, has resulted in more agriculture production. The increased availability of irrigation motivated farmers to expand cropping area, use improved seeds and technologies, and apply recommended doses of farm inputs, particularly fertilizers. Table A7.3 illustrates cropping patterns with and without the Project. Cropping intensity increased from 167% without the Project to 185% with the Project, which is slightly below the appraisal target of 197%.

9. Farm models of inputs and outputs were developed for major crops with and without the Project based on data collected from the field and secondary sources such as Government

¹³ Sum total of expenditure of the project implementation period (1996–2004) multiplied by 0.05. This amount is assumed constant for each year until 2014.

¹⁴ World Bank. 2004. *Global Economic Prospects*. Washington, DC (Table A2.14).

publications¹⁵ and consultant progress reports. There were significant increases in input usage and crop yields. At project completion, the average yield of irrigated winter wheat was 2.31 metric tons per hectare (t/ha) (1.88 t/ha without the Project), winter maize 2.07 t/ha (1.53 t/ha without), spring paddy 3.01 t/ha (2.53 t/ha without), and rainy season paddy 2.85 t/ha (2.60 t/ha without). The increases were 10–16%, against the appraisal target of 10–20%. At project completion, the incremental outputs were 37,961 t for rainy season paddy, 1,717 t for spring paddy, 575 t for wheat, 4,670 t for winter maize, 1,385 t for oilseeds, 17,208 t for potato, and 14,205 t for sugarcane (Table 7.4). The total farm output of 273,854 t is slightly less than the appraisal target of 275,000 t. Shortage of water in source rivers during the spring and winter seasons and lack of proper linkage of farmers with extension and marketing services providers are the main reasons for the shortfall.

b. Unquantified Benefits

10. Some secondary and tertiary benefits for farm families were identified during the project formulation. Emergency flood protection and construction of drainage structures in Chandra Canal, Hardinath, Kamala, Khageri, Manusmara, and Mohana protected the project area from water logging and soil erosion and improved drainage systems. The construction of 196 kilometers (km) of canal service roads and 11 km of farm-to-market roads in Banganga, Chandra Canal, Hardinath, Kamala, Khageri, Panchakanya, and West Gandak improved farmers' access to markets. About 5,400 person-years of employment was generated during project implementation and 10,500 person-years thereafter. Establishing and developing the capacity of water user associations (WUAs) and their assumption of full or partial O&M responsibility has considerably reduced the burden on the Government exchequer to finance routine O&M of subprojects.

D. Financial Analysis

11. Financial analysis was carried out for each major crop cultivated in the project area. A farm size of 1 ha was assumed for the situation both with and without the Project, reflecting representative cropping intensities and patterns in the project area. Financial costs at 2004 values were derived for each major crop (Tables A7.5a1, A7.5a2, A7.5b1, and A7.5b2). The net crop revenue was then obtained by deducting the production costs from gross production (Tables A7.6a and A7.6b). A farm family under the situation with the Project would earn an average incremental net income of NRs621 (\$8.52)/ha from paddy and its byproducts (Table A7.7) at full irrigation. The highest level of incremental income per hectare was from vegetables at NRs73,604 (\$1,001). Spring maize and sugarcane are the other crops providing high net incremental income of NRs20,391 (\$280) for spring maize and NRs5,210 (\$72) for sugarcane. The land under vegetables, potato, and sugarcane cultivation was only 8% of the cultivated land in the project area. However, with improved access to markets, the area under vegetable cultivation is on the rise.

12. From the typical 1 ha farm model, incremental net financial farm income is estimated to be NRs6,323 (\$87)/year (Table A7.8). With this farm model, the irrigated area of 45,563 ha will provide annual incremental farm income of NRs233 million (\$3.24 million). Farmers cultivating 0.73 ha of land will generate an incremental income of about NRs4,623 (\$63). Similarly, the additional income per household from crops was estimated to be NRs8,206 (\$112) for medium

¹⁵ Project Completion Review Mission Field Survey, September–October 2005; Department of Agriculture. 2005. *Cost of Production of Cereal Crops and Important Vegetable Crops for 2003, 2004, and 2005*. Kathmandu,

farmers (1.30 ha) and NRs11,192 (\$154) for large farmers (1.77 ha) (Table A7.9). The annual net income per household from agriculture was 6% in Chandra Canal (NRs31,518 [\$432]) and 70% in Hardinath (NRs57,061 [\$783]) (Tables A7.10 and A7.11). The financial internal rate of return (FIRR) for the Project as a whole was estimated to be 13.23% (Table A7.12).

E. Economic Analysis

13. Assuming that the relative prices of major commodities would change over time, four types of farm models in economic terms were derived using 2004 prices and projected future prices in 2005, 2010, and 2015. Economic benefits for years 2003–2004 were valued at 2004 prices and for years 2005–2009 at 2005 prices—all in constant 2004 dollars. For economic analysis, the incremental benefit from agricultural production was worked out following the methodology discussed in paras. 11 and 12 above for the financial analysis, and the real cost and benefit values were adjusted by multiplying them by the standard conversion factor of 0.9. The economic internal rate of return (EIRR) was estimated at 15.30% (Table A7.13), against the appraisal target of 22.00%. The economic net present value (ENPV) with a 12% discount rate was \$1.96 million. The main reasons for the low EIRR are that (i) the total irrigated area of 45,563 ha is 9% less than the appraisal target of 50,100 ha, (ii) the cropped area under wheat and pulses were 17,350 ha and 4,850 ha against the appraisal targets of 27,540 ha and 6,355 ha, (iii) higher production costs arose from the increased use of fertilizers and high labor costs, (iv) some medium and large subprojects performed poorly due to structural deficiencies, and (v) water in source rivers was in short supply during the spring and winter seasons in most subprojects.

F. Sensitivity Analysis

14. The ENPV and EIRR were calculated to ascertain the sensitivity of project benefits to changes in assumptions and parameters projected during project formulation. Sensitivity analysis was conducted for a 13%, 12%, and 4% decrease in 2004 project benefits, and the corresponding EIRRs decreased to 19%, 17%, and 11%. This indicates that the Project's economic feasibility is highly sensitive to a decrease in benefits from agriculture. The switching value beyond which the Project had an EIRR below 12% was a 19% decrease in incremental benefits from agriculture. Hence, the economic viability of the Project is sensitive to production shortfalls at 52%. Sensitivity analysis was also conducted for increases in project costs, including O&M and replacement costs, by 10%, 20%, and 91%; delays in benefits by 1 year, 2 years, and 3.3 years; and a combination of an increase in project cost by 20% and a delay in benefits by 2 years. The analysis indicated that an increase in project costs by 10%, 20%, and 91% resulted in corresponding decrease in EIRRs to 14%, 12% and 5%. The switching value, at a 23% increase in project cost, resulted in an ENPV of zero. This switching value indicates that the Project is risky only when its costs increase by 91%.

15. The second scenario is related to the delays in benefits. The sensitivity analysis tested for 1-year, 2-year, and 3.3-year delays in the incremental benefits and saw corresponding EIRR declines of 13%, 10%, and 8%. These results indicate that the Project is sensitive and suffered significant economic impacts from delays in its completion. The scenario of increased project costs of 20% combined with 2 years' delay in incremental agricultural benefits has sensitivity, decreasing the EIRR to 8%. Altogether, these sensitivity tests indicate that, unless DOI and the WUAs in the project area perform normal O&M, the Project has some risk of not attaining a viable rate of return.

16. It should be noted that the economic benefits have been estimated conservatively. Other likely benefits of the Project—such as multiplier effect of DOI and WUA capacity building, women's empowerment, and environmental protection—were not included in the analysis. If these benefits were quantified and monetized, the EIRR would increase significantly.

Table A7.1a: Derivation of Economic Prices for Major Tradable Grains

Crop/Item	Unit	Year											
		Actual									Projected		
		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2010	2015
A. Paddy													
World Market Price FOB ^a													
Constant 1990 Dollars ^b	\$/t	297.3	280.0	291.9	240.5	202.4	180.1	191.9	197.6	237.7	205.0	220.0	230.0
Constant 2004 Dollars ^b	\$/t	286.6	269.9	281.4	231.8	195.1	173.6	185.0	190.5	229.1	197.6	212.1	221.7
Less Quality Adjustment ^c	0.3	86.0	81.0	84.4	69.5	58.5	52.1	55.5	57.1	68.7	59.3	63.6	66.5
Quality Adjusted FOB	\$/t	200.6	188.9	197.0	162.3	136.6	121.5	129.5	133.3	160.4	138.3	148.4	155.2
International Freight	\$/t	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Calcutta CIF Price	\$/t	250.6	238.9	247.0	212.3	186.6	171.5	179.5	183.3	210.4	188.3	198.4	205.2
Transport and handling to Nepal border (Birgunj)	\$/t	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Nepal border CIF price	\$/t	285.6	273.9	282.0	247.3	221.6	206.5	214.5	218.3	245.4	223.3	233.4	240.2
CIF price in NRs. ^d	NRs/t	20,827.2	19,975.9	20,561.5	18,032.4	16,157.7	15,060.4	15,641.0	15,921.5	17,894.6	16,285.6	17,023.7	17,515.7
Freight to and from mill	NRs/t	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)
Processing Rate	NRs/t	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Processing Cost	NRs/t	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)	(250.0)
Freight to Farmgate (Terai)	NRs/t	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
Economic Farmgate Price (Terai)	NRs/t	13,725.2	13,171.9	13,552.5	11,908.5	10,690.0	9,976.8	10,354.2	10,536.5	11,819.0	10,773.1	11,252.9	11,572.7
B. Wheat													
World Market Price FOB ^e													
Constant 1990 Dollars	\$/t	182.1	147.2	121.1	108.5	114.1	132.2	148.1	146.1	156.9	130.0	145.0	155.0
Constant 2004 Dollars	\$/t	175.5	141.9	116.7	104.6	110.0	127.4	142.8	140.8	151.2	125.3	139.8	149.4
Less Quality Adjustment	0.3	52.7	42.6	35.0	31.4	33.0	38.2	42.8	42.2	45.4	37.6	41.9	44.8
Quality Adjusted FOB	\$/t	122.9	99.3	81.7	73.2	77.0	89.2	99.9	98.6	105.9	87.7	97.8	104.6
International Freight	\$/t	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Calcutta CIF Price	\$/t	192.9	169.3	151.7	143.2	147.0	159.2	169.9	168.6	175.9	157.7	167.8	174.6
Transport and handling to Nepal border	\$/t	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Nepal border CIF price	\$/t	227.9	204.3	186.7	178.2	182.0	194.2	204.9	203.6	210.9	192.7	202.8	209.6
CIF price in NRs.	NRs/t	16,617.3	14,900.1	13,615.8	12,995.8	13,271.4	14,162.0	14,944.3	14,845.9	15,377.3	14,053.7	14,791.8	15,283.9
Freight to Farmgate (Terai)	NRs/t	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0

Economic Farmgate Price (Terai)	NRs/mt	17,217.3	15,500.1	14,215.8	13,595.8	13,871.4	14,762.0	15,544.3	15,445.9	15,977.3	14,653.7	15,391.8	15,883.9
C. Maize													
World Market Price FOB ^f													
Constant 1990 Dollars	\$/mt	145.5	108.0	97.9	87.3	88.5	93.4	99.3	105.4	111.8	95.0	105.0	112.0
Constant 2004 Dollars	\$/mt	140.2	104.1	94.4	84.1	85.3	90.0	95.7	101.6	107.8	91.6	101.2	108.0
Less Quality Adjustment	0.2	28.0	20.8	18.9	16.8	17.1	18.0	19.1	20.3	21.6	18.3	20.2	21.6
Quality Adjusted FOB	\$/mt	112.2	83.3	75.5	67.3	68.2	72.0	76.6	81.3	86.2	73.3	81.0	86.4
International Freight	\$/mt	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0
Calcutta CIF Price	\$/mt	178.2	149.3	141.5	133.3	134.2	138.0	142.6	147.3	152.2	139.3	147.0	152.4
Transport and handling to Nepal border	\$/mt	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Nepal border CIF price	\$/t	213.2	184.3	176.5	168.3	169.2	173.0	177.6	182.3	187.2	174.3	182.0	187.4
CIF price in NRs.	NRs/t	15,547.5	13,438.7	12,870.7	12,274.6	12,342.1	12,617.7	12,949.5	13,292.5	13,652.4	12,707.6	13,270.0	13,663.6
Freight to Farmgate (Terai)	NRs/t	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
Economic Farmgate Price (Terai)	NRs/t	16,147.5	14,038.7	13,470.7	12,874.6	12,942.1	13,217.7	13,549.5	13,892.5	14,252.4	13,307.6	13,870.0	14,263.6

FOB = free on board, CIF = cost, insurance, and freight, () = minus, NRs = Nepalese Rupees, t = metric ton.

