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PROJECT PERFORMANCE ASSESSMENT REPORT

SRI LANKA

NATIONAL IRRIGATION REHABILITATION PROJECT
(CREDIT NO. 2260-CE)

June 1, 2004

Sector and Thematic Evaluation Group
Operations Evaluation Department

Currency Equivalents (annual averages)

Currency Unit = Sri Lanka Rupees (Rs)

1980	US$1.00	Rs 16.5
1981 - 1990	US$1.00	Rs 28.2
1991	US$1.00	Rs 41.4

Abbreviations and Acronyms

ICR	Implementation Completion Report
OED	Operations Evaluation Department
PPAR	Project Performance Assessment Report

Fiscal Year

Government: January 1 – December 31

Director-General, Operations Evaluation	:	Mr. Gregory K. Ingram
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OED Mission: Enhancing development effectiveness through excellence and independence in evaluation.

About this Report

The Operations Evaluation Department assesses the programs and activities of the World Bank for two purposes: first, to ensure the integrity of the Bank's self-evaluation process and to verify that the Bank's work is producing the expected results, and second, to help develop improved directions, policies, and procedures through the dissemination of lessons drawn from experience. As part of this work, OED annually assesses about 25 percent of the Bank's lending operations. In selecting operations for assessment, preference is given to those that are innovative, large, or complex; those that are relevant to upcoming studies or country evaluations; those for which Executive Directors or Bank management have requested assessments; and those that are likely to generate important lessons. The projects, topics, and analytical approaches selected for assessment support larger evaluation studies.

A Project Performance Assessment Report (PPAR) is based on a review of the Implementation Completion Report (a self-evaluation by the responsible Bank department) and fieldwork conducted by OED. To prepare PPARs, OED staff examine project files and other documents, interview operational staff, and in most cases visit the borrowing country for onsite discussions with project staff and beneficiaries. The PPAR thereby seeks to validate and augment the information provided in the ICR, as well as examine issues of special interest to broader OED studies.

Each PPAR is subject to a peer review process and OED management approval. Once cleared internally, the PPAR is reviewed by the responsible Bank department and amended as necessary. The completed PPAR is then sent to the borrower for review; the borrowers' comments are attached to the document that is sent to the Bank's Board of Executive Directors. After an assessment report has been sent to the Board, it is disclosed to the public.

About the OED Rating System

The time-tested evaluation methods used by OED are suited to the broad range of the World Bank's work. The methods offer both rigor and a necessary level of flexibility to adapt to lending instrument, project design, or sectoral approach. OED evaluators all apply the same basic method to arrive at their project ratings. Following is the definition and rating scale used for each evaluation criterion (more information is available on the OED website: http://worldbank.org/oed/eta-mainpage.html).

Relevance of Objectives: The extent to which the project's objectives are consistent with the country's current development priorities and with current Bank country and sectoral assistance strategies and corporate goals (expressed in Poverty Reduction Strategy Papers, Country Assistance Strategies, Sector Strategy Papers, Operational Policies). *Possible ratings:* High, Substantial, Modest, Negligible.

Efficacy: The extent to which the project's objectives were achieved, or expected to be achieved, taking into account their relative importance. *Possible ratings:* High, Substantial, Modest, Negligible.

Efficiency: The extent to which the project achieved, or is expected to achieve, a return higher than the opportunity cost of capital and benefits at least cost compared to alternatives. *Possible ratings:* High, Substantial, Modest, Negligible. This rating is not generally applied to adjustment operations.

Sustainability: The resilience to risk of net benefits flows over time. *Possible ratings:* Highly Likely, Likely, Unlikely, Highly Unlikely, Not Evaluable.

Institutional Development Impact: The extent to which a project improves the ability of a country or region to make more efficient, equitable and sustainable use of its human, financial, and natural resources through: (a) better definition, stability, transparency, enforceability, and predictability of institutional arrangements and/or (b) better alignment of the mission and capacity of an organization with its mandate, which derives from these institutional arrangements. Institutional Development Impact includes both intended and unintended effects of a project. *Possible ratings:* High, Substantial, Modest, Negligible.

Outcome: The extent to which the project's major relevant objectives were achieved, or are expected to be achieved, efficiently. *Possible ratings:* Highly Satisfactory, Satisfactory, Moderately Satisfactory, Moderately Unsatisfactory, Unsatisfactory, Highly Unsatisfactory.

Bank Performance: The extent to which services provided by the Bank ensured quality at entry and supported implementation through appropriate supervision (including ensuring adequate transition arrangements for regular operation of the project). *Possible ratings:* Highly Satisfactory, Satisfactory, Unsatisfactory, Highly Unsatisfactory.

Borrower Performance: The extent to which the borrower assumed ownership and responsibility to ensure quality of preparation and implementation, and complied with covenants and agreements, towards the achievement of development objectives and sustainability. Possible ratings: Highly Satisfactory, Satisfactory, Unsatisfactory, Highly Unsatisfactory.

Contents

This report was prepared by John Heath, who assessed the project in October 2003. The report was peer reviewed by Keith Pitman and edited by William Hurlbut. Rose Gachina provided administrative support.

Principal Ratings

	*ICR**	*ICR Review**	*PPAR*
Outcome	Unsatisfactory	Moderately Unsatisfactory	Unsatisfactory
Sustainability	Unlikely	Unlikely	Unlikely
Institutional Development Impact	Modest	Modest**	Negligible
Bank Performance	Satisfactory	Unsatisfactory	Unsatisfactory
Borrower Performance	Unsatisfactory	Unsatisfactory	Unsatisfactory

* The Implementation Completion Report (ICR) is a self-evaluation by the responsible operational division of the Bank. The ICR Review is an intermediate OED product that seeks to independently verify the findings of the ICR.

** Rated partial in the ICR. OED's ratings database converts this to modest (the current equivalent designation) in the interests of harmonization; but it should be noted that the ICR rates institutional development impact only as a part of the achievement of objectives, differing from current guidelines.

Key Staff Responsible

Project	*Task Manager/Leader*	*Division Chief/ Sector Director*	*Country Director*
Appraisal	H. Van Voorthuizen	Chaim Helman	S. Asanuma
Completion	Nihal Fernando	Ridwan Ali	Mariana Todorova

Preface

This is a Project Performance Assessment Report (PPAR) for the Sri Lanka National Irrigation Rehabilitation Project, for which Credit No. 2260-CE in the amount of US$29.6 million equivalent was approved on June 6, 1991. The credit closed on December 31, 1998, six months later than expected. Final disbursement took place on May 11, 1999 and a balance of US$5.0 million equivalent was canceled.

The PPAR presents the findings of a mission by the Operations Evaluation Department that visited Sri Lanka in October 2003. The mission was conducted by Mr. John R. Heath, assisted by Dr. Sarath Bandara Mananwatte and Dr. Ranjith Dissanayake Wanigaratne (consultants). The findings draw on interviews with beneficiaries, project staff, officials of the Government of Sri Lanka and Bank staff. Also, as a follow-up to the mission, Dr. Dissanayake conducted a survey of farm households in January-February 2004. The collaboration of these persons is gratefully acknowledged, as is the generous financial support received from a Norwegian Trust Fund, without which the survey work would not have been possible.

Following standard OED procedures, the draft PPAR was sent to the borrower for comments before it was finalized. No comments were received.

Summary

This is the Project Performance Assessment Report prepared by the Operations Evaluation Department (OED) on the National Irrigation Rehabilitation Project for which a credit of US$29.6 million equivalent was approved in June 1991 and closed in December 1998, six months behind schedule.

The objective of the project was to stabilize and increase agricultural production and incomes and to raise standards of living through rehabilitation and improved operations and maintenance of existing irrigation schemes. This entailed upgrading the skills of farmers and the staff of implementing agencies and creating viable Farmer Organizations for managing the rehabilitation schemes. The project aimed to rehabilitate about 1,000 minor schemes covering some 25,000 ha and about 60 medium/major schemes (12,500 ha)—comprising about 7 percent of all irrigated land.

The project built on a government program, launched in 1988, to share responsibility for operations and maintenance with farmer organizations. The program was intended to reduce the budget burden of recurrent funding for irrigation, to improve maintenance and to boost productivity of irrigated water and land. The program was an attempt to redress the limited efficiency and low returns to the heavy investment that Sri Lanka made in irrigation in the 1970s and 1980s.

The findings of this report are based on a comprehensive re-evaluation of the economic rate of return to the project and a survey of 120 households from six representative irrigation schemes.

OED rates outcome as unsatisfactory, based on the modest relevance of the project's development objectives, modest progress in achieving those objectives and modest efficiency. Relevance was limited by the failure to address farmer incentives to use water efficiently and the lack of explicit attention to poverty reduction. Progress toward objectives was limited by the lower than expected growth in farm yields, cropping intensity and net farm income. Although the project's re-estimated rate of return, at 10 percent, is about equal to the opportunity cost of capital there were serious deficiencies in the rehabilitation works, reducing cost efficiency.