^a Thai white, 5% broken, FOB, Bangkok.

^b Constant 1990 prices are derived from World Bank Commodity Price Projections for 2000–2015.

^c Quality adjustment are as at project formulation.

^d Average exchange rate to \$1.00 in 2004 is NRs72.92.

^e Wheat, U.S., No. 1, Hard Red Winter.

^f US, No.2 Yellow, FOB, Gulf Ports.

Sources: Ministry of Agriculture and Cooperatives. 2005. *Statistical Information on Nepalese Agriculture*. Kathmandu; Project Completion Review Mission Field Survey, September–October 2005.

Table A7.1b: Derivation of Economic Prices of Fertilizers

Fertilizer/Item	Unit	Year											
		Actual								Projected			
		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2010	2015
A. Urea													
World Market Price FOB ^a													
Constant 1990 Dollars ^b	\$/t	180.3	118.0	98.9	75.3	101.1	99.3	94.4	138.9	175.3	122.3	118.1	114.6
Constant 2004 Dollars ^b	\$/t	173.8	113.7	95.3	72.6	97.5	95.7	91.0	133.9	169.0	117.9	113.8	110.5
International Freight	\$/t	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
Calcutta CIF Price	\$/t	233.8	173.7	155.3	132.6	157.5	155.7	151.0	193.9	229.0	177.9	173.8	170.5
Transport and Handling to													
Nepal Border	\$/t	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Nepal Border CIF Price	\$/t	268.8	208.7	190.3	167.6	192.5	190.7	186.0	228.9	264.0	212.9	208.8	205.5
CIF Price in NRs ^c	NRs/t	19,601.6	15,222.4	13,879.8	12,220.9	14,034.4	13,907.9	13,563.5	16,691.5	19,250.1	15,524.6	15,229.4	14,983.4
Transport and Handling to													
Wholesaler (Terai)	NRs/t	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
Wholesalers' Margin (Terai)	0.2	4,040.3	3,164.5	2,896.0	2,564.2	2,926.9	2,901.6	2,832.7	3,458.3	3,970.0	3,224.9	3,165.9	3,116.7
Transport and Handling to													
Farmgate (Terai)	NRs/t	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0
Retailors' Margin (Terai)	0.1	2474.2	1948.7	1787.6	1588.5	1806.1	1790.9	1749.6	2125.0	2432.0	1985.0	1949.5	1920.0
Economic Farmgate Price (Terai)	NRs/t	27,216.1	21,435.5	19,663.3	17,473.6	19,867.5	19,700.4	19,245.8	23,374.8	26,752.2	21,834.5	21,444.8	21,120.7
B. Diammonium Phosphate													
World Market Price FOB ^d													
Constant 1990 Dollars	\$/t	187.0	184.5	195.2	172.1	154.2	154.0	157.5	179.4	221.2	170.0	170.0	175.0
Constant 2004 Dollars	\$/t	180.2	177.8	188.2	165.9	148.6	148.4	151.8	172.9	213.2	163.9	163.9	168.7
International Freight	\$/t	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0
Calcutta CIF Price	\$/t	246.2	243.8	254.2	231.9	214.6	214.4	217.8	238.9	279.2	229.9	229.9	234.7
Transport and Handling to													
Nepal Border	\$/t	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
Nepal Border CIF Price	\$/t	306.2	303.8	314.2	291.9	274.6	274.4	277.8	298.9	339.2	289.9	289.9	294.7
CIF Price in NRs ^c	NRs/t	22,333.2	22,157.5	22,909.6	21,285.9	20,027.6	20,013.6	20,259.6	21,799.0	24,737.2	21,138.3	21,138.3	21,489.7
Transport and Handling to													
Wholesaler (Terai)	NRs/t	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
Wholesalers' Margin (Terai)	0.2	4,586.6	4,551.5	4,701.9	4,377.2	4,125.5	4,122.7	4,171.9	4,479.8	5,067.4	4,347.7	4,347.7	4,417.5

Fertilizer/Item	Unit	Year											
		Actual								Projected			
		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2010	2015
Transport and Handling to Farmgate (Terai)	NRs/t	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0
Retailers' Margin (Terai)	0.1	2,802.0	2,780.9	2,871.2	2,676.3	2,525.3	2,523.6	2,553.2	2,737.9	3,090.5	2,658.6	2,658.6	2,700.8
Economic Farmgate Price (Terai)	NRs/t	30,821.9	30,589.9	31,582.7	29,439.4	27,778.5	27,759.9	28,084.7	30,116.7	33,995.1	29,244.5	29,244.5	29,708.4
C. Muriate of Potash													
World Market Price FOB ^a													
Constant 1990 Dollars	\$/t	102.6	107.5	112.2	117.8	122.5	123.1	113.3	113.3	124.6	116.0	118.0	120.0
Constant 2004 Dollars	\$/t	98.9	103.6	108.1	113.5	118.1	118.7	109.2	109.2	120.1	111.8	113.7	115.7
International Freight	\$/t	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0
Calcutta CIF Price	\$/t	164.9	169.6	174.1	179.5	184.1	184.7	175.2	175.2	186.1	177.8	179.7	181.7
Transport and Handling to Nepal Border	\$/t	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
Nepal Border CIF Price	\$/t	224.9	229.6	234.1	239.5	244.1	244.7	235.2	235.2	246.1	237.8	239.7	241.7
CIF Price in NRs ^c	NRs/t	16,400.6	16,745.0	17,075.4	17,469.0	17,799.4	17,841.5	17,152.7	17,152.7	17,947.0	17,342.5	17,483.1	17,623.6
Transport and Handling to Wholesaler (Terai)	NRs/t	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
Wholesalers' Margin (Terai)	0.2	3,400.1	3,469.0	3,535.1	3,613.8	3,679.9	3,688.3	3,550.5	3,550.5	3,709.4	3,588.5	3,616.6	3,644.7
Transport and Handling to Farmgate (Terai)	NRs/t	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0
Retailers' Margin (Terai)	0.1	2,090.1	2,131.4	2,171.0	2,218.3	2,257.9	2,263.0	2,180.3	2,180.3	2,275.6	2,203.1	2,220.0	2,236.8
Economic Farmgate Price (Terai)	NRs/t	22,990.7	23,445.4	23,881.5	24,401.1	24,837.2	24,892.8	23,983.5	23,983.5	25,032.0	24,234.1	24,419.6	24,605.2

FOB = free on board, CIF = cost, insurance, and freight, NRs = Nepalese Rupees, t = metric ton.

^a Bulk, FOB, East Europe

^b Constant 1990 prices are derived from World Bank Commodity Price Projections

^c Average exchange rate to 1US dollar in 2004 is NRs72.92

^d Bulk spot, FOB, US Gulf

^e Standard grade, spot, FOB, Vancouver

Sources: Ministry of Agriculture and Cooperatives. 2005. *Statistical Information on Nepalese Agriculture*. Kathmandu; Project Completion Review Mission Field Survey, September–October 2005.

Table A7.2: Summary of Financial and Economical Prices

[illegible]

Item	Unit	Financial	Economic Price (constant 2004) ^b											
		Price												
		2004 ^a	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2010	2015
Spring Paddy	NRs/kg	20.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
Spring Maize	NRs/kg	13.0	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7
Sugarcane	NRs/kg	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Vegetables	NRs/kg	4,110.0	3,699.0	3,699.0	3,699.0	3,699.0	3,699.0	3,699.0	3,699.0	3,699.0	3,699.0	3,699.0	3,699.0	3,699.0
Fertilizers														
Urea (Terai)	NRs/kg	18.0	27.2	21.4	19.7	17.5	19.9	19.7	19.2	23.4	26.8	21.8	21.4	21.1
Urea (Hills)	NRs/kg		30.7	24.9	23.1	20.9	23.3	23.1	22.7	26.8	30.2	25.3	24.9	24.6
DAP (Terai)	NRs/kg	29.0	30.8	30.6	31.6	29.4	27.8	27.8	28.1	30.1	34.0	29.2	29.2	29.7
DAP (Hills)	NRs/kg		34.3	34.0	35.0	32.9	31.2	31.2	31.5	33.6	37.4	32.7	32.7	33.2
Potash (Terai)	NRs/kg	14.0	23.0	23.4	23.9	24.4	24.8	24.9	24.0	24.0	25.0	24.2	24.4	24.6
Potash (Hills)	NRs/kg		26.4	26.9	27.3	27.8	28.3	28.3	27.4	27.4	28.5	27.7	27.9	28.0
Farmyard Manure	NRs/t	840.0	840.0	840.0	840.0	840.0	840.0	840.0	840.0	840.0	840.0	840.0	840.0	840.0
Miscellaneous	NRs/set	150.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0
C. Labor														
Farm Labor ^c	NRs/person-day	85.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0	68.0
Draft Animal ^d	NRs/pair-day	150.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0	135.0
D. Machine														
Tractor	NRs/hour	480.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0	432.0
Thresher	NRs/hour	490.0	441.0	441.0	441.0	441.0	441.0	441.0	441.0	441.0	441.0	441.0	441.0	441.0

DAP = diammonium phosphate, kg = kilogram, NRs = Nepalese rupees.

^a Financial prices adjusted to 2004 levels.

^b Economic prices for major traded commodities were derived from the World Bank Commodity Price Projections 2000–2015. Economic prices for non-traded goods, labor, and other costs were based on local financial prices and adjusted by the standard conversion factor of 0.8.

^c Economic prices for labor computed as follows: local wage rate multiplied by the standard conversion factor of 0.8.

^d Including handler.

Sources: Ministry of Agriculture and Cooperatives. 2005. *Statistical Information on Nepalese Agriculture*. Kathmandu; Project Completion Review Mission Field Survey, September–October 2005.