The project's institutional development impact is rated negligible based on the pre-eminent attention given to the physical aspects of rehabilitation rather than to the strengthening of irrigation agencies, Farmer Organizations, or the incentive framework. Sustainability is rated unlikely owing to design deficiencies in the rehabilitation and the Farmer Organizations' limited success in mobilizing user funding to pay for operations and maintenance.

Bank performance is rated unsatisfactory, in particular, because it failed to ensure that farmers and staff were properly organized and trained before the rehabilitation work began, giving insufficient emphasis to the institutional challenges. Partly for the same reasons but also because of the delay in project start-up, the failure to strengthen provincial irrigation agencies and poor management of cash flow, Borrower performance is also rated unsatisfactory.

These findings suggest two lessons that might be taken into account when the Bank prepares future irrigation projects in Sri Lanka and elsewhere. First, after the economic rationale for rehabilitation has been demonstrated, consideration needs to be given to the supporting policy and institutional changes that must be made to boost and sustain the benefit flow. Measures are needed to provide farmers with incentives to behave as commercial operators and to use water sparingly, in line with its marginal cost.

Second, if farmers are to assume responsibility for operations and maintenance following rehabilitation, they must be fully consulted on the design of the proposed works. The creation of farmer organizations needs to precede rehabilitation, and building the capacity of these organizations—always a slow process—needs to be given no less emphasis than the engineering aspects.

Gregory Ingram
Director-General
Operations Evaluation

Rationale and Approach

1. The implementation completion report (ICR) for the National Irrigation Rehabilitation Project argued that it should be the subject of a "post-project impact evaluation"; a recommendation that was endorsed in OED's June 1999 desk review of the report. The ICR noted that despite the project's unsatisfactory outcome it offered a rich source of learning about the handover of irrigation schemes to farmer organizations. The current evaluation examines whether in the five years since the loan closed the irrigation systems are performing better, and whether farmers are likely to have become better off.

2. Both the project appraisal report and the ICR conducted an economic analysis based on six irrigation schemes (four minor and two medium/major) which are described as representative of all the schemes included in the project (1,034 minor schemes and 34 medium/major schemes had been covered at loan closing). OED re-examined the same six schemes, the main features of which are summarized in Annex A, Table A3. First, the economic rate of return was re-estimated (Annex B). Second, in January-February 2004, following the main mission, a farm and household survey was administered to 120 project beneficiaries drawn from the six schemes (see Annex C for questionnaire). The OED survey was not a formal impact evaluation because the project had neither a baseline survey nor a control group of non-beneficiaries. However, by revisiting the same sample of schemes that were studied at appraisal and completion, this evaluation aimed to establish if circumstances had improved over the last five years. While it was impossible to assess to what extent observed changes are attributable to the project, the evaluation was able to determine if these changes were consistent with the development objectives of the project.

Background—The Low Return to Irrigation in Sri Lanka

3. In 1988, following a decade of field experiments, Sri Lanka became one of the first South Asian countries to endorse the sharing of responsibility for operations and maintenance with farmer organizations. In medium and major schemes (80 ha or larger), the Farmer Organization was made responsible for operations and maintenance below the distributary head, while the public water agency retained control of the headworks and main canals. For minor schemes (under 80 ha), full responsibility for all aspects of operations and maintenance was transferred to the Farmer Organization. The Participatory Irrigation System Management program had the following objectives:

- Relieve the government of the financial burden of funding recurrent expenditures for irrigation;
- Improve the maintenance of irrigation facilities and the irrigation service;
- Enhance the productivity of irrigated land and water; and
- Promote a spirit of self-reliance among farmers in irrigation schemes.[1]

1. N. Abeywickrema, Participatory Management in Sri Lanka's Irrigation Schemes, International Irrigation Management Institute, Colombo, Sri Lanka, 1986; J.D. Brewer, "The participatory irrigation system management policy" Economic Review, Vol. 20, No. 6, 1994, pp. 4-9.

4. About 85 percent of 200 schemes targeted by the government are under participatory management (representing about 15 percent of all irrigation schemes in the country). This program provided the design context for the project that is the subject of this assessment. The following paragraphs summarize key aspects of the broader framework of irrigated agriculture in Sri Lanka.

5. Sri Lanka had a total irrigated area of 659, 000 ha in 2000, or about 35 percent of farmland. More than 75 percent of irrigated land is in the dry zone and is mainly used for highly water-intensive paddy cultivation. Unlike surface water, ground water is a limited resource whose availability has not yet been fully assessed (although it is likely that most of the major aquifers have already been tapped)[2]. The bulk of water demand is met from surface supplies, using an infrastructure that comprises 60 large multi-purpose dams, 260 major irrigation tanks, and about 12,000 minor reservoirs (village tanks). About 85 percent of the water supply is used for irrigated agriculture.

Sri Lanka has invested heavily in irrigation—

6. Successive administrations sought to make the nation self-sufficient in rice and to promote movement of population out of the crowded wet zone of the island to newly-established, irrigated farming communities in the dry zone. From 1980 to 1997, the government spent about SLR 215 billion (at 1996 prices) on developing irrigation infrastructure. But budgets are now more constrained and priorities have shifted. Irrigation outlays declined from 80 percent of agriculture sector spending in the early 1980s to about 40 percent in 2000.[3] The share of new construction in irrigation investments declined from the 80 percent plus that prevailed from 1950 to 1985 to less than one-third by the late 1990s. In 1997 the total investment in irrigation was divided as follows: new works, 28 percent; rehabilitation, 41 percent; operations and maintenance, 11 percent; and private investment 19 percent (Table A1, Annex A).

—but the impact on output and productivity has been disappointing.

7. The combined effect of trade, marketing, technology, land and water policies has been to tie most farm households to low productivity activities—about 90 percent of irrigated land is used to grow paddy. Poor reliability of water delivery and limited access to water by tail-enders, combined with the inadequate supply of agricultural extension and improved technologies, contribute to low crop yields. In many areas in the dry zone, diversification into higher value crops is impeded by water delivery schedules that are designed for paddy cultivation—schedules over which farmers exercise little control. Low productivity depresses farmer incomes—and also raises resistance to the introduction of water charges needed to fund maintenance of the irrigation system.

2. World Bank, Sri Lanka: Promoting Agricultural and Rural Non-farm Sector Growth (Report No. 25387), February 26, 2003, p. 29.

3. World Bank, 2003,ibid., p. 29.

Falling returns from farming have driven the rural population out of agriculture…

8. The percentage share of labor employed in agriculture decreased from 47 percent of total employment in 1990 to 36 percent in 1999; but throughout this decade agricultural productivity per worker stagnated at around SLR 53,000 per year (in constant 1996 prices). In 2000, about 80 percent of the population lived in rural areas but only 23 percent of the mean earnings of rural households came from agriculture. About 45 percent of rural households are dependent on farming (including casual agricultural wage employment). Half of these households are located in the poorest 40 percent of the income distribution. Agriculture in Sri Lanka is becoming increasingly polarized between a small, dynamic sector (fruits, vegetables and spices) and a large, relatively stagnant sector comprising paddy production and tree crops. The dynamic sector accounts for a rising share of GDP and is fueled by domestic (particularly tourist) and export demand. The stagnant sector is associated with stable to declining GDP shares; easing of import restrictions on cereals has reduced the stimulus that these crops receive from domestic demand while their relatively high costs reduce export potential. Much of the irrigated farm area is tied up in paddy; and this sector's share of agricultural GDP declined from 28 percent in 1982-85 to 22 percent in 1996-2000.[4]

Has the experiment in participatory irrigation management helped to address these constraints?

9. The early evidence—based on independent evaluation by the International Water Management Institute— is not encouraging.[5] First, IWMI reports that in schemes where management responsibilities are handed over to Farmer Organizations government spending on operations and maintenance tends to increase in the five-year period after transfer. Second, farmers in schemes that have been handed over do not make increased payments (in cash or kind) after the handover—although they may contribute more labor for canal maintenance. Third, the quality of irrigation service does not improve with handover: farmers report no improvement in the adequacy, timeliness and fairness of water distribution, and no reduction in the incidence of irrigation-related conflicts. Fourth, farmers are frequently dissatisfied with the quality of the government-financed rehabilitation works that are typically a precondition for handover; and not convinced that the functional condition of canal infrastructure improves with handover.

Most importantly, it was found that:

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4. World Bank, 2003, ibid., Executive Summary.

5. The data are drawn from an intensive study of two irrigation schemes (Nachchaduwa and Hakwatuna Oya) and from an extensive survey of 50 randomly selected schemes from four districts (Anuradhapura, Kurunegala, Moneragala and Hambantota) where major and medium irrigation schemes are concentrated. (None of these schemes were included in the National Irrigation Rehabilitation Project but the findings are probably still broadly relevant).(M. Samad and D. Vermillion, Assessment of Participatory Management of Irrigation Schemes in Sri Lanka, Research Report No. 34, International Water Management Institute, Colombo, 1999).

> "Management transfer alone did not result in significant improvements in agricultural production levels or the gross value of agricultural production per unit of land or per unit of water diverted. Neither did rehabilitation alone create significant effects. However, in schemes where both management transfer and rehabilitation have occurred, significant effects on agricultural productivity levels and economic returns were observed".[6]

10. This assessment considers whether the project in question bears out these earlier findings about the impact of rehabilitation and management transfer.

Project Objectives and Design

11. A detailed description of project features is given in Table A2 (Annex A).

12. The main objective of the National Irrigation Rehabilitation Project was to stabilize and increase agricultural production and incomes and to raise the standards of living through rehabilitation and improved operations and maintenance of existing irrigation schemes. Subsidiary objectives included (a) upgrading the skills of farmers and the staff of the implementing agencies, and (b) creating viable Farmer Organizations for managing the rehabilitation schemes.

13. The project aimed to rehabilitate about 1,000 minor schemes covering some 25,000 ha and about 60 medium/major schemes (12,500 ha), covering 7 percent of the total irrigated area as of 1990. Before any scheme could be rehabilitated the relevant Farmer Organization had to agree that:

- With respect to minor schemes, the full cost of operations and maintenance would be borne by the Organization once rehabilitation was complete;
- With respect to the medium/major schemes, the full cost of operations and maintenance for distributary and field canals would be met by the Organization immediately after rehabilitation, with costs for operating and maintaining headworks and main canals beginning to be recovered from the Organization two years after rehabilitation.

Relevance

14. The project's objectives were consistent with the strategy of Bank and Borrower when the project was appraised. A major Bank economic report of 1988 argued that the emphasis given to irrigation in the country's development plans should be reconsidered. Faced with the evidence of low rates of return on investments in new irrigation schemes, the report recommended that the share of irrigation/resettlement in future public investment programs be reduced substantially and that future investment concentrate on high return projects in rehabilitation and upgrading of existing irrigation schemes.

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6. Samad and Vermillion, 1999, ibid., p. 27.

15. This recommendation was embodied in the design of the National Irrigation Rehabilitation Project—building on the earlier Village Irrigation Rehabilitation Project. The summary of government strategy in the appraisal report focused on the need to preserve and make optimal use of existing irrigation infrastructure in the short and medium term. The Bank's project rationale ignored the sunk costs argument: it justified fresh investment on the grounds that the returns to past investment were worth protecting—without rigorously examining alternatives that might have offered higher returns.

16. OED measures relevance in terms of current strategy, not the strategy when the project was appraised. The key issue is whether, by the standards of today, the project's development objectives, as formulated during implementation, responded to a problem that was meaningful at that time, and whether the nature of that response was appropriate.

17. The current strategy of Bank and Borrower emphasizes (a) efficient management of water (which includes applying prices that reflect the scarcity of the resource) and (b) reduction of poverty. These were also key issues when the project was designed and implemented. The project responded to these objectives in a way that was only partly relevant. Transferring management to Farmer Organizations was, in principle, a way of increasing efficiency. But it was only half the answer; the other half had to do with correcting the trade and taxation regime to provide farmers with an incentive to get the highest possible return to their use of irrigation water. The project did not address the rice bias, failing to question the logic of government price support and input subsidies.

18. Second, there are equity considerations that the Bank's strategy did not address. Government support to the domestic price of paddy—the wedge between domestic and world market price exceeding 20 percent, equivalent to 2 percent of GDP—benefited larger producers, discriminating against poorer farmers and rural workers, many of whom were net buyers of rice. Indeed, around the time the project was designed, it was estimated that 84 percent of rural households purchased more rice than they sold.[7] Most families would be obliged to sell rice at harvest time (because of immediate cash needs or the lack of on-farm storage) and then buy back later in the year at much higher prices. An irrigation rehabilitation project would need to be linked to an appropriately-designed sector adjustment operation if these distributional issues were to be effectively tackled. This did not happen.

Based on these considerations relevance is rated *modest*.

Efficacy

19. According to the ICR, the expected outputs were substantially delivered, and at 90 percent of the anticipated cost. The command area rehabilitated was in line with the target set at appraisal; but fewer medium or major schemes were covered than expected (Table 1). The number of Farmer Organizations created was also broadly consistent with

7. David Sahn, "Food Consumption Patterns and Parameters in Sri Lanka: The Census and Control of Malnutrition", Washington, D.C.: International Food Policy Research Institute, June 1985 (Draft).

expectations, although coverage of the larger schemes is not very clear. About 70 percent of the expected training was delivered.

Table 1. Outputs by Component

COMPONENTS	COSTS (US$ million)		OUTPUTS
	Appraisal Estimate	Actual	
Rehabilitation and improvement works, vehicles & equipment	34.9	31.6	1,048 minor schemes, 105% of appraisal target 34 medium/major schemes, 57% of target 38,390 ha (command area), 102% of target
Farmer Organizations	2.7	2.1	1,255 Organizations, 105% of target (minor schemes)/1
Training and technical assistance	7.4	8.0	172 persons trained overseas, 71% of target; 92,471 person/days of in-country training, 67% of target; 2,367 person/days of technical assistance, 110% of target
Other/2	4.8	3.0	Not Available
TOTAL	49.8	44.7	

Source: Implementation Completion Report.

/1 No target was specified for the number of organizations to be created in medium/major schemes; between the 34 schemes in this category, 207 Organizations were created, each covering part of the network of distributary and field canals.

/2 Institutional support and Studies, Environmental Protection (No output indicators specified).

20. With respect to outcomes, the picture is less promising: the project's main development objectives were not fully achieved.

Objective 1: Raising Farm Output and Incomes (Partially Achieved)

21. According to the ICR, the increase in cropped area was slightly higher than expected but cropping intensity and yields grew by less than the expected amount. The net effect was that paddy output grew in line with appraisal expectations. On the other hand, there was no significant diversification into other (more profitable) field crops. Net annual farm incomes increased by substantially less than appraisal estimates (Table A4, Annex A).

22. OED's 2004 farm survey[8] revisited the same six schemes covered in the appraisal and ICRs and found that cropping intensity and paddy yield were respectively slightly higher and slightly lower than appraisal estimates (Table 2). But the growth of paddy output and the diversification into other field crops were both lower than expected. Net farm income grew by less than the appraisal had forecast. However, this aggregate picture conceals substantial differences between the schemes: three had net farm incomes that much exceeded appraisal estimates, and three did less well than expected (Table A3, Annex A). Both of the two medium/major schemes in the study (Kaltota and Mahagal Wewa) had lower than expected farm income growth.

8. This survey was carried out in January-February 2004, as a follow-up to the main mission which took place in October 2003.

Table 2. Determinants of Farm Income Growth

	Appraisal Estimate (1991)		Survey Results (2004)/a	Change	
	(A)	(B)	(C)	(B)/(A)	(C)/(A)
	Without Project	With Project	With Project		
Cropping intensity (%)	99	146	149	47%	51%
Paddy yield (mt/ha)/b	2.62	3.95	3.87	51%	48%
Paddy output (mt)	4,070	8,087	7,164	99%	76%
OFC Share (%)/c	-	7	4	NA	NA
Net farm income/d	7,857	22,807	16,788	190%	114%

Source: Staff Appraisal Report; Implementation Completion Report; OED Farm Survey, 2004.

Note. See Annex A, Table A3 for details of each of the six schemes.

/a Mean value for six schemes.

/b Main season *(maha*).

/c Share of Other Field Crops in net farm income.

/d '000 Sri Lanka rupees, converted to SLR 1995 values using GDP deflator.

23. The ICR attributed the shortfall in farm output and incomes to a weak incentive framework. The lack of legal title to land and the absence of secure water rights reduces investment by farmers. Also, farms are too small to be economically viable. Household incomes are therefore derived mainly from subsistence-oriented rice production supplemented by off-farm wage earnings. There is little scope for the crop diversification that is necessary if irrigation potential is to be realized.

24. The 2004 survey results partly support this analysis. On the one hand, the mean area owned by farmers is, in each of the six schemes, somewhat larger than assumed at appraisal (Table 3, footnote /a); and none of the 120 farmers interviewed reported that the area owned at the time of the survey was less than that they had owned five years previously—in most cases farm size had remained constant. Also, two-thirds or more of farmers have title to their land; and, with the exception of Kaltota (where 47 percent were untitled five years before), titling appears to have occurred some time ago. Whether or not farmers have secure water rights, a majority report that they are satisfied with the supply of irrigation water that they receive. On the other hand, there is little crop diversification and a significant dependence on other income sources, mainly wage earnings (particularly at Dorakada, which is located on the edge of a town) (Annex A, Table A6). A national household survey in 2000 showed that more than two-thirds of households involved in crop production believe that diversification would boost their income; but these same respondents cite problematic access to credit, water, appropriate inputs, technical assistance and roads as the main obstacles to diversifying.[9]

9. World Bank, Sri Lanka: Promoting Agricultural and Rural Non-farm Sector Growth (Report No. 25387), February 26, 2003, pp. 19-22.