Table A7.3: Cropping Patterns With and Without the Project
(Hectare)

Item	Total Project Area			Amount per 1 ha Farm		
	Without Project	With Project	Increment	Without Project	With Project	Increment
A. Irrigated Area	44,505.0	45,563.0	1,058.0	0.9	0.9	0.0
Rainy Season Paddy	44,505.0	45,563.0	1,058.0	0.9	0.9	0.0
Spring Paddy	941.0	1,360.0	419.0	0.0	0.0	0.0
Wheat	19,865.0	15,350.0	(4,515.0)	0.4	0.3	(0.1)
Maize	8,650.0	2,260.0	(6,390.0)	0.2	0.0	(0.1)
Oilseed	2,545.0	4,470.0	1,925.0	0.1	0.1	0.0
Pulses	5,670.0	4,850.0	(820.0)	0.1	0.1	0.0
Potato	484.0	2,000.0	1,516.0	0.0	0.0	0.0
Spring Maize	0.0	270.0	270.0	0.0	0.0	0.0
Vegetables	0.0	335.0	335.0	0.0	0.0	0.0
Sugarcane	1,350.0	1,700.0	350.0	0.0	0.0	0.0
Total	84,010.0	78,158.0	(5,852.0)	1.7	1.6	(0.1)
B. Partly Irrigated Area	5,695.0	12,400.0	6,705.0	0.1	0.2	0.1
Rainy Season Paddy	0.0	12,400.0	12,400.0	0.0	0.2	0.2
Spring Paddy	0.0	0.0	0.0	0.0	0.0	0.0
Wheat	0.0	2,000.0	2,000.0	0.0	0.0	0.0
Maize	0.0	0.0	0.0	0.0	0.0	0.0
Oilseed	0.0	0.0	0.0	0.0	0.0	0.0
Pulses	0.0	0.0	0.0	0.0	0.0	0.0
Potato	0.0	0.0	0.0	0.0	0.0	0.0
Spring Maize	0.0	150.0	150.0	0.0	0.0	0.0
Vegetables	0.0	0.0	0.0	0.0	0.0	0.0
Sugarcane	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	14,550.0	14,550.0	0.0	0.3	0.3
C. Total Area	50,200.0	57,963.0	7,763.0	1.0	1.2	0.2
Rainy Season Paddy	44,505.0	57,963.0	13,458.0	0.9	1.2	0.3
Spring Paddy	941.0	1,360.0	419.0	0.0	0.0	0.0
Wheat	19,865.0	17,350.0	(2,515.0)	0.4	0.3	(0.1)
Maize	8,650.0	2,260.0	(6,390.0)	0.2	0.0	(0.1)
Oilseed	2,545.0	4,470.0	1,925.0	0.1	0.1	0.0
Pulses	5,670.0	4,850.0	(820.0)	0.1	0.1	0.0
Potato	484.0	2,000.0	1,516.0	0.0	0.0	0.0
Spring Maize	0.0	420.0	420.0	0.0	0.0	0.0
Vegetables	0.0	335.0	335.0	0.0	0.0	0.0
Sugarcane	1,350.0	1,700.0	350.0	0.0	0.0	0.0
Total	84,010.0	92,708.0	8,698.0	1.7	1.8	0.2
Cropping Intensity (%)	1.7	1.9	0.2	1.7	1.9	0.2

() = minus.

Sources: Ministry of Agriculture and Cooperatives. 2005. *Statistical Information on Nepalese Agriculture*. Kathmandu; Project Completion Review Mission Field Survey, September–October 2005.

Table A7.4: Cropped Area, Yields, and Production in the Project Area

Season/Crop		Without Project			With Project			Increment	
		Area	Yield	Production	Area	Yield1	Production	Area	Production
		(ha)	(t/ha)	(t)	(ha)	(t/ha)	(t)	(ha)	(t)
A.	Wet Season								
1.0	Rainy Season Paddy (irrig.)	44,505.0	2.6	115,559.2	45,563.0	2.9	129,875.6	1,058.0	14,316.4
	Rainy Season Paddy (partly irrig.)				12,400.0	1.9	23,645.0	12,400.0	23,645.0
3.0	Maize	8,650.0	1.5	13,197.3			0.0	0.0	0.0
B.	Dry Season			0.0					
1.0	Spring Paddy	941.0	2.5	2,377.0	1,360.0	3.0	4,094.4	419.0	1,717.4
2.0	Wheat (irrigated)	19,865.0	1.9	37,369.0	15,350.0	2.3	35,406.0	(4,515.0)	(,963.0)
3.0	Wheat (partly irrigated)				2,000.0	1.3	2,538.4	2,000.0	2,538.4
4.0	Spring Maize (irrigated)			0.0	270.0	3.3	894.4	270.0	894.4
	Spring Maize (partly irrig.)				150.0	1.8	265.7	150.0	265.7
5.0	Winter Maize				2,260.0	2.1	4,670.1	2,260.0	4,670.1
6.0	Pulses	5,670.0	0.7	3,945.8	4,850.0	0.7	3,543.8	(820.0)	(401.9)
7.0	Oilseeds	2,545.0	0.6	1,645.1	4,470.0	0.7	3,029.9	1,925.0	1,384.8
8.0	Potatoes	484.0	8.0	3,872.0	2,000.0	10.5	21,080.4	1,516.0	17,208.4
9.0	Vegetables			0.0	335.0	10.8	3,605.1	335.0	3,605.1
C.	Perennial			0.0					
1.0	Sugarcane	1,350.0	20.0	27,000.0	1,700.0	24.2	41,205.3	350.0	14,205.3
Total		84,010.0		204,965.4	92,708.0		273,854.1	8,698.0	68,888.7
Total Net Cultivable Area (ha)		50,200.0			50,200.0				
Cropping Intensity (%)		1.7			1.8				

ha = hectare, irrig. = irrigated, partly irrig. = partly irrigated, t = metric ton, () minus.

Sources: Ministry of Agriculture and Cooperatives. 2005. *Statistical Information on Nepalese Agriculture*. Kathmandu; Project Completion Review Mission Field Survey, September–October 2005.

Table A7.5a1: Farm Model of Inputs per Hectare: Financial Costs Without Project
(Physical Inputs and Production Costs)

		Financial Costs (constant 2004 NRs)											
		Rice			Wheat			Maize			Oilseed		
Item	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Irrigated Areas													
Seed	kg	58.3	16.0	932.8	150.0	19.0	2,850.0	25.0	15.0	375.0	11.3	38.0	429.4
Urea	kg	41.3	18.0	743.4	48.3	18.0	869.4	20.0	18.0	360.0	10.0	18.0	180.0
DAP	kg	16.7	29.0	484.3	20.0	29.0	580.0	15.0	29.0	435.0	6.7	29.0	194.3
Potash	kg	0.0	14.0	0.0	0.0	14.0	0.0	0.0	14.0	0.0	0.0	14.0	0.0
Manure	t	0.8	840.0	672.0	0.7	840.0	588.0	2.5	840.0	2,100.0	0.7	840.0	588.0
Miscellaneous	NRs	0.0	150.0	0.0	0.0	150.0	0.0	0.0	150.0	0.0	0.0	150.0	0.0
Irrigation	NRs	0.0	1.0	0.0	0.0		0.0	0.0	1.0	0.0	0.0	1.0	0.0
Labor	person-day	113.0	0.0	0.0	54.0	0.0	0.0	122.0	0.0	0.0	34.0	0.0	0.0
Bullock	day	16.5	150.0	2,475.0	13.0	150.0	1,950.0	4.0	150.0	600.0	16.0	150.0	2,400.0
Tractor	hour	3.5	480.0	1,680.0	2.0	480.0	960.0	6.0	480.0	2,880.0	1.5	480.0	720.0
Thresher	hour	0.0	490.0	0.0	3.0	490.0	1,470.0	0.0	490.0	0.0	0.0	490.0	0.0
Total Cost				6,987.5	9,267.4				6,750.0				4,511.7
Partly Irrigated Areas													
Seeds	kg	58.3	16.0	932.8	150.0	19.0	2,850.0	25.0	15.0	375.0	11.3	38.0	429.4
Urea	kg	41.3	18.0	743.4	48.3	18.0	869.4	20.0	18.0	360.0	10.0	18.0	180.0
DAP	kg	16.7	29.0	484.3	20.0	29.0	580.0	15.0	29.0	435.0	6.7	29.0	194.3
Potash	kg	0.0	14.0	0.0	0.0	14.0	0.0	0.0	14.0	0.0	0.0	14.0	0.0
Manure	t	0.8	840.0	672.0	0.7	840.0	588.0	2.5	840.0	2,100.0	0.7	840.0	588.0
Miscellaneous	NRs	0.0	150.0	0.0	0.0	150.0	0.0	0.0	150.0	0.0	0.0	150.0	0.0
Irrigation	NRs	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Labor	person-day	113.0	0.0	0.0	54.0	0.0	0.0	122.0	0.0	0.0	34.0	0.0	0.0
Bullocks	day	16.5	150.0	2,475.0	13.0	150.0	1,950.0	4.0	150.0	600.0	16.0	150.0	2,400.0
Tractor	hour	3.5	480.0	1,680.0	2.0	480.0	960.0	6.0	480.0	2,880.0	1.5	480.0	720.0
Thresher	hour	0.0	490.0	0.0	3.0	490.0	1,470.0	0.0	490.0	0.0	0.0	490.0	0.0
Total Cost				6,987.5	9,267.4				6,750.0				4,511.7

DAP = diammonium phosphate, kg = kilogram, NRs = Nepalese Rupees, t = metric ton.

Sources: Ministry of Agriculture and Cooperatives. 2005. *Statistical Information on Nepalese Agriculture*. Kathmandu; Project Completion Review Mission Field Survey, September–October 2005.

Table A7.5a2: Farm Model of Inputs per Hectare: Financial Costs Without Project
(Physical Inputs and Production Costs)

Item		Financial Costs (constant 2004 NRs)											
		Lentils/Pulses			Potato			Sugarcane			Spring Paddy		
		Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Irrigated Areas													
Seed	Kg	36.7	33.0	1,211.1	1,000.0	19.0	19,000.0	2,500.0	2.0	5,000.0	50.0	20.0	1,000.0
Urea	Kg	0.0	18.0	0.0	50.0	18.0	900.0	65.0	18.0	1,170.0	45.0	18.0	810.0
DAP	Kg	0.0	29.0	0.0	25.0	29.0	725.0	40.0	29.0	1,160.0	17.5	29.0	507.5
Potash	Kg	0.0	14.0	0.0	0.0	14.0	0.0	15.0	14.0	210.0	0.0	14.0	0.0
Manure	t	0.0	840.0	0.0	0.0	840.0	0.0	4.0	840.0	3,360.0	0.5	840.0	420.0
Miscellaneous	NRs	0.0	150.0	0.0	0.0	150.0	0.0	0.0	150.0	0.0	0.0	150.0	0.0
Irrigation	NRs	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Labor	person-day	28.0	0.0	0.0	127.0	0.0	0.0	150.0	0.0	0.0	105.0	0.0	0.0
Bullock	Day	12.5	150.0	1,875.0	10.0	150.0	1,500.0	40.0	150.0	6,000.0	7.0	150.0	1,050.0
Tractor	Hour	0.0	480.0	0.0	0.0	480.0	0.0	0.0	480.0	0.0	5.0	480.0	2,400.0
Thresher	Hour	0.0	490.0	0.0	0.0	490.0	0.0	0.0	490.0	0.0	0.0	490.0	0.0
Total Cost				3,086.1	22,125.0			16,900.0			6,187.5		
Partly Irrigated Areas													
Seed	Kg	36.7	33.0	1,211.1	1,000.0	19.0	19,000.0	2,500.0	2.0	5,000.0	50.0	20.0	1,000.0
Urea	Kg	0.0	18.0	0.0	50.0	18.0	900.0	65.0	18.0	1,170.0	45.0	18.0	810.0
DAP	Kg	0.0	29.0	0.0	25.0	29.0	725.0	40.0	29.0	1,160.0	17.5	29.0	507.5
Potash	Kg	0.0	14.0	0.0	0.0	14.0	0.0	15.0	14.0	210.0	0.0	14.0	0.0
Manure	t	0.0	840.0	0.0	0.0	840.0	0.0	4.0	840.0	3,360.0	0.5	840.0	420.0
Miscellaneous	NRs	0.0	150.0	0.0	0.0	150.0	0.0	0.0	150.0	0.0	0.0	150.0	0.0
Irrigation	NRs	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0
Labor	person-day	28.0	0.0	0.0	127.0	0.0	0.0	150.0	0.0	0.0	105.0	0.0	0.0
Bullocks	Day	12.5	150.0	1,875.0	10.0	150.0	1,500.0	40.0	150.0	6,000.0	7.0	150.0	1,050.0
Tractor	Hour	0.0	480.0	0.0	0.0	480.0	0.0	0.0	480.0	0.0	5.0	480.0	2,400.0
Thresher	Hour	0.0	490.0	0.0	0.0	490.0	0.0	0.0	490.0	0.0	0.0	490.0	0.0
Total Cost				3,086.1	22,125.0			16,900.0			6,187.5		

DAP = diammonium phosphate, kg = kilogram, NRs = Nepalese Rupees, t = metric tons.

Sources: Ministry of Agriculture and Cooperatives. 2005. *Statistical Information on Nepalese Agriculture*. Kathmandu. Project Completion Review Mission Field Survey, September–October 2005.

Table A7.5b1: Farm Model of Inputs per Heactare: Financial Costs with Project
(Physical Inputs and Production Costs)

Item		Financial Costs (constant 2004 NRs)														
		Rice			Wheat			Maize			Oilseed			Pulses		
		Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Irrigated Areas																
Seed	kg	41.0	16.0	656.0	120.0	19.0	2,280.0	30.0	15.0	450.0	12.0	38.0	456.0	21.0	33.0	693.0
Urea	kg	37.0	18.0	666.0	34.0	18.0	612.0	32.0	18.0	576.0	14.0	18.0	252.0	0.0	18.0	0.0
DAP	kg	25.0	29.0	725.0	25.0	29.0	725.0	30.0	29.0	870.0	8.0	29.0	232.0	0.0	29.0	0.0
Potash	kg	9.0	14.0	126.0	14.0	14.0	196.0	13.0	14.0	182.0	4.0	14.0	56.0	0.0	14.0	0.0
Manure	t	3.8	840.0	3,192.0	0.8	840.0	672.0	3.0	840.0	2,520.0	0.0	840.0	0.0	0.4	840.0	336.0
Miscellaneous	NRs	2.0	150.0	300.0	5.0	150.0	750.0	1.0	150.0	150.0	0.0	150.0	0.0	0.0	150.0	0.0
Irrigation	NRs	81.0	1.0	81.0	67.0	1.0	67.0	89.0	1.0	89.0	89.0	1.0	89.0	79.0	1.0	79.0
Labor	person-day	94.0		0.0	58.0	0.0	0.0	115.0	0.0	0.0	18.0	0.0	0.0	22.0	0.0	0.0
Bullock	day	10.0	150.0	1,500.0	17.0	150.0	2,550.0	17.0	150.0	2,550.0	9.0	150.0	1,350.0	14.0	150.0	2,100.0
Tractor	hour	3.1	480.0	1,474.8	2.0	480.0	960.0	0.0	480.0	0.0	0.0	480.0	0.0	0.0	480.0	0.0
Thresher	hour	0.0	490.0	0.0	2.0	490.0	980.0	0.0	490.0	0.0	0.0	490.0	0.0	0.0	490.0	0.0
Total Cost				8,720.8			9,792.0			7,387.0			2,435.0			3,208.0
Partially Irrigated Areas																
Seed	Kg	41.0	16.0	656.0	120.0	19.0	2,280.0	30.0	15.0	450.0	12.0	38.0	456.0	21.0	33.0	693.0
Urea	Kg	37.0	18.0	666.0	34.0	18.0	612.0	32.0	18.0	576.0	14.0	18.0	252.0	0.0	18.0	0.0
DAP	Kg	25.0	29.0	725.0	25.0	29.0	725.0	30.0	29.0	870.0	8.0	29.0	232.0	0.0	29.0	0.0
Potash	Kg	9.0	14.0	126.0	14.0	14.0	196.0	13.0	14.0	182.0	4.0	14.0	56.0	0.0	14.0	0.0
Manure	Mt	3.8	840.0	3,192.0	0.8	840.0	672.0	3.0	840.0	2,520.0	0.0	840.0	0.0	0.4	840.0	336.0
Miscellaneous	NRs	2.0	150.0	300.0	5.0	150.0	750.0	1.0	150.0	150.0	0.0	150.0	0.0	0.0	150.0	0.0
Irrigation	NRs	81.0	1.0	81.0	67.0	1.0	67.0	89.0	1.0	89.0	89.0	1.0	89.0	79.0	1.0	79.0
Labor	Person-day	94.0	0.0	0.0	58.0	0.0	0.0	115.0	0.0	0.0	18.0	0.0	0.0	22.0	0.0	0.0
Bullock	Day	10.0	150.0	1,500.0	17.0	150.0	2,550.0	17.0	150.0	2,550.0	9.0	150.0	1,350.0	14.0	150.0	2,100.0
Tractor	Hour	3.1	480.0	1,474.8	2.0	480.0	960.0	0.0	480.0	0.0	0.0	480.0	0.0	0.0	480.0	0.0
Thresher	Hour	0.0	490.0	0.0	2.0	490.0	980.0	0.0	490.0	0.0	0.0	490.0	0.0	0.0	490.0	0.0
Total Cost				8,720.8			9,792.0			7,387.0			2,435.0			3,208.0

DAP = diammonium phosphate, kg = kilogram, NRs = Nepalese Rupees, t = metric tons.

Sources: Ministry of Agriculture and Cooperatives. 2005. *Statistical Information on Nepalese Agriculture*. Kathmandu; Project Completion Review Mission Field Survey, September–October 2005.

Table A7.5b2: Farm Model of Inputs per Hectare: Financial Costs with Project
(Physical Inputs and Production Costs)

Item		Financial Costs (constant 2004 NRs)														
		Potato			Sugarcane			Early Paddy			Spring Maize			Vegetables		
		Quantity	Price	Total	Q'ty	Price	Total	Q'ty	Price	Total	Q'ty	Price	Total	Q'ty	Price	Total
Irrigated Areas																
Seed	kg	1,742.0	19.0	33,098.0	5,904.0	1.8	10,627.2	46.0	18.0	828.0	118.0	11.7	1,380.6	0.4	3,699.0	1,452.0
Urea	kg	46.0	18.0	828.0	52.0	18.0	936.0	32.0	18.0	576.0	37.0	18.0	666.0	47.0	18.0	846.0
DAP	kg	32.0	29.0	928.0	59.0	29.0	1,711.0	20.0	29.0	580.0	37.0	29.0	1,073.0	33.0	29.0	957.0
Potash	kg	15.0	14.0	210.0	33.0	14.0	462.0	9.0	14.0	126.0	18.0	14.0	252.0	19.0	14.0	266.0
Manure	t	1.3	840.0	1,092.0	3.3	840.0	2,772.0	0.6	840.0	504.0	3.0	840.0	2,520.0	3.7	840.0	3,108.0
Miscellaneous	NRs	3.0	150.0	450.0	11.0	150.0	1,650.0	3.0	150.0	450.0	2.0	150.0	300.0	14.0	150.0	2,100.0
Irrigation	NRs	96.0	1.0	96.0	89.0	1.0	89.0	106.0	1.0	106.0	81.0	1.0	81.0	98.0	1.0	98.0
Labor	person-day	121.0	0.0	0.0	81.0	0.0	0.0	69.0	0.0	0.0	118.0	0.0	0.0	211.0	0.0	0.0
Bullock	day	16.0	150.0	2,400.0	0.0	150.0	0.0	8.0	150.0	1,200.0	21.0	150.0	3,150.0	18.0	150.0	2,700.0
Tractor	hour	0.0	480.0	0.0	4.0	480.0	1,920.0	2.0	480.0	960.0	0.0	480.0	0.0	2.0	480.0	960.0
Thresher	hour	0.0	490.0	0.0	0.0	490.0	0.0	0.0	490.0	0.0	0.0	490.0	0.0	0.0	490.0	0.0
Total Cost				39,102.0			20,167.2			5,330.0			9,422.6			12,487.0
Partially Irrigated Areas																
Seed	kg	1,742.0	19.0	33,098.0	5,904.0	1.8	10,627.2	46.0	18.0	828.0	118.0	11.7	1,380.6	0.4	3,699.0	1,452.0
Urea	kg	46.0	18.0	828.0	52.0	18.0	936.0	32.0	18.0	576.0	37.0	18.0	666.0	47.0	18.0	846.0
DAP	kg	32.0	29.0	928.0	59.0	29.0	1,711.0	20.0	29.0	580.0	37.0	29.0	1,073.0	33.0	29.0	957.0
Potash	kg	15.0	14.0	210.0	33.0	14.0	462.0	9.0	14.0	126.0	18.0	14.0	252.0	19.0	14.0	266.0
Manure	t	1.3	840.0	1,092.0	3.3	840.0	2,772.0	0.6	840.0	504.0	3.0	840.0	2,520.0	3.7	840.0	3,108.0
Miscellaneous	NRs	3.0	150.0	450.0	11.0	150.0	1,650.0	3.0	150.0	450.0	2.0	150.0	300.0	14.0	150.0	2,100.0
Irrigation	NRs	96.0	1.0	96.0	89.0	1.0	89.0	106.0	1.0	106.0	81.0	1.0	81.0	98.0	1.0	98.0
Labor	person-day	121.0	0.0	0.0	81.0	0.0	0.0	69.0	0.0	0.0	118.0	0.0	0.0	211.0	0.0	0.0
Bullock	day	16.0	150.0	2,400.0	0.0	150.0	0.0	8.0	150.0	1,200.0	21.0	150.0	3,150.0	18.0	150.0	2,700.0
Tractor	hour	0.0	480.0	0.0	4.0	480.0	1,920.0	2.0	480.0	960.0	0.0	480.0	0.0	2.0	480.0	960.0
Thresher	hour	0.0	490.0	0.0	0.0	490.0	0.0	0.0	490.0	0.0	0.0	490.0	0.0	0.0	490.0	0.0
Total Cost				39,102.0			20,167.2			5,330.0			9,422.6			12,487.0

NRs = Nepalese rupees, Q'ty = quantity, kg = kilogram, t = metric ton.

Sources: Ministry of Agriculture and Cooperatives. 2005. *Statistical Information on Nepalese Agriculture*. Kathmandu; Project Completion Review Mission Field Survey, September–October 2005.