Table 3. Salient Features of Farms in Six Representative Irrigation Schemes

	Kaltota (N=30)	Mahagal Wewa (N=30)	Dorakada Liyadde (N=15)	Kobeigane (N=15)	Mahakiri Ibewa (N=15)	Nittewa (N=15)
Farmland owned (ha)/**a**	0.8	1.8	0.4	1.5	0.8	1.8
Farmers with land title (%)	70.0	90.0	100.0	66.7	100.0	100.0
Farmers "satisfied" or "fairly satisfied" with supply of irrigation water (%)	90.0	60.0	80.0	86.7	100.0	85.7
Share of Other Field Crops in net farm income (%)	--	0.9	60.9	1.1	--	3.5
Share of farm income in net household income/**b** (%)	68.1	54.3	16.4	43.7	41.2	48.6

Source: OED Farm Survey, 2004.

/a The appraisal models assumed the following farm sizes: Kaltota, 0.4 ha; Mahagal Wewa, 1.1 ha; Dorakada Liyadde, 0.2 ha; Kobeigane, 0.2 ha; Mahakiri Ibbewa, 0.4 ha; Nittewa, 0.6 ha (Staff Appraisal Report, Table 5.2, p. 29).

/b "Farm income" refers to income from holdings operated directly by the farmer, as distinct from "Off-Farm Income" (mainly wages received for working for other farmers) and "Non-Farm Income (all income from outside the agriculture sector; mainly wages).

Objective 2: Creating Sound Institutions for Operations and Maintenance (Partially Achieved)

25. Although the number of Farmer Organizations created matched expectations, the completion report presents evidence that they were unlikely to be viable. The Organizations were not created before the rehabilitation works were begun, giving farmers no say in the design. Not surprisingly, most farmers did not provide labor or materials, thus failing to make the envisaged contribution of 10 percent to the total cost of works. There were major flaws in the quality of the works and their environmental appropriateness,[10] weakening sustainability and therefore reducing the prospects for longer-term farmer commitment. Farmer resistance was invoked to explain why the target for handover of operations and maintenance responsibilities to Organizations had only been partially met—64 percent for small schemes, 32 percent for larger schemes—when the project closed. OED was unable to verify what the current status of handover is but was advised that there are still schemes that await transfer.

26. What has changed since? In the 2004 survey, OED found that 14 out of 15 Farmer Organizations in the six schemes had, in principle, assumed responsibility for the cost of operating and maintaining the lower end of the canal network. Each has an irrigation committee which oversees water supply to individual fields—hiring a sluice-gate operator—and mobilizes members' (unpaid) labor for maintaining distributary and field

10. Irrigation tanks in Sri Lanka are generally arrayed in linked cascades, occupying sub-watersheds. The planning, selection and design of the rehabilitation works failed to take into account the water flow between tanks.

canals. Members are summoned to a meeting at the beginning of each season to agree on the cultivation calendar and the attendant chores. Book keeping is rudimentary. It was not possible to obtain accurate information about the financing of works by these Organizations. It was found that farmers pay a token membership fee to the Organization but there is no significant upfront contribution to a fund for financing operations and maintenance. Organizations receive government money for identifying suitable private contractors to carry out rehabilitation works: this takes the form of a commission equal to 5 percent of the value of the rehabilitation contract. In other words, the financing of essential irrigation tasks remains government-driven.

Table A8 (Annex A) shows that a plurality of farmers are either satisfied or fairly satisfied with the Farmer Organization with respect to

- Organizing rehabilitation
- Organizing maintenance
- Supplying farm inputs
- Providing information about the use of funds
- Settling disputes between members.

27. Except at Kaltota, a majority farmers were satisfied or fairly satisfied with the Farmer Organization's role in securing credit. The only area where the dissatisfied contingent dominated (four out of six schemes) was the assistance provided by Organizations with the marketing of paddy.

28. In conclusion, Farmer Organizations can be deemed viable if they are judged solely by their members' satisfaction with the services they provide—but this may simply reflect farmers' very low expectations. The Organizations are not viable in terms of being financially self-sustaining. Probably they do not play a significant role in promoting the efficiency or profitability of farming. The 2004 survey showed that only 16 percent of farmers received an income from the sale of farm produce that exceeded income from all other sources; five years previously the proportion was 14 percent (Table A8, Annex A). This paints a picture of part-time subsistence production, rather than a booming commercial farm economy. Of the six sites, only Dorakada is periurban: much of the off-farm employment involves long-distance migration (including jobs in the army and, for young women—a key source of remittances—domestic service in Middle Eastern countries).

In the light of these findings, efficacy is rated *modest*.

Efficiency

29. The ICR assessed that the project's overall economic rate of return was 14 percent (in the base case), compared to the 31 percent forecast at appraisal. The reduction in benefits is attributed to lower than expected cropping intensity and yields, and the lack of diversification into crops more profitable than rice. Costs were higher than anticipated owing to delayed implementation. But the 14 percent estimate is predicated on adequate maintenance of the works following rehabilitation. The ICR indicated that adequate maintenance was unlikely, given the limited viability of the Farmer Organizations. The

ICR adjusted the rate of return to reflect a 20 percent reduction in production phased over time owing to poor maintenance. This yields a rate of return (10 percent) that is barely equal to the opportunity cost of capital, suggesting that efficiency should be rated modest.

30. This evaluation refers to three new sets of data bearing on the efficiency of the Project. First, Kikuchi and colleagues re-estimated the rate of return as 12 percent, the third highest of the six rehabilitation projects reviewed by the International Water Management Institute.[11] However, the authors caution that they have taken at face value the increase in cropping intensity reported in the completion report; this is "the most critical parameter in determining the benefit flow of this type of project" and they suggest that it was probably overestimated. The completion report says that cropping intensity increased by 6 percent in the minor schemes and 2 percent in the larger schemes.

31. The second data source derives from a re-estimate of the economic rate of return commissioned by OED in 2003. Using the same analytic framework used in the appraisal and ICR, OED derived a rate of return of 18 percent. Cropping intensity showed an increment of 9 percent for the minor schemes and 15 percent for the larger schemes. The higher rate of return is driven not only by increased cropping intensity (13 percent higher than the completion report estimate) but also by the increase in the irrigable area (6 percent higher) and yields (13 percent higher). The net effect is that paddy output is almost one-third higher than estimated at completion (Table 4). The cost side of the equation remained largely unchanged: the cost of works and operations and maintenance used the data in the completion report. There was some increase in labor and farm input costs but this cancels out when offset against a 12 percent increase in paddy price.

Table 4. Economic Rate of Return—Drivers

	Minor Schemes	Medium/Major Schemes	Total or Mean
ICR (1999)			
Irrigable area (ha)	21,250	11,382	32,632
Cropping Intensity (%)	134	168	151
Yield (t/ha)	3.96	3.95	3.96
Paddy output (t)	112,573	75,528	188,101
OED (2003)			
Irrigable area (ha)	22,000	12,721	34,721
Cropping Intensity (%)	150	190	170
Yield (t/ha)	4.04	4.87	4.46
Paddy output (t)	129,281	117,703	246,984

Source: Implementation Completion Report; OED's 2003 re-estimate of the economic rate of return.

32. The third data source is OED's 2004 farm survey, which found a lower than expected increase in cropping intensity and yields (Table 5), consistent with a more modest rate of return than the 2003 re-estimate. Why is there a discrepancy? The 2003

11. M. Kikuchi *et al*., Irrigation Sector in Sri Lanka: Recent Investment Trends and the Development Path Ahead, International Water Management Institute Research Report No. 62, Colombo, 2002, p. 12.

estimate is not based on a simple scaling-up of data collected from the six representative schemes; it adds data from other sources (following the same procedures used in the appraisal and ICRs). The 2004 data are drawn only from the six schemes: these data may not be representative of the whole universe of the project (1,048 minor and 34 medium/major schemes).

Table 5. "With Project" Estimates of Cropping Intensity and Yields: Representative Schemes.