Table A7.6a: Net Crop Revenue Without Project (NRs)

Crop	Irrigated					Partly Irrigated		
	Yield t/ha	Price	Gross Revenue	Prod. Cost	Net Revenue	Yield t/ha	Price	Prod. Cost
Financial Net Crop Revenue/ha (constant 2004 NRs)								
Paddy	2.6	9.0	23,400.0	6,987.5	16,412.5	0.0	9.0	6,987.5
Paddy Byproducts	2.1	0.5	1,040.0		1,040.0	0.0	0.5	
Wheat	1.9	8.5	15,980.0	9,267.4	6,712.6	0.0	8.5	9,267.4
Wheat Byproducts	1.7	0.3	496.3		496.3	0.0	0.3	
Maize	1.5	9.0	13,770.0	6,750.0	7,020.0	0.0	9.0	6,750.0
Oilseed	0.7	35.0	22,750.0	4,511.7	18,238.3	0.0	35.0	4,511.7
Pulses	0.7	30.0	21,000.0	3,086.1	17,913.9	0.0	30.0	3,086.1
Potato	8.0	8.0	64,000.0	22,125.0	41,875.0	0.0	8.0	22,125.0
Spring Paddy	2.5	10.0	25,300.0	6,187.5	19,112.5	0.0	10.0	6,187.5
Spring Maize	0.0	9.0	0.0	0.0	0.0	0.0	9.0	0.0
Vegetables	0.0	8.0	0.0	0.0	0.0	0.0	8.0	0.0
Sugarcane	20.0	2.0	40,000.0	16,900.0	23,100.0	0.0	2.0	16,900.0
Economic Net Crop Revenue/ha (2004 prices in constant 2004 NRs)								
Paddy	2.6	11.8	30,729.3	14,607.6	16,121.7	0.0	11.8	14,607.6
Paddy Byproducts	2.1	0.5	1,040.0		1,040.0	0.0	0.5	
Wheat	1.9	16.0	30,037.4	12,739.0	17,298.4	0.0	16.0	12,739.0
Wheat Byproducts	1.7	0.3	496.3		496.3	0.0	0.3	
Maize	1.5	14.3	21,806.1	14,910.5	6,895.7	0.0	14.3	14,910.5
Oilseed	0.7	31.5	20,475.0	6,589.7	13,885.3	0.0	31.5	6,589.7
Pulses	0.7	27.0	18,900.0	4,681.5	14,218.5	0.0	27.0	4,681.5
Potato	8.0	7.2	57,600.0	29,273.5	28,326.5	0.0	7.2	29,273.5
Spring Paddy	2.5	11.8	29,902.0	13,363.8	16,538.2	0.0	11.8	17,516.7
Spring Maize	0.0	14.3	0.0	0.0	0.0	0.0	14.3	0.0
Vegetables	0.0	7.2	0.0	0.0	0.0	0.0	7.2	0.0
Sugarcane	20.0	1.8	36,000.0	26,934.2	9,065.8	0.0	1.8	26,934.2
Economic Net Crop Revenue/ha (2005 prices in constant 2004 NRs)								
Paddy	2.6	10.8	28,010.1	14,325.2	13,685.0	0.0	10.8	14,325.2
Paddy Byproducts	2.1	0.5	1,040.0		1,040.0	0.0	0.5	
Wheat	1.9	14.7	27,549.0	12,406.5	15,142.5	0.0	14.7	12,406.5
Wheat Byproducts	1.7	0.3	496.3		496.3	0.0	0.3	
Maize	1.5	13.3	20,360.7	14,740.9	5,619.8	0.0	13.3	14,740.9
Oilseed	0.7	31.5	20,475.0	6,508.7	13,966.3	0.0	31.5	6,508.7
Pulses	0.7	27.0	18,900.0	4,681.5	14,218.5	0.0	27.0	4,681.5
Potato	8.0	7.2	57,600.0	28,908.8	28,691.2	0.0	7.2	28,908.8
Spring Paddy	2.5	10.8	27,256.0	13,059.3	14,196.7	0.0	10.8	13,059.3
Spring Maize	0.0	13.3	0.0	0.0	0.0	0.0	13.3	0.0
Vegetables	0.0	7.2	0.0	0.0	0.0	0.0	7.2	0.0
Sugarcane	20.0	1.8	36,000.0	26,412.5	9,587.5	0.0	1.8	26,412.5
Economic Net Crop Revenue/ha (2010 prices in constant 2004 NRs)								
Paddy	2.6	11.3	29,257.5	14,309.1	14,948.4	0.0	11.3	14,309.1
Paddy Byproducts	2.1	0.5	1,040.0		1,040.0	0.0	0.5	
Wheat	1.9	15.4	28,936.6	12,387.7	16,548.9	0.0	15.4	11,064.7
Wheat Byproducts	1.7	0.3	496.3		496.3	0.0	0.3	

Crop	Irrigated					Partly Irrigated		
	Yield t/ha	Price	Gross Revenue	Prod. Cost	Net Revenue	Yield t/ha	Price	Prod. Cost
Maize	1.5	13.9	21,221.1	14,733.1	6,488.0	0.0	13.9	14,733.1
Oilseed	0.7	31.5	20,475.0	6,504.8	13,970.2	0.0	31.5	6,504.8
Pulses	0.7	27.0	18,900.0	4,681.5	14,218.5	0.0	27.0	4,681.5
Potato	8.0	7.2	57,600.0	28,889.4	28,710.6	0.0	7.2	28,889.4
Spring Paddy	2.5	10.8	27,256.0	13,041.8	14,214.2	0.0	10.8	13,041.8
Spring Maize	0.0	13.9	0.0	0.0	0.0	0.0	13.9	0.0
Vegetables	0.0	7.2	0.0	0.0	0.0	0.0	7.2	0.0
Sugarcane	20.0	1.8	36,000.0	26,390.0	9,610.0	0.0	1.8	26,390.0
Economic Net Crop Revenue/ha (2015 prices in constant 2004 NRs)								
Paddy	2.6	11.6	30,089.0	14,303.4	15,785.6	0.0	11.6	14,303.4
Paddy Byproducts	2.1	0.5	1,040.0		1,040.0	0.0	0.5	
Wheat	1.9	15.9	29,861.6	12,381.3	17,480.4	0.0	15.9	12,381.3
Wheat Byproducts	1.7	0.3	496.3		496.3	0.0	0.3	
Maize	1.5	14.3	21,823.3	14,733.5	7,089.8	0.0	14.3	14,733.5
Oilseed	0.7	31.5	20,475.0	6,504.7	13,970.3	0.0	31.5	6,504.7
Pulses	0.7	27.0	18,900.0	4,681.5	14,218.5	0.0	27.0	4,681.5
Potato	8.0	7.2	57,600.0	28,884.7	28,715.3	0.0	7.2	28,884.7
Spring Paddy	2.5	11.6	29,278.9	13,035.3	16,243.6	0.0	11.6	13,035.3
Spring Maize	0.0	14.3	0.0	0.0	0.0	0.0	14.3	0.0
Vegetables	0.0	7.2	0.0	0.0	0.0	0.0	7.2	0.0
Sugarcane	20.0	1.8	36,000.0	26,390.2	9,609.8	0.0	1.8	26,390.2

ha = hectare, prod. = production, t = metric ton.

Sources: Derived from Appendix 7, Tables 5a and 5b.

Table A7.6b: Net Crop Revenue With Project (NRs)

Crop	Irrigated					Partly Irrigated				
	Yield t/ha	Price	Gross Revenue	Prod. Cost	Net Revenue	Yield t/ha	Price	Gross Revenue	Prod. Cost	Net Revenue
Financial Net Crop Revenue/ha										
Paddy	2.9	9.0	25,654.2	8,720.8	16,933.4	1.9	9.0	17,161.7	8,720.8	8440.9
Paddy Byproducts	2.3	0.5	1,140.2		1,140.2	1.5	0.5	762.7		762.7
Wheat	2.3	8.5	19,605.9	9,792.0	9,813.9	1.3	8.5	10,788.0	9,792.0	996.0
Wheat Byproducts	2.0	0.3	608.9		608.9	1.1	0.3	335.1		335.1
Maize	2.1	9.0	18,597.6	7,387.0	11,210.6		9.0	0.0	7,387.0	0.0
Oilseed	0.7	35.0	23,724.3	2,435.0	21,289.3		35.0	0.0	2,435.0	0.0
Pulses	0.7	30.0	21,920.5	3,208.0	18,712.5		30.0	0.0	3,208.0	0.0
Potato	10.5	8.0	84,321.8	39,102.0	45,219.8		8.0	0.0	39,102.0	0.0
Early Paddy	3.0	10.0	30,105.7	5,330.0	24,775.7		10.0	0.0	5,330.0	0.0
Spring Maize	3.3	9.0	29,813.6	9,422.6	20,391.0	1.8	9.0	15,940.8	9,422.6	6518.2
Vegetables	10.8	8.0	86,091.8	12,487.7	73,604.1		8.0	0.0	12,487.7	0.0
Sugarcane	24.2	2.0	48,476.9	20,167.2	28,309.7		2.0	0.0	20,167.2	0.0
Economic Net Crop Revenue/ha (2004 prices)										
Paddy	2.9	11.8	33,689.5	15,267.7	18,421.8	1.9	11.8	22,537.1	15,186.7	7350.4
Paddy Byproducts	2.3	0.5	1,140.2		1,140.2	1.5	0.5	762.7		762.7
Wheat	2.3	16.0	36,853.0	13,560.9	23,292.1	1.3	16.0	20,278.1	13,493.9	6,784.2
Wheat Byproducts	2.0	0.3	608.9		608.9	1.1	0.3	335.1		335.1
Maize	2.1	14.3	29,451.1	15,465.3	13,985.8	0.0	14.3	0.0	15,376.3	0.0
Oilseed	0.7	31.5	21,351.9	3,685.0	17,666.8	0.0	31.5	0.0	3,596.0	0.0
Pulses	0.7	27.0	19,728.4	4,424.7	15,303.7	0.0	27.0	0.0	4,345.7	0.0
Potato	10.5	7.2	75,889.6	44,463.1	31,426.5	0.0	7.2	0.0	44,367.1	0.0
Spring Paddy	3.0	11.8	35,581.9	10,240.3	25,341.6	0.0	11.8	0.0	10,240.3	0.0
Spring Maize	3.3	14.3	47,212.8	17,808.8	29,404.0	1.8	14.3	25,243.8	17,808.8	7,435.0
Vegetables	10.8	7.2	77,482.6	27,045.5	50,437.1	0.0	7.2	0.0	27,045.5	0.0
Sugarcane	24.2	1.8	43,629.2	26,432.1	17,197.1	0.0	1.8	0.0	26,432.1	0.0
Economic Net Crop Revenue/ha (2005 prices)										
Paddy	2.9	10.8	30,708.4	14,959.8	15,748.6	1.9	10.8	20,542.8	14,959.8	5,583.0
Paddy Byproducts	2.3	0.5	1,140.2		1,140.2	1.5	0.5	762.7		762.7
Wheat	2.3	14.7	33,800.0	13,263.8	20,536.2	1.3	14.7	18,598.2	13,263.8	5,334.4
Wheat Byproducts	2.0	0.3	608.9		608.9	1.1	0.3	335.1		335.1
Maize	2.1	13.3	27,498.9	15,155.1	12,343.8	0.0	13.3	0.0	15,155.1	0.0
Oilseed	0.7	31.5	21,351.9	3,575.0	17,776.9	0.0	31.5	0.0	3,575.0	0.0
Pulses	0.7	27.0	19,728.4	4,424.7	15,303.7	0.0	27.0	0.0	4,424.7	0.0
Potato	10.5	7.2	75,889.6	44,072.9	31,816.7	0.0	7.2	0.0	44,072.9	0.0
Spring Paddy	3.0	10.8	32,433.3	9,980.7	22,452.6	0.0	10.8	0.0	9,980.7	0.0
Spring Maize	3.3	13.3	44,083.3	17,436.7	26,646.5	1.8	13.3	23,570.5	17,436.7	6,133.8
Vegetables	10.8	7.2	77,482.6	26,642.5	50,840.2	0.0	7.2	0.0	26,642.5	0.0

Crop	Irrigated					Partly Irrigated				
	Yield t/ha	Price	Gross Revenue	Prod. Cost	Net Revenue	Yield t/ha	Price	Gross Revenue	Prod. Cost	Net Revenue
Sugarcane	24.2	1.8	43,629.2	25,869.7	17,759.4	0.0	1.8	0.0	25,869.7	0.0
Economic Net Crop Revenue/ha (2010 prices)										
Paddy	2.9	11.3	32,075.9	14,947.1	17,128.8	1.9	11.3	21,457.6	14,947.1	6,510.5
Paddy Byproducts	2.3	0.5	1,140.2		1,140.2	1.5	0.5	762.7		762.7
Wheat	2.3	15.4	35,502.4	13,253.1	22,249.3	1.3	15.4	19,534.9	13,253.1	6,281.8
Wheat Byproducts	2.0	0.3	608.9		608.9	1.1	0.3	335.1		335.1
Maize	2.1	13.9	28,660.9	15,145.0	13,515.9	0.0	13.9	0.0	15,145.0	0.0
Oilseed	0.7	31.5	21,351.9	3,570.3	17,781.6	0.0	31.5	0.0	3,570.3	0.0
Pulses	0.7	27.0	19,728.4	4,424.7	15,303.7	0.0	27.0	0.0	4,424.7	0.0
Potato	10.5	7.2	75,889.6	44,057.8	31,831.8	0.0	7.2	0.0	44,057.8	0.0
Spring Paddy	3.0	10.8	32,433.3	9,969.9	22,463.4	0.0	10.8	0.0	9,969.9	0.0
Spring Maize	3.3	13.3	44,083.3	17,425.7	26,657.6	1.8	13.3	23,570.5	17,425.7	6,144.8
Vegetables	10.8	7.2	77,482.6	26,627.7	50,855.0	0.0	7.2	0.0	26,627.7	0.0
Sugarcane	24.2	1.8	43,629.2	25,855.6	17,773.6	0.0	1.8	0.0	25,855.6	0.0
Economic Net Crop Revenue/ha (2015 prices)										
Paddy	2.9	11.6	32,987.6	14,948.3	18,039.2	1.9	11.6	22,067.5	14,948.3	7,119.1
Paddy Byproducts	2.3	0.5	1,140.2		1,140.2	1.5	0.5	762.7		762.7
Wheat	2.3	15.9	36,637.4	13,256.3	23,381.1	1.3	15.9	20,159.4	13,256.3	6,903.1
Wheat Byproducts	2.0	0.3	608.9		608.9	1.1	0.3	335.1		335.1
Maize	2.1	14.3	29,474.4	15,151.0	14,323.4	0.0	14.3	0.0	15,151.0	0.0
Oilseed	0.7	31.5	21,351.9	3,570.2	17,781.7	0.0	31.5	0.0	3,570.2	0.0
Pulses	0.7	27.0	19,728.4	4,424.7	15,303.7	0.0	27.0	0.0	4,424.7	0.0
Potato	10.5	7.2	75,889.6	44,060.5	31,829.1	0.0	7.2	0.0	44,060.5	0.0
Spring Paddy	3.0	10.8	32,433.3	9,970.5	22,462.8	0.0	10.8	0.0	9,970.5	0.0
Spring Maize	3.3	13.3	44,083.3	17,434.1	26,649.1	1.8	13.3	23,570.5	17,434.1	6,136.4
Vegetables	10.8	7.2	77,482.6	26,631.2	50,851.4	0.0	7.2	0.0	26,631.2	0.0
Sugarcane	24.2	1.8	43,629.2	25,872.2	17,757.0	0.0	1.8	0.0	25,872.2	0.0

ha = hectare, prod. = production, t = metric ton.

Sources: Sources: Derived from Appendix 7, Tables 5a, 5b, 6a, and 6b.

Table A7.7: Net Incremental Crop Revenue, Without Project vs. With Project (NRs)

Crop	Irrigated			Partly Irrigated		
	Net Crop Revenue			Net Crop Revenue		
	Without Project	With Project	Increment	Without Project	With Project	Increment
Financial Net Incremental Crop Revenue/ha (2004 prices)						
Paddy	16,412.5	16,933.4	520.9	0.0	8,440.9	8,440.9
Paddy Byproducts	1,040.0	1,140.2	100.2	0.0	762.7	762.7
Wheat	6,712.6	9,813.9	3,101.3	0.0	996.0	996.0
Wheat Byproducts	496.3	608.9	112.6	0.0	335.1	335.1
Maize	7,020.0	11,210.6	4,190.6	0.0	0.0	0.0
Oilseed	18,238.3	21,289.3	3,051.0	0.0	0.0	0.0
Pulses	17,913.9	18,712.5	798.6	0.0	0.0	0.0
Potato	41,875.0	45,219.8	3,344.8	0.0	0.0	0.0
Spring Paddy	19,112.5	24,775.7	5,663.2	0.0	0.0	0.0
Spring Maize	0.0	20,391.0	20,391.0	0.0	6,518.2	6,518.2
Vegetables	0.0	73,604.1	73,604.1	0.0	0.0	0.0
Sugarcane	23,100.0	28,309.7	5,209.7	0.0	0.0	0.0
Economic Net Crop Revenue/ha (2004 prices)						
Paddy	16,121.7	18,421.8	2,300.1	0.0	7,350.4	7,350.4
Paddy Byproducts	1,040.0	1,140.2	100.2	0.0	762.7	762.7
Wheat	17,298.4	23,292.1	5,993.7	0.0	6,784.2	6,784.2
Wheat Byproducts	496.3	608.9	112.6	0.0	335.1	335.1
Maize	6,895.7	13,985.8	7,090.1	0.0	0.0	0.0
Oilseed	13,885.3	17,666.8	3,781.6	0.0	0.0	0.0
Pulses	14,218.5	15,303.7	1,085.2	0.0	0.0	0.0
Potato	28,326.5	31,426.5	3,100.0	0.0	0.0	0.0
Spring Paddy	16,538.2	25,341.6	8,803.4	0.0	0.0	0.0
Spring Maize	0.0	29,404.0	29,404.0	0.0	7,435.0	7,435.0
Vegetables	0.0	50,437.1	50,437.1	0.0	0.0	0.0
Sugarcane	9,065.8	17,197.1	8,131.3	0.0	0.0	0.0
Economic Net Crop Revenue/ha (2005 prices)						
Paddy	13,685.0	15,748.6	2,063.6	0.0	5,583.0	5,583.0
Paddy Byproducts	1,040.0	1,140.2	100.2	0.0	762.7	762.7
Wheat	15,142.5	20,536.2	5,393.7	0.0	5,334.4	5,334.4
Wheat Byproducts	496.3	608.9	112.6	0.0	335.1	335.1
Maize	5,619.8	12,343.8	6,724.0	0.0	0.0	0.0
Oilseed	13,966.3	17,776.9	3,810.6	0.0	0.0	0.0
Pulses	14,218.5	15,303.7	1,085.2	0.0	0.0	0.0
Potato	28,691.2	31,816.7	3,125.5	0.0	0.0	0.0
Spring Paddy	14,196.7	22,452.6	8,255.9	0.0	0.0	0.0

Crop	Irrigated			Partly Irrigated		
	Net Crop Revenue			Net Crop Revenue		
	Without Project	With Project	Increment	Without Project	With Project	Increment
Spring Maize	0.0	26,646.5	26,646.5	0.0	6,133.8	6,133.8
Vegetables	0.0	5,0840.2	50,840.2	0.0	0.0	0.0
Sugarcane	9,587.5	17,759.4	8,172.0	0.0	0.0	0.0
Economic Net Crop Revenue/ha (2010 prices)						
Paddy	14,948.4	17,128.8	2,180.4	0.0	6,510.5	6,510.5
Paddy Byproducts	1,040.0	1,140.2	100.2	0.0	762.7	762.7
Wheat	16,548.9	22,249.3	5,700.4	0.0	6,281.8	6,281.8
Wheat Byproducts	496.3	608.9	112.6	0.0	335.1	335.1
Maize	6,488.0	13,515.9	7,027.9	0.0	0.0	0.0
Oilseed	13,970.2	17,781.6	3,811.4	0.0	0.0	0.0
Pulses	14,218.5	15,303.7	1,085.2	0.0	0.0	0.0
Potato	28,710.6	31,831.8	3,121.2	0.0	0.0	0.0
Spring Paddy	14,214.2	22,463.4	8,249.1	0.0	0.0	0.0
Spring Maize	0.0	26,657.6	26,657.6	0.0	6,144.8	6,144.8
Vegetables	0.0	50,855.0	50,855.0	0.0	0.0	0.0
Sugarcane	9,610.0	17,773.6	8,163.6	0.0	0.0	0.0
Economic Net Crop Revenue/ha (2015 prices)						
Paddy	15,785.6	18,039.2	2,253.6	0.0	7,119.1	7,119.1
Paddy Byproducts	1,040.0	1,140.2	100.2	0.0	762.7	762.7
Wheat	17,480.4	23,381.1	5,900.7	0.0	6,903.1	6,903.1
Wheat Byproducts	496.3	608.9	112.6	0.0	335.1	335.1
Maize	7,089.8	14,323.4	7,233.6	0.0	0.0	0.0
Oilseed	13,970.3	17,781.7	3,811.4	0.0	0.0	0.0
Pulses	14,218.5	15,303.7	1,085.2	0.0	0.0	0.0
Potato	28,715.3	31,829.1	3,113.8	0.0	0.0	0.0
Spring Paddy	16,243.6	22,462.8	6,219.2	0.0	0.0	0.0
Spring Maize	0.0	26,649.1	26,649.1	0.0	6,136.4	6,136.4
Vegetables	0.0	50,851.4	50,851.4	0.0	0.0	0.0
Sugarcane	9,609.8	17,757.0	8,147.2	0.0	0.0	0.0

ha = hectare.

Sources: Derived from A7.Tables 5a and 5b, 6a, and 6b.