	Kaltota	Mahagal Wewa	Dorakada Liyadde	Kobeigane	Mahakiri Ibewa	Nittewa	Mean
Cropping Intensity (%)							
SAR (1990)/a	200	114	200	118	121	117	145
ICR (1999)/b	168	168	168	119	119	119	144
OED (2003)/c	168	168	176	124	124	124	147
OED (2004)/d	168	132	129	169	98	124	137
Yield (t/ha)/e							
SAR (1990)/a	4.2	4.1	2.5	4.4	4.5	4.0	4.0
ICR (1999)/b	4.0	4.2	3.2	4.9	4.9	4.9	4.4
OED (2003)/c	5.1	4.9	3.6	5.1	5.1	4.6	4.7
OED (2004)/d	5.1	4.0	2.2	3.3	4.8	3.9	3.9

Sources. /a Staff Appraisal Report /b Implementation Completion Report /c OED Re-estimate of Economic Rate of Return /d OED Farm Survey, 2004 /e Main season (*maha*). The OED (2004) data is a three-year (i.e. three *maha*) mean.

33. What of other measures of efficiency? Kiguchi and others show that rehabilitation works under this project had a shorter average gestation period (2.2 years) than works in other projects. Capital costs per hectare were also relatively low (Annex A, Table A5). The project's actual physical costs were 91 percent of the appraisal target; and Bank administrative costs were low in relation to the regional average (Table 6 below).

34. But this does not mean that, overall, the project was cost efficient. At four of the six sites the quality of the works seems to have been low. At Mahakiri Ibbewa and Nittewa OED found significant technical defects in the rehabilitation of tanks and main canals (e.g. closure of an old spillway leading to overtopping of the bund, shoddy cement work). At Mahagalwewa, problems include weak bunds and failure to properly design canals to deliver the required discharge. These defects are said to have reduced farmers' commitment to assuming responsibility for operations and maintenance costs. At Dorakada, six years after handing over the rehabilitated works, the Irrigation Department had to undertake major repairs because the renovated structures had not been robust enough to resist flood damage.

35. All in all, OED judges that the economic rate of return is about the opportunity cost of capital (10 percent). The evidence of low growth in net farm income, low quality of physical works and uncertain financing of maintenance point to an efficiency rating of *modest*.

Outcome

36. Based on the evidence of modest relevance, modest efficacy and modest efficiency, OED guidelines suggest that the project's outcome should be rated *unsatisfactory*, reinstating the rating proposed by the completion report.

Institutional Development Impact

37. The design of the project gave more weight to the physical aspects of rehabilitation rather than to the strengthening of the institutional framework, whether at the government or the water user level. Project components did include the establishment of three support units in the Irrigation Department (to handle dam safety, irrigation management research and civil works quality control) but these did not have a significant impact on the project's operation—or on the broader environment. The ICR notes, for example, that the proposed improvements in quality control were only partially implemented. The control system reported when rehabilitation works were complete but there were inadequate safeguards against low-quality construction.

38. The project raised capacity through training—seeking, for example, to promote the principles of participatory irrigation management—but benefits were largely limited to the Irrigation Department. The completion report states that the Department of Agrarian Services (responsible for minor irrigation schemes) and the Provincial Irrigation Agencies should have been allocated more training opportunities. The lack of field-level trainers limited the scope for transferring skills to farmer representatives and institutional organizers. The general lack of emphasis on institutional development is most clearly manifest in the decision to launch rehabilitation works before consulting Farmer Organizations on design and financing issues. The project's institutional development impact was further limited by the lack of linkage to a broader sector dialogue on the incentive regime and the proper role of government.

39. These factors are consistent with a rating of *negligible* on institutional development impact, rather than the rating of modest given in the completion report.

Sustainability

40. The sustainability of the project investment will be influenced by the quality of the initial works, and the funding of operations and maintenance costs—whether by government or by Farmer Organizations.

41. Reports from various project sites visited by the OED consultant indicate that technical specifications are poor. Also, too little is being spent to sustain irrigation schemes. The life span of a newly-constructed irrigation system is conventionally assumed to be 50 years. It is expected that the desired level of operations and maintenance expenditures maintains the benefit stream from irrigation during this period. But in Sri Lanka new projects rarely survive more than twenty years before they need rehabilitation—and sometimes as little as eleven years. Throughout Sri Lanka, expenditures on operations and maintenance are estimated at around 30-35 percent of the desired level (SLR 1,830 per hectare for major irrigation schemes, SLR 940 per hectare

for minor schemes, both in 1995 prices).[12] The data on how much Farmers Organizations spend on this activity is unreliable. Few Organizations keep a dedicated fund and accounting is not transparent.

42. Users seem to be under-investing in operations and maintenance: this is one message that is common to all the project ICRs. Although over the last decade there has, in principle, been a widespread transfer of this responsibility to Farmers Organizations, the amount that government spends on operations and maintenance has scarcely budged: in 1995 prices, the government spent SLR 0.27 billion in 1990 and SLR 0.26 billion in 1997. Government will probably be less and less inclined to make up the shortfall in user contributions, given the downward trend in the overall irrigation budget. At 1995 prices, public investment in irrigation was SLR 9 billion in 1985, falling to SLR 2 billion by 1997—irrigation's share of total public investment fell from 17 percent to 7 percent.[13]

43. There are two trends that may serve to reduce farmer commitment to paying for operations and maintenance. First, many farmers cannot make a living from their farms; their high dependence on outside work makes it less likely that they will have the means or the time to spend on irrigation. Farmers at the six schemes surveyed by OED in 2004 showed a trend toward increased dependence on off-farm income. Nine percent of households had members who lived at home but worked off-farm for a wage more than three months each year; 23 percent had members who were wage-workers and lived at a distance from home (the relative size of these proportions suggesting that the local economic is not very dynamic). Five years previously the respective proportions were 7 percent and 9 percent.

44. Second, there is another group of farmers who do have the means to invest and have used their savings to install agro-wells and pumps. (Private spending on these items rose, in 1995 prices, from SLR 0.23 billion to SLR 0.44 billion between 1990 and 1997).[14] The OED farm survey found that 10 percent of the 120 farmers interviewed had invested in drip, spray or pump irrigation; based on respondent recall, five years previously only 5 percent were thus equipped. The effect of these improvements is likely to be double-edged. They may make farmers better off (more able to pay for the water they use) but because these investments give them access to an alternative (underground) water supply, farmers may be less inclined to contribute to the upkeep of communal (surface water) infrastructure. This defection of better-off farmers would sap the vitality of the Farmer Organizations. However, the tapping of groundwater for farming is a limited expedient—water tables have already dropped drastically in some areas reducing the availability of drinking water—and long run prospects for farmers hinge on sound management of surface works. These factors lead OED to rate sustainability *unlikely*.

12. M. Kikuchi, et al., Irrigation Sector in Sri Lanka, Research Report No. 62, Colombo, IWMI, 2002, p. 15.

13. Kikuchi, et al., 2002, ibid., Tables 1 and 2, pp. 5-6.

14. Kikuchi, et al., 2002, ibid., Table 1, p. 5.

Bank and Borrower Performance

45. The ICR contains a frank and full discussion of the weaknesses of project preparation and implementation; OED has no fresh evidence to add. The author of the ICR argues that the failure to tackle weak property rights and poor farmer incentives undermined project outcome. Neither the Government nor the Bank adequately addressed the implications of these issues on the project development objectives at the project design, appraisal and during implementation.

46. The cost to the Bank of preparing and supervising the project was lower than the mean for the Region (Table 6).

Table 6. Bank Administrative Cost

	Preparation through Board approval		Supervision through completion	
	US$	Staff weeks	US$ per year	Staff weeks per year
This Project	158,400	96.3	41,410	19.8
South Asia mean	275,500/a	143.6/a	48,500/b	Na

Source: Implementation Completion Report, p. 26; Blue Books, FY1998 and FY1999.

/a Agriculture projects /b All projects.

47. The ICR rates Bank performance satisfactory on project identification and preparation because the project's objectives were consistent with the strategy of the government and the Bank; it rates performance at appraisal as deficient because the Bank failed to ensure that farmers and staff were organized and trained before the rehabilitation work began; and it rates project supervision as partially satisfactory, based partly on the tendency for the Bank to give more weight to the engineering aspects than to policies and institutional development. (The ICR shows that of 415 person-days of supervision, 62 percent were accounted for by irrigation engineers). If these sub-ratings are netted out, an overall verdict of *unsatisfactory* is indicated, contrary to the completion report's rating of Bank Performance as satisfactory.

48. The Borrower is faulted in the ICR for the delay in project start-up, the failure to strengthen provincial irrigation agencies and poor management of cash flow. The project management unit performed poorly in terms of procurement and consultant oversight, failing to ensure that the works were carried out to the necessary specifications and not taking the steps needed to strengthen the Farmer Organizations. The ICR rates Borrower Performance as *unsatisfactory*, a verdict with which OED concurs.

Findings and Lessons

49. OED found that

- With respect to the economic rate of return, there is some discrepancy between the various estimates but all suggest that this is at or just above the opportunity cost of capital; there is substantial variation between the six representative schemes that were studied.

- This suggestion that the project was economically justified must be set in the broader context of a farm economy that is increasingly polarized between a small, dynamic sector and a large, stagnant sector, much of this later devoted to irrigated paddy. There is very limited diversification into higher margin crops; and paddy is grown mainly for subsistence with farmers deriving most of their income from off-farm sources.

- Many of the rehabilitation works were poorly designed and implemented. Farmer Organizations are not are able to finance maintenance from user contributions, and continue to depend on the government; fiscal constraints threaten to reduce the flow of benefits from these schemes.

50. These findings suggest two lessons that might be taken into account when the Bank prepares future irrigation projects in Sri Lanka and elsewhere. *First,* after the economic rationale for rehabilitation has been demonstrated, consideration needs giving to the supporting policy and institutional changes that must be made to boost and sustain the benefit flow. Measures are needed to provide farmers with incentives to behave as commercial operators and to use water sparingly, in line with its marginal cost. Ideally, these measures—policy dialogue or adjustment operations—should precede the financing of rehabilitation works. However, where irrigation works are depreciating rapidly, policy reform may have to proceed on a parallel track. In the case of this project, inadequacies in the policy and institutional framework were not identified at the outset, nor were they tackled during implementation. Even if the irrigation schemes had been rehabilitated effectively, the incentives were not there for farmers to use water efficiently and the intended result of boosting output and income would not have occurred

51. *Second*, if farmers are to assume responsibility for operations and maintenance following rehabilitation, they must be fully consulted on the design of the proposed works. OED's review of the completion report noted that the project had failed to take into account an important "lesson learned" that was cited in the appraisal report: the creation of farmer organizations needs to precede rehabilitation and building the capacity of these organizations—always a slow process—needs to be given no less emphasis than the engineering aspects.

Annex A. Tables

Table A1. Irrigation Investments in Sri Lanka, 1950-1997.

Investment : SLR billion in 1995 prices (Percent of Total)/a					
	Public investment			Private investment/b	Total
	New construction	Rehabilitation	Operations and maintenance		
1950	2.47 (96)	-	0.09 (4)	-	2.56 (100)
1955	2.36 (96)	-	0.11 (4)	-	2.46 (100)
1960	1.54 (83)	-	0.32 (17)	-	1.86 (100)
1965	1.59 (91)	-	0.16 (9)	-	1.75 (100)
1970	2.55 (93)	-	0.20 (7)	-	2.75 (100)
1975	2.86 (89)	0.01 (0)	0.33 (10)	0.02 (1)	3.22 (100)
1980	7.76 (89)	0.58 (7)	0.35 (4)	0.03 (0)	8.71 (100)
1985	7.11 (81)	1.16 (13)	0.40 (5)	0.08 (1)	8.74 (100)
1990	1,73 (63)	0.52 (19)	0.27 (10)	0.23 (8)	2.74 (100)
1995	0.69 (35)	0.61 (31)	0.28 (14)	0.37 (19)	1.96 (100)
1997	0.62 (28)	0.92 (41)	0.26 (11)	0.44 (19)	2.23 (100)

Source : M. Kikuchi et. al., Irrigation Sector in Sri Lanka, (Research Report No. 62), International Water Management Institute, Colombo, Sri Lanka, 2002, Table 1, p. 5.

/a Five-year averages centering on the years shown. /b Investments in agro-wells and irrigation pumps by farmers.

Table A2. National Irrigation Rehabilitation Project—Detailed Features.

Specific Objectives Components	Intended actions Target/	Significant Inputs and Outputs	Initial Outcome
(1) Upgrade irrigation schemes	(a) 1,000 minor schemes (25,000 ha), with cost not to exceed US$750/ha. (b) 60 medium/major schemes (12,500 ha), with ERR at least 15% (c) Complete work on 90 minor schemes (from previous project) (d) FO to bear 10% of upgrade cost. (e) FO to bear 100% of cost of O&M (f) Plan for periodic safety inspection of dams to be submitted by December 1992 (g) 10% of investment cost to be devoted to Northern & Eastern Provinces	Estimated cost, US$31.3 million, actual cost US$29.1 million. Physical targets fully met 1,048 minor schemes upgraded, covering 25,000 ha 34 major schemes upgraded, covering 13,390 ha 483 reservoirs built (cf target of 700) 565 diversions (cf target of 300) In Northeast, 106 minor schemes (3,200 ha) and 1 major scheme (1,640 ha) covered.	Weak development impact Actual ERR 10-14% (cf 31% at appraisal), decline owing to less than expected increases in cropping intensity and yield, implementation delays (reflecting poor ag. policies and farmer incentives), and expected shortfall in maintenance.
(2) Establish viable Farmer Organizations	(a) Create over 1,000 FOs. (b) Appoint IOs, each to serve two adjacent (minor) schemes; or 300 families (for major schemes). (c) Obtain legal recognition of FO. (d) Prepare improved scheme maintenance plans. (e) Demonstrate improved cropping practices (to cover 10% of all schemes).	Estimated cost, US$2.7 million, actual cost US$2.1 million 1,269 FOs registered. 64% of completed minor schemes handed over to FOs. 32% of distributory & feeder canals of major schemes handed over to FOs.	Hand-over of O&M to FOs supply- not demand-driven FOs not financially viable, resistant to bearing O&M costs
(3) Improve skills of staff and farmers	(a) Train staff (243 overseas, 25,242 participant days in country). (b) Train farmer reps (83,949 participant days). (d) Train farmers (29,334 participant days).	Estimated cost, US$2.3 million, actual cost US$1.6 million Staff training (172 overseas, 17,262 participant days in country Farmer reps (62,424 participant days) Farmers (22,785 participant days)	Staff training satisfactory, but training of IOs and farmer reps not satisfactory
(4) Strengthen Irrigation Department	(a) Create Irrigation Research Management Unit. (b) Create Dam Safety Unit. (c) Create Quality Control Unit.	Estimated cost US$3.8 million, actual cost US$3.0 million Quality Control Unit satisfactorily established Irrigation Research MU set up but performance has declined. Dam Safety Unit established in 1994 but not activated.	Government institutions only moderately strengthened
(5) Protect environment	(a) Complete impact assessments for each scheme. (b) Give environmental awareness training to staff and farmers. (c) Monitor silt build up in 50 minor and 5 medium/major schemes (d) Land consolidation study	Estimated cost US$1.0 million, actual cost US$0.0	No progress. Interventions overlooked, watershed approach not adopted.

Source: Implementation Completion Report.

Acronyms: FO Farmers Organization; IO Institutional Organizer O&M Operations and Maintenance

Table A3. Salient Features of the Six Schemes Evaluated

	Scheme					
	Nittewa	Mahakiri Ibbewa	Uggal Kaltota	Mahagal Wewa	Kobegane	Dorakada
District	Anuradhapura	Anuradhapura	Ratnapura	Hambantota	Kurunegala	Kalutara
Scale	Minor	Minor	Major	Medium	Minor	Minor
System	Tank	Tank	Anicut	Tank	Tank	Anicut
N of FOs	1	1	10	1	1	1
Date set up	1993	1990	Around 1990	2003	1992	1991
N of farmers	40	54	809	117	68	56
Handed over?	Yes	Yes	Yes	No	Yes	Yes
Net Irrigable Area (ha)	22	39	819	195	32	17
Pre-project (SAR)						
Farm size (ha)	0.6	0.3	0.4	1.1	0.2	0.2
Cropping intensity (%)	109	98	200	105	100	200
Paddy yield (Maha) (t/ha)	3.6	4.0	3.9	3.9	4.0	2.3
Net farm income (SRL 1995)	14,148	8,329	17,805	31,216	5,038	3,683
OFCs grown?	No	No	No	No	No	No
Without Project (SAR)						
Farm size (ha)	0.6	0.3	0.4	1.1	0.2	0.2
Cropping intensity (%)	77	63	160	77	78	141
Paddy yield (Maha) (t/ha)	2.7	3.1	2.7	2.1	3.1	2.0
Net farm income (SRL 1995)	7,908	3,483	6,737	13,719	2,714	2,022
OFCs grown?	No	No	No	No	No	No
With Project (SAR)						
Farm size (ha)	0.6	0.3	0.4	1.1	0.2	0.2
Cropping intensity (%)	127	118	200	114	118	200
Paddy yield (Maha) (t/ha)	4.0	4.5	4.2	4.1	4.4	2.5
Net farm income (SRL 1995)	16,556	9,865	20,314	38,502	5,981	4,756
OFCs grown?	Yes	Yes	Yes	Yes	Yes	Yes
With Project (ICR)						
Farm size (ha)	0.6	0.3	0.4	1.1	0.2	0.2
Cropping intensity (%)	119	119	168	168	119	168
Paddy yield (Maha) (t/ha)	4.9	4.9	4.0	4.2	4.9	3.2
Net farm income (SRL 1995)	14,541	8,392	10,974	30,177	4,806	3,360
OFCs grown?	No	No	No	No	No	No
With Project (PPAR)						
Farm size (ha)	0.4	0.3	0.6	1.6	0.2	0.2
Cropping intensity (%)	124	124	168	168	124	176
Paddy yield (Maha) (t/ha)	4.6	5.1	5.1	4.9	5.1	3.6
Net farm income (SRL 1995)	7,132	7,765	20,893	50,092	5,111	2,554
OFCs grown?	No	No	No	No	No	No

Source: OED Farm Survey, 2004.

Table A4. Net Farm Income (Sri Lanka Rupees per farm)

	Kaltota	Mahagal Wewa	Doraka Liyadde	Kobeigane	Mahakiri Ibewa	Nittewa
CURRENT PRICES						
SAR (1990)/a						
Without project	4,244	8,643	1,274	1,710	2,194	4,982
With project	12,798	24,256	2,996	3,768	6,215	10,430
ICR (1999)/b						
Without project	13,881	38,199	4,540	5,660	9,757	16,734
With project	15,144	41,644	4,637	6,632	11,581	20,066
OED (2004)	28,655	21,576	11,581	39,244	11,546	60,474
CONSTANT PRICES/c						
SAR Based						
Without project	6,737	13,719	2,022	2,714	3,483	7,908
With project	20,314	38,502	4,756	5,981	9,865	16,556
Percent Change	202%	181%	135%	120%	183%	109%
ICR Based						
Without project	10,058	27,680	3,290	4,101	7,070	12,126
With project	10,974	30,177	3,360	4,806	8,392	14,541
Percent change	9%	9%	2%	17%	19%	20%
OED (2004)	15,003	11,296	6,063	20,547	6,045	31,662
Percent change (over SAR w/o project	123%	-18%	200%	657%	74%	300%

Source: Staff Appraisal Report; Implementation Completion Report; OED Farm Survey.

/a Annex 11, Tables 7 to 12 (pp. 115-120). (P. 29 notes that farm incomes were based on actual December 1990 market prices)

/b Table 9, p. 49. (Note: “Without project” figures are labeled “Present” in the table on p. 39 of the ICR: this is assumed to be an error).

/c Financial prices in sources /a and /b converted into 1995 Sri Lanka rupees, using GDP deflator

Table A5. Rates of Return on Irrigation Rehabilitation Projects in Sri Lanka: National Irrigation Rehabilitation Project (NIRP) Compared to Five Others.

	Major Rehabilitation Projects					
	TIMP	Gal Oya	VIRP	ISMP	MIRP	NIRP
Year commenced	1976	1980	1981	1987	1985	1991
Year completed	1984	1987	1990	1992	1994	1999
Year benefit started accruing	1983	1985	1982	1989	1986	1992
Total benefited area (ha)	12,753	25,000	45,555	70,668	23,817	38,390
Average gestation period (years)	4.0	3.1	3.9	2.5	4.4	2.2
Unit capital cost (SLR '000/ha)						
--Current prices	22.57	18.01	20.27	20.94	42.51	65.83
--1995 prices	131.06	59.84	64.69	38.00	85.57	57.23
Post-project rice yield (kg/ha)	4,000	4,000	3,000	4,000	4,000	4,000
Increase in rice yield due to project	471	471	420	471	471	420
Increase in cropping intensity	0.54	0.59	0.08	0.11	0.20	0.06
Operations and maintenance cost (SLR/ha, 1995 prices)	1,830	1,830	940	1,830	1,830	940
Cost/Benefit Ratio	1.04	0.37	1.09	0.60	1.02	0.88
Internal rate of return (%)	10	26	9	17	10	12

Source: M. Kikuchi et. al., Irrigation Sector in Sri Lanka (Research Report No. 62), International Water Management Institute, Colombo, Sri Lanka, 2002, Table 4 (p. 12) and Annex Table a-5 (p. 41).

Table A6. Household Income

	Mean Income per Household, US$ (Percent of total)					
	Total	On-Farm	Off-Farm	Non-Farm	Paddy	Paddy (Cash income)
Irrigation scheme (N of farmers interviewed)						
Nittewa	2,505	1,353	269	883	1,308	1,213
(N=15)	(100.0)	(54.0)	(10.7)	(35.2)	(52.2)	(48.4)
Mahakiri Ibbewa (N=15)	885	357	70	458	357	317
	(100.0)	(40.3)	(7.9)	(51.8)	(40.3)	(35.8)
Kaltota	916	740	34	142	740	521
(N=30)	(100.0)	(80.8)	(3.7)	(15.5)	(80.8)	(56.9)
Mahagalwewa	953	675	--	278	670	469
(N=30)	(100.0)	(70.8)		(29.2)	(70.3)	(49.2)
Kobegane	1,724	704	164	856	696	424
(N=15)	(100.0)	(40.8)	(9.5)	(49.7)	(40.4)	(24.6)
Dorakada	1,142	487	97	558	158	--
(N=15)	(100.0)	(42.6)	(8.5)	(48.9)	(13.8)	
ALL	1,249	716	84	449	667	487
(N=120)	(100.0)	(57.3)	(6.7)	(35.9)	(53.4)	(39.0)

Source: OED Farm Survey, 2004

* Two seasons, monetary plus non-monetary income except for final column. Exchange rate, June 30, 2003: US$1.00 = 97.18 LKR

Table A7. Irrigation Assessment

	Percent "Satisfied" or "Fairly Satisfied"/a					
Irrigation scheme (N of farmers interviewed)	1.How satisfied are you with the supply of water you receive from the irrigation system?	2.How satisfied are you with the overall design of the irrigation system?*	3.How satisfied are you with the way that irrigation water is shared between farmers in the system?	4.How satisfied are you with the arrangements for maintaining the headworks and canals?	5.How satisfied are you with the arrangements for maintaining distributary and field canals?	6.How satisfied are you with the rehabilitation works that have been carried out in the past five years?
Nittewa (N=15)	85.7	92.3	78.6	85.7	92.9	78.6
Mahakiri Ibbewa (N=15)	--	40.0	82.7	82.7	--	14.3
Kaltota (N=30)	90.0	63.3	73.3	70.0	70.0	43.3
Mahagalwewa (N=30)	60.0	53.3	53.3	55.2	60.0	46.7
Kobegane (N=15)	86.7	82.7	82.7	66.7	66.7	93.3
Dorakada (N=15)	80.0	82.7	80.0	82.7	82.7	93.3
ALL (N=120)	87.5	76.2	73.1	72.0	75.6	57.6

Source: OED Farm Survey, 2004
/a In all there were three response categories: "satisfied", "fairly satisfied" and "not satisfied".
*Headworks, main canal, distributary and field canals.

Table A8. Farmer Organization Assessment

Irrigation scheme (N of farmers interviewed)	Nittewa (N=15)	Mahakiri Ibbewa (N=15)	Kaltota (N=30)	Mahagalwewa (N=30)	Kobegane (N=15)	Dorakada (N=15)	ALL (N=120)
Year FO was legally constituted	1988	1990	1992	?	?	?	NA
Handed over?	Yes	Yes	Yes	No	Yes	Yes	NA
Percent « Satisfied » or « Fairly Satisfied »							
1.How satisfied are you with the job done by the FO in organizing rehabilitation of the irrigation system?	78.6	66.7	82.0	60.0	82.7	92.3	78.0
2.How satisfied are you with the job done by the FO in organizing regular maintenance work?	82.7	100.0	100.0	80.0	100.0	92.3	92.4
3.How satisfied are you with the assistance that the FO provides in supplying farm inputs (e.g. fertilizer, seed)?	80.0	100.0	57.1	56.7	100.0	100.0	78.8
4.How satisfied are you with the assistance that the FO provides in marketing paddy?	--	100.0	43.7	3.3	20.0	100.0	28.6
5.How satisfied are you with the assistance that the FO provides in helping its members get access to credit?	80.0	100.0	47.4	80.0	93.3	100.0	78.9
6.How satisfied are you with the information that the FO provides about the use of funds at its disposal?	80.0	100.0	80.8	90.0	100.0	92.9	89.5
7.How satisfied are you with the FO's ability to help settle disputes between members (e.g. over access to water)?	86.7	100.0	92.9	80.0	92.3	93.3	89.7

/a In all there were three response categories: "satisfied", "fairly satisfied" and "not satisfied".
Source: OED Farm Survey, 2004.