**Table A7.8: Financial Revenue on a Typical 1 Hectare Farm
(NRs)**

Item	Total Project Area			Amount per 1 ha Farm							
	Project	Without Project		Without Project				With Project		Increment	
		Project	Increment	Net Rev.	Net	Revenue	ha	Net Rev.	Net	ha	Net
				Ha	per ha	Revenue	ha	per ha	Revenue	ha	Revenue
A. Irrigated Area	44,505.0	45,563.0	1,058.0	0.9			0.9			0.0	
Rainy Season Paddy	44,505.0	45,563.0	1,058.0	0.9	17,452.5	15,472.6	0.9	18,073.5	1,6404.1	0.0	931.5
Spring Paddy	941.0	1,360.0	419.0	0.0	20,152.5	377.8	0.0	25,915.9	702.1	0.0	324.3
Wheat	19,865.0	15,350.0	(4,515.0)	0.4	7,208.9	2,852.7	0.3	10,422.9	3,187.1	(0.1)	334.4
Maize	8,650.0	2,260.0	(6,390.0)	0.2	7,020.0	1,209.6	0.0	11,210.6	504.7	(0.1)	(704.9)
Oilseed	2,545.0	4,470.0	1,925.0	0.1	18,238.3	924.6	0.1	21,289.3	1,895.7	0.0	971.0
Pulses	5,670.0	4,850.0	(820.0)	0.1	17,913.9	2,023.3	0.1	18,712.5	1,807.9	0.0	(215.5)
Potato	484.0	2,000.0	1,516.0	0.0	41,875.0	403.7	0.0	45,219.8	1,801.6	0.0	1397.8
Spring Maize	0.0	270.0	270.0	0.0	0.0	0.0	0.0	20,391.0	109.7	0.0	109.7
Vegetables	0.0	335.0	335.0	0.0	0.0	0.0	0.0	73,604.1	491.2	0.0	491.2
Sugarcane	1,350.0	1,700.0	350.0	0.0	23,100.0	621.2	0.0	28,309.7	958.7	0.0	337.5
Total	84,010.0	78,158.0	(5,852.0)	1.7		23,885.6	1.6		27,862.7	[0.1]	3,977.1
B. Partly Irrigated Area	5,695.0	12,400.0	6,705.0	0.1			0.2			0.1	
Monsoon Paddy	0.0	12,400.0	12,400.0	0.0	0.0	0.0	0.2	9,203.6	2,273.4	0.2	2,273.4
Spring Paddy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	762.7	0.0	0.0	0.0
Wheat	0.0	2,000.0	2,000.0	0.0	0.0	0.0	0.0	1,331.1	53.0	0.0	53.0
Maize	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oilseed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pulses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potato	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spring Maize	0.0	150.0	150.0	0.0	0.0	0.0	0.0	6,518.2	19.5	0.0	19.5
Vegetables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sugarcane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	14,550.0	14,550.0	0.0		0.0	0.3		2,345.9	0.3	2,345.9
C. Total Area	50,200.0	57,963.0	7,763.0	1.0			1.2			0.2	
Monsoon Paddy	44,505.0	57,963.0	13,458.0	0.9		15,472.6	1.2		18,677.5	0.3	3,204.9

Item	Total Project Area			Amount per 1 ha Farm					
	Project	Without Project	Increment	Without Project		With Project		Increment	
				Ha	Net Rev. per ha	ha	Net Rev. per ha	ha	Net Revenue
Spring Paddy	941.0	1,360.0	419.0	0.0	377.8	0.0	702.1	0.0	324.3
Wheat	19,865.0	17,350.0	(2,515.0)	0.4	2,852.7	0.3	3,240.1	(0.1)	387.4
Maize	8,650.0	2,260.0	(6,390.0)	0.2	1,209.6	0.0	504.7	(0.1)	(704.9)
Oilseed	2,545.0	4,470.0	1,925.0	0.1	924.6	0.1	1,895.7	0.0	971.0
Pulses	5,670.0	4,850.0	(820.0)	0.1	2,023.3	0.1	1,807.9	0.0	(215.5)
Potato	484.0	2,000.0	1,516.0	0.0	403.7	0.0	1,801.6	0.0	1,397.8
Spring Maize	0.0	420.0	420.0	0.0	0.0	0.0	129.1	0.0	129.1
Vegetables	0.0	335.0	335.0	0.0	0.0	0.0	491.2	0.0	491.2
Sugarcane	1,350.0	1,700.0	350.0	0.0	621.2	0.0	958.7	0.0	337.5
Total	84,010.0	92,708.0	8,698.0	1.7	23,885.6	1.9	30,208.6	0.2	6,323.0
Cropping Intensity (%)	1.7	1.9	0.2	1.7		1.9		0.2	

ha = hectare, () = minus, Rev. = revenue.

Sources: Ministry of Agriculture and Cooperatives. 2005. *Statistical Information on Nepalese Agriculture*. Kathmandu; Department of Irrigation. 2004. *Borrower's Project Completion Report for the Irrigation Management Transfer Project*. Kathmandu; Project Completion Review Mission Field Survey, September–October 2005.

Table A7.9: Distribution of Project Benefits on Incremental Net Crop Revenue

Size of Farm Holding	Percent of Farm Households	Number of Farm Households	Average Land Holding (ha per household)	Incremental Net Revenue on a Typical 1 ha Farm	Incremental Net Revenue Per Household	Incremental Net Revenue All Households		(%)
				(NRs)	(NRs)	(NRs)	(\$)	
Small	69	27,205	0.73	6,323.0	4,623.0	125,768,715	1,724,749	54
Medium	25	9,857	1.30	6,323.0	8,205.6	80,882,599	1,109,196	35
Large	6	2,366	1.77	6,323.0	11,191.6	26,479,362	363,218	11
		39,428				233,130,640	3,197,074	100

ha = hectare, NRs = Nepalese Rupees.

Sources: Department of Irrigation. 2004. *Borrower's Project Completion Report for the Irrigation Management Transfer Project*. Kathmandu; Project Completion Review Mission Field Survey, September–October 2005.

Table A7.10: No. of Households, Total Population, Farm Size and Income Level in the Project Area

Subprojects	Number of Households	Total Population	Average Farm Size (ha)	Family Income (NRs/yr)	Per Capita Income (NRs/yr)	Family Income (NRs/yr)	Increment	% Increase in Household Income
Panchkanya	1,612	9,672	0	11,244	1,874	9,957	1,287	11
Chandra Canal	7,153	42,918	1	31,518	5,253	29,488	2,030	6
Khageri	5,726	34,356	1	19,203	3,201	9,896	9,307	48
West Gandak ¹	9,900	49,500	1	38,066	7,613	16,595	21,471	56
Pathraiya	1,050	6,300	2	50,348	8,391	32,703	17,645	35
Hardinath	9,00	5,400	2	57,061	9,510	17,000	40,061	70
Manusmara	3,894	23,364	1	40,340	6,723	29,181	11,159	28
Kamala	15,465	92,790	1	28,324	4,721	27,253	1,071	4
Banganga	7,500	45,000	1	22,757	3,793	13,877	8,880	39
Mohana	1,140	6,840	2	52,997	8,833	32,703	20,294	38
Chaurjahari	0	0	0	0	0	13,352	[13,352]	
Total	54,340	316,140						

ha = hectare, , () = minus, NRs = Nepalese Rupees, yr = year.

¹ West Gandak includes the command area of Piparpati (1000 ha) and Parsauni (600 ha)

Sources: SAGUN. 2005. *Cumulative Progress on Income, Employment Generation and Capacity Building through the Irrigation Management Transfer Project*. Kathmandu; Department of Irrigation. 2004. *Borrower's Project Completion Report for the Irrigation Management Transfer Project*. Kathmandu.; Project Completion Review Mission Field Survey, September–October 2005.

Table A7.11: Physical Output for a Typical One Hectare Farm and the Project

Item	Without	With	Increment	Ha	Without Project			Ha	With Project			Ha	Increment	
	Project	Project			Yield per ha (t)	Typical 1 ha Farm Output (t)	Total Project Area Output (t)		Yield per ha (t)	Typical 1 ha Farm Output (t)	Total Project Area Output (t)		Typical Farm Output (t)	Total Project Area Output (t)
A. Irrigated Area	44,505.00	45,563.00	1,058.00	0.89				0.91				0.02		
Rainy Season Paddy	44,505.00	45,563.00	1,058.00	0.89	2.60	2.31	115,713.00	0.91	2.85	2.59	129,875.63	0.02	0.28	14,162.63
Spring Paddy	941.00	1,360.00	419.00	0.02	2.53	0.05	2,380.73	0.03	3.01	0.08	4,094.38	0.01	0.03	1,713.65
Wheat	19,865.00	15,350.00	(4,515.00)	0.40	1.88	0.74	37,346.20	0.31	2.31	0.71	35,406.00	0.09	(0.04)	(1,940.20)
Maize	8,650.00	2,260.00	(6,390.00)	0.17	1.53	0.26	13,234.50	0.05	2.07	0.09	4,670.06	0.13	(0.17)	(8,564.44)
Oilseed	2,545.00	4,470.00	1,925.00	0.05	0.65	0.03	1,654.25	0.09	0.68	0.06	3,029.93	0.04	0.03	1,375.68
Pulses	5,670.00	4,850.00	(820.00)	0.11	0.70	0.08	3,969.00	0.10	0.73	0.07	3,543.81	0.02	(0.01)	(425.19)
Potato	484.00	2,000.00	1,516.00	0.01	8.00	0.08	3,872.00	0.04	10.54	0.42	21,080.44	0.03	0.34	17,208.44
Spring Maize	0.00	270.00	270.00	0.00	0.00	0.00	0.00	0.01	3.31	0.02	894.41	0.01	0.02	894.41
Vegetables	0.00	335.00	335.00	0.00	0.00	0.00	0.00	0.01	10.76	0.07	3,605.10	0.01	0.07	3,605.10
Sugarcane	1,350.00	1,700.00	350.00	0.03	20.00	0.54	27,000.00	0.03	24.24	0.82	41,205.34	0.01	0.28	14,205.34
Total A	84,010.00	78,158.00	(5852.00)	1.67				1.56						42,235.42
B. Partly Irrigated Areas	5,695.00	12,400.00	6,705.00	0.11				0.25				0.13		
Monsoon Paddy	0.00	12,400.00	12,400.00	0.00	0.00	0.00	0.00	0.25	1.91	0.47	2,3645.00	0.25	1.91	23,645.00
Spring Paddy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wheat	0.00	2,000.00	2,000.00	0.00	0.00	0.00	0.00	0.04	1.27	0.05	2,538.35	0.04	0.05	2,538.35
Maize	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oilseed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pulses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potato	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Spring Maize	0.00	150.00	150.00	0.00		0.00	0.00	0.00	1.77	0.01	265.68	0.00	0.01	265.68
Vegetables	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sugarcane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total B	0.00	14,550.00	14,550.00	0.00			0.00	0.29						26,183.35

Item	Without	With	Increment	Ha	Without Project			Ha	With Project			Ha	Increment	
	Project	Project			Yield per ha (t)	Typical 1 ha Farm Output (t)	Total Project Area Output (t)		Yield per ha (t)	Typical 1 ha Farm Output (t)	Total Project Area Output (t)		Typical Farm Output (t)	Total Project Area Output (t)
C. Total Area	50,200.00	57,963.00	7,763.00	1.00				1.15				0.15		
Monsoon Paddy	44,505.00	57,963.00	13,458.00	0.89			115,713.00	1.15		3.06	153,520.62	0.27		37,807.62
Spring Paddy	941.00	1,360.00	419.00	0.02			2,380.73	0.03		0.08	4,094.38	0.01		1,713.65
Wheat	19,865.00	17,350.00	(2,515.00)	0.40			37,346.20	0.35		0.76	37,944.36	[0.05]		598.16
Maize	8,650.00	2,260.00	(6,390.00)	0.17			13,234.50	0.05		0.09	4,670.06	[0.13]		(8,564.44)
Oilseed	2,545.00	4,470.00	1,925.00	0.05			1,654.25	0.09		0.06	3,029.93	0.04		1,375.68
Pulses	5,670.00	4,850.00	(820.00)	0.11			3,969.00	0.10		0.07	3,543.81	[0.02]		(425.19)
Potato	484.00	2,000.00	1,516.00	0.01			3,872.00	0.04		0.42	21,080.44	0.03		17,208.44
Spring Maize	0.00	420.00	420.00	0.00			0.00	0.01		0.02	1,160.09	0.01		1,160.09
Vegetables	0.00	335.00	335.00	0.00			0.00	0.01		0.07	3,605.10	0.01		3,605.10
Sugarcane	1,350.00	1,700.00	350.00	0.03			27,000.00	0.03		0.82	41,205.34	0.01		14,205.34
Total C	84,010.00	92,708.00	8,698.00	1.67				1.85						68,418.77
Cropping Intensity (%)	1.67	1.85	0.18	1.67				1.85						

ha = hectare, () = minus, t = metric ton.