Table A9. Changes in Household Economy Over Past Five Years: Selected Characteristics

	Irrigation schemes (N of farmers interviewed)						
	Nittewa (N=15)	Mahakiri Ibbewa (N=15)	Kaltota (N=30)	Mahagal Wewa (N=30)	Kobegane (N=15)	Dorakada (N=15)	**ALL (N=120)**
Now (Five Years Ago)							
% of farmers unless otherwise indicated							
Use of drip, spray, pump irrigation	20 (13)	-(-)	3 (-)	10 (3)	33 (20)	-(-)	**11 (6)**
Use of improved paddy seed	67 (47)	80 (33)	77 (63)	47 (43)	20 (13)	60 (20)	**59 (37)**
Mean annual volume of fertilizer applied to paddy (kg)/a	789 (873)	125 (122)	323 (315)	1,245 (1,332)	465 (465)	131 (133)	**513 (540)**
Mean paddy yield (t/ha)/b	3.93 (3.69)	4.77 (4.45)	5.11 (3.86)	3.95 (3.97)	3.26 (2.91)	2.22 (1.22)	**3.87 (3.35)**
With formal title to land	100 (87)	100 (80)	70 (53)	90 (87)	67 (67)	100 (100)	**88 (79)**
Mean area farmed (irrigated) (ha)/c	1.82 (1.53)	0.50 (0.46)	0.69 (0.55)	1.14 (1.08)	0.93 (0.93)	0.34 (0.25)	**0.90 (0.80)**
Planting other field crops	20 (7)	- (-)	7 (7)	17 (3)	7 (-)	73 (13)	**21 (5)**
Renting out tractor/plow	13 (13)	7 (7)	7 (3)	7 (7)	20 (7)	13 (7)	**11 (7)**
With family members in wage work >3 mo/yr (living at home)	13 (13)	33 (-)	7 (3)	7 (7)	- (7)	20 (13)	**13 (7)**
With family members in wage work (living at a distance from home)	57 (14)	40 (13)	10 (3)	13 (13)	27 (7)	13 (7)	**27 (9)**
With income from sale of farm produce exceeding income from all other sources	25 (27)	13 (7)	7 (7)	17 (17)	47 (33)	- (-)	**18 (15)**

Source: OED Farm Survey, 2004

/a Total per farm, two seasons, all types of fertilizer.

/b Main season (*maha*), average for three consecutive seasons.

/c Refers to all irrigated land directly operated by the farmer, whether owned, rented in or otherwise received.

Annex B. Re-Estimate of the Economic Rate of Return

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Table 1: Cropping Intensities in Selected Minor Schemes (Tanks)

No.	Name of Tank	Const. Year	District	Farm Families	Irrigable Area (ha)	Cropping Intensity (%) W/O Project	Cropping Intensity (%) With Project	Total Cultivated Area (ha) W/O Project	Total Cultivated Area (ha) With Project
1	Nelugollekade Wewa	1992	Anuradhapura	40	350	83	90	291	315
2	Mahakiri Ibbewa Wewa[1]	1992	Anuradhapura	50	250	100	150	250	375
3	Pethiyannakada Wewa	1992	Anuradhapura	65	525	110	115	578	604
4	Kobeigane Wewa[2]	1992	Kurunegala	68	218	145	170	315	370
5	Karawadeniya Wewa	1992	Kurunegala	60	75	114	125	86	94
6	Thittawela Wewa	1993	Kurunegala	80	238	88	100	209	238
7	Dunupotha Wewa	1993	Kurunegala	44	200	200	200	400	400
8	Aulegama Wewa	1993	Kurunegala	60	100	80	90	80	90
9	Matihakka Wewa	1993	Hambantota	10	88	100	100	88	88
10	Omara Gonawetuna Ara Wewa	1993	Hambantota	40	120	85	100	102	120
	Total				**2163**			**2397**	**2692**

[1] The cropping intensity With Project has increased to 150%

[2] The cropping intensity With Project has increased to 170%

Weighted Cropping Intensity (Without Project)	111%
Weighted Cropping Intensity (With Project)	124%
Incremental Cropping Intensity	14%

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Table 2: Cropping Intensities in Selected Minor Schemes (Anicuts)

No.	Name of Anicut	Const. Year	District	Farm Families	Irrigable Area (ha)	Cropping Intensity (%) W/O Project	Cropping Intensity (%) With Project	Total Cultivated Area (ha) W/O Project	Total Cultivated Area (ha) With Project
1	Dorakada Liyadde Anicut[1]	1992	Kalutara	25	100	187	200	187	300
2	Mahakumbura Anicut	1993	Badulla	30	175	182	192	319	336
3	Ekka Amuna	1993	Kegalle	15	40	200	200	80	80
4	Edanwala Amuna	1993	Kegalle	84	68	200	200	135	135
5	Punmulla Anicut	1993	Ratnapura	68	130	196	196	255	255
6	Halangoda Amuna	1994	Matale	65	250	146	146	365	365
7	Ittawala Anicut	1993	Matara	240	300	130	135	390	405
8	Pallewela Anicut	1993	Badulla	30	68	200	200	135	135
9	Devale Liyadde Anicut	1993	Ratnapura	46	125	142	150	178	188
10	Mitiwalatenna Amuna	1993	Matale	36	68	200	200	135	135
	Total				**1323**			**2178**	**2333**

[1] The irrigable area With Project has increased to 150 ha (by 50%)

Weighted Cropping Intensity (Without Project)	165%
Weighted Cropping Intensity (With Project)	176%
Incremental Cropping Intensity	12%

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Table 3: Paddy Farm Budget
FINANCIAL PRICES (LKR/ha)

Activity	Unit	No. of Units	Unit Cost	Total Cost	No. of Units	Unit Cost	Total Cost
		Without Project				With Project	
1. Material Cost							
Seed	kg	110	18	1,980	103	25	2,575
Base Application (V1)	kg	125	16	2,000			
Urea	kg			0	350	14	4,725
TSP	kg			0	125	14	1,750
MOP	kg			0	125	14	1,688
Weed Control	LKR			625	1	2,125	2,125
Pest Control	LKR			550	1	1,562	1,562
TOTAL	LKR			5,155			14,425
2. Machenary & Equipment							
Tractor (1st, 2nd & 3rd Ploughs)	LKR			4,000	1	7,000	7,000
Tractor for Threshing	LKR			1,500	1	1,250	1,250
Winnowing with Fan	LKR				1	500	500
Transport Produce	LKR				1	400	400
Hire of Spraying Equipment	LKR			750			
TOTAL	LKR			6,250			9,150
3. Labour							
Hired Labour	md	10	150	1,500	10	200	2,000
Family Labour	md	55	150	8,250	55	200	11,000
TOTAL	LKR			9,750			13,000
4. Other	LKR			750			
TOTAL	LKR			750			
Total Production Costs	LKR			21,905			
Total Production Costs[1]	**LKR**			**32,858**			**36,575**

[1] In 2002 prices

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ECONOMIC RE-EVALUATION
Table 4: Paddy Farm Budget
ECONOMIC PRICES[1] (LKR/ha)

Activity	Unit	No. of Units	Unit Cost	Total Cost	No. of Units	Unit Cost	Total Cost
		Without Project			With Project		
1. Material Cost							
Seed	kg	110	16.2	1,782	103	24	2,518
Base Application (V1)	kg	125	14.4	1,800			
Urea	kg			0	350	13	4,621
TSP	kg			0	125	14	1,712
MOP	kg			0	125	13	1,650
Weed Control	LKR			563	1	2,078	2,078
Pest Control	LKR			495	1	1,528	1,528
TOTAL	LKR			4,640			14,107
2. Machenary & Equipment							
Tractor (1st, 2nd & 3rd Ploughs)	LKR			3,600	1	6,846	6,846
Tractor for Threshing	LKR			1,350	1	1,223	1,223
Winnowing with Fan	LKR				1	489	489
Transport Produce	LKR				1	391	391
Hire of Spraying Equipment	LKR			675			
TOTAL	LKR			5,625			8,949
3. Labour							
Hired Labour	md	10	135	1,350	10	196	1,956
Family Labour	md	55	135	7,425	55	196	10,758
TOTAL	LKR			8,775			12,714
4. Other	LKR			675			
TOTAL	LKR			675			
Total Production Costs	LKR			19,715			
Total Production Costs[2]	**LKR**			**29,572**			**35,770**

[1] Standard Conversion Factor of 0.978 was used for 2002 and 0.9 used for 1994 without project prices; [2] In 2002 prices

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Table 5: Yields of Paddy Without and With Project (mt/ha)

Name of Scheme/Type	Without Project		With Project	
	Maha	Yala	Maha	Yala
A. Minor Schemes				
1. Dorakada Liyadde - Anicut	3.00	2.75	3.59	3.08
2. Kobeigane - Tank	4.50	4.25	5.13	4.87
3. Mahakiri Ibbewa - Tank	4.50	4.25	5.13	4.87
4. Nittewa - Tank	3.50	3.25	4.61	3.84
B. Medium/Major Schemes				
1. Kaltota	3.75	3.50	5.13	4.87
2. Mahagal Wewa	3.75	3.50	4.87	4.61

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Table