Sources: Ministry of Agriculture and Cooperatives.2005. *Statistical Information on Nepalese Agriculture*. Kathmandu; Project Completion Review Mission Field Survey, September–October 2005.

Table A7.12: Financial Cash Flow

Fiscal Year	Total Loan (\$)	Government & Farmers' Cost (\$)	Institutional Support TA Cost ^a (\$)	Total Investment (\$)	O&M Cost of Civil Works ^b (\$)	Replacement Costs ^c (\$)	Total Costs (\$)	Total Incremental Net Crop Revenue (\$)	Incremental Financial Cash Flow (\$)
1996	742,203.20	148,660.03	400,000.00	1,290,863.50			1,290,863.50		(1,290,863.50)
1997	716,165.20	126,293.70	400,000.00	1,242,458.90			1,242,458.90		(1,242,458.90)
1998	38,4321.10	67,740.50	400,000.00	852,061.60			852,061.60	0.00	(852,061.60)
1999	521,621.30	108,475.8	400,000.00	1,030,097.10			1,030,097.10	0.00	(1,030,097.10)
2000	1,322,274.10	297,369.00	200,000.00	1,819,643.10			1,819,643.10	0.00	(1,819,643.10)
2001	1,419,722.90	763,910.40	211,765.00	2,395,398.30			2,395,398.30	0.00	(2,395,398.30)
2002	713,673.40	703,362.20	571,910.00	198,8945.60			1,988,945.60	0.00	(1,988,945.60)
2003	1,287,447.70	630,345.60	551,020.00	2,468,813.30			2,468,813.30	790,111.50	(1,678,701.80)
2004	1064,853.10	474,469.40	551,020.00	209,0342.50			2,090,342.50	1,975,278.70	(115,063.90)
2005					251,000.00		251,000.00	3,950,557.30	3,699,557.30
2006					251,000.00		251,000.00	4,009,815.70	3,758,815.70
2007					251,000.00		251,000.00	4,069,074.10	3,818,074.10
2008					251,000.00		251,000.00	4,231,837.00	3,980,837.00
2009					251,000.00	1,506,000.00	175,7000.00	4,422,269.70	2,665,269.70
2010					251,000.00	1,004,000.00	1,255,000.00	4,643,383.20	3,388,383.20
2011					301,200.00		301,200.00	4,643,383.20	4,342,183.20
2012					301,200.00		301,200.00	4,643,383.20	4,342,183.20
2013					301,200.00		301,200.00	4,643,383.20	4,342,183.20
2014					301,200.00		301,200.00	4,643,383.20	4,342,183.20
2015					301,200.00		301,200.00	4,643,383.20	4,342,183.20
								9,180,669.30	
									13.23%

() = minus, FIRR = financial internal rate of return, NPV = net present value, O&M = operation and maintenance, TA = technical assistance.

^a Institutional support granted by the United States Agency for International Development continued until September 2006.

^b O&M of civil works calculated at \$5/ha annually (rising to \$6 after 15 years).

^c Substantial replacement cost at \$50/ha allocated in the 14th and 15th years for structure improvement.

Sources: Project Completion Review Mission, September–October 2005.

Table A7.13: Economical Cash Flow

	Fiscal Year	Total Loan (\$)	Government & Farmers' Cost (\$)	Institutional Support TA Cost (\$)	Total Investment (\$)	O&M Cost of Civil Works (\$)	Replacement Costs (\$)	Total Costs (\$)	Total Incremental Net Crop Revenue (\$)	Incremental Economical Cash Flow (\$)
1.	1996	667,982.90	133,794.30	360,000.00	1,161,777.20			1,161,777.20		(1,161,777.20)
2.	1997	64,4548.70	113,664.30	360,000.00	1,118,213.00			1,118,213.00		(1,118,213.00)
3.	1998	345,889.00	60,966.40	360,000.00	766,855.40			766,855.40	0.00	(766,855.40)
4.	1999	46,9459.20	97,628.20	360,000.00	927,087.40			927,087.40	0.00	(927,087.40)
5.	2000	1,190,046.70	267,632.10	180,000.00	1,637,678.70			1,637,678.70	0.00	(1,637,678.70)
6.	2001	1,277,750.60	687,519.30	190,588.50	2,155,858.50			2,155,858.50	0.00	(2,155,858.50)
7.	2002	642,306.10	633,025.90	514,719.00	1,790,051.00			1,790,051.00	0.00	(1,790,051.00)
8.	2003	1,158,702.90	567,311.00	495,918.00	2,221,931.90			2,221,931.90	937,221.10	(1,284,710.80)
9.	2004	95,367.80	427,022.40	495,918.00	1,881,308.30			1,881,308.30	2,343,052.80	461,744.60
10.	2005					225,900.00		225,900.00	3,892,116.10	3,666,216.10
11.	2006					225,900.00		225,900.00	3,950,497.80	3,724,597.80
12.	2007					225,900.00		225,900.00	4,008,879.60	3,782,979.60
13.	2008					225,900.00		225,900.00	4,169,234.70	3,943,334.70
14.	2009					225,900.00	1,506,000.00	1,731,900.00	4,356,850.30	2,624,950.30
15.	2010					225,900.00	1,004,000.00	1,229,900.00	4,683,578.30	3,453,678.30
16.	2011					271,080.00		271,080.00	4,683,578.30	4,412,498.30
17.	2012					271,080.00		271,080.00	4,683,578.30	4,412,498.30
18.	2013					271,080.00		271,080.00	4,683,578.30	4,412,498.30
19.	2014					271,080.00		271,080.00	4,683,578.30	4,412,498.30
20.	2015					271,080.00		271,080.00	4,769,153.30	4,498,073.30
ENPV at 12%										1,961,478.60
EIRR										15.30

() = minus, EIRR = economic internal rate of return, ENPV = economic net present value, O&M = operation and maintenance.

Source: Project Completion Review Mission, September–October 2005.

Table A7.14 Project Viability Under a Range of Adverse Changes

Scenario	Change	EIRR (%)			Sensitivity Indicator			Switching Value (%)	
			At Formulation			At Completion		At Formulation	At Completion
			Review	Review		Review	Review		
Baseline Case			22	15					
A. Decrease in Project Benefits	(i) 10%		20	13	0.97	5.72			
	(ii) 20%		17	12	1.00	5.50			
	(iii) 52%		10	4	1.04	5.36	52	19	
B. Increase in Project Costs	(i) 10%		20	14	0.88	4.77			
	(ii) 20%		18	12	0.82	4.54			
	(iii) 91%		10	5	0.59	4.37	91	23	
C. Delay in Benefits	(i) 1 yr		17	13					
	(ii) 2 yrs		14	10					
	(iii) 3.3 yrs		10	8					
D. 20% Increase in Project Costs and 2-Year Delay in Benefits			12	8					

EIRR = economic internal rate of return.

Source: Project Completion Review Mission, September–October 2006.

Table A7.15: Summary of Farm Income Analysis

Item	Khageri	Panchakanya	West Gandak	Hardinath	Manusmara	Kamala	Chandra Canal	Banganga	Chaurjahari	Pathraiya	Mohana
Average Farm Size (ha)											
Without the Project	0.73	0.70	1.20	1.40	1.40	1.95	1.95	0.93	0.91	2.20	2.20
With the Project	0.61	0.31	1.26	1.89	1.34	0.94	1.04	0.75	NA	1.67	1.75
Cropping Intensity (%)											
Without the Project	174	204	156	171	183	177	175	138	189	159	149
At Project Completion Review Mission	264	215	164	219	221	133	168	191	(0.00)	174	125
Increment (%)	90	11	8	48	38	(44)	(7)	53	(0.00)	15	(24)
% Change with & without	34	5	5	22	17	(34)	(4)	28	(0.00)	9	(19)
Net Farm Income (NRs/year)											
Without the Project	9,896	9,957	16,595	17,000	29,181	27,253	29,488	13,877	13,352	32,703	32,703
At Project Completion Review Mission	19,203	11,244	38,066	57,061	40,340	28,324	31,518	22,757	(0.00)	50,348	52,997
Increment (%)	9,307	1,287	21,471	40,061	11,159	1,071	2,030	8,880	(0.00)	17,645	20,294
% Change with & without	48	11	56	70	28	4	6	39	(0.00)	35	38
Net Return to Labor (NRs/labor day)											
Without the Project	116	108	162	132	145	109	116	138	90	149	147
At Project Completion Review Mission	160	94	317	476	336	236	263	190	(0.00)	420	442
Increment (%)	44.03	(14.30)	155.22	343.51	191.17	127.03	146.65	51.64	(0.00)	270.56	294.65
% Change with & without	28	(15)	49	72	57	54	56	27	(0.00)	64	67

() = minus, ha = hectare, NRs = Nepalese Rupees.

Source: Department of Irrigation. 2004. *Borrower's Project Completion Report for the Irrigation Management Transfer Project*. Kathmandu; Project Completion Review Mission, September–October 2005.

Table A7.16: Indices of Productivity at Project Appraisal and Completion Review

Commodities	Project Appraisal Target	Project Completion Review Survey
Irrigated Area in Hectares	50,100	45,563
Cropping Intensity in %	197	185
Crop Yield Improvement in %	10–20	10–16
Farm Output in Metric Tons	275,000	273,854
Increase in Net Income per Family in %	20–38	4–70

Sources: ADB. 1994. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Kingdom of Nepal for the Irrigation Management Transfer Project*. Manila; Department of Irrigation. 2004. *Borrower's Project Completion Report for the Irrigation Management Transfer Project*. Kathmandu; Project Completion Review Mission Field Survey, September–October 2005.

OVERALL ASSESSMENT

Criteria used in determining the overall assessment are relevance, effectiveness, efficiency, and sustainability on the basis of the checklists prepared for each criteria.

Criterion	Assessments	Rating (0–3)	Weight (%)	Weighted Rating
Relevance	Relevant	1.6	30	0.48
Effectiveness	Less effective	1.5	25	0.37
Efficiency	Less efficient	1.5	25	0.37
Sustainability	Less likely	1.4	20	0.28
D. Overall Assessment	Partly Successful		100	1.5

Note: To be classified as highly successful, the overall weighted average must be more than 2.7 and none of the four criteria can have a score of less than 2; otherwise, the rating will be downgraded by one level. To be classified as successful, the average must be 1.6–2.7 and no criterion can have a score of less than 1; otherwise, the rating will be downgraded by one level. To be classified as partly successful, the average must be 0.8–1.6 and the number of criteria receiving ratings of less than 1 should not exceed two; otherwise, the lowest rating would be given. To be classified as unsuccessful, the average must be less than 0.8.

Source: Project Completion Review Mission, September–October 2006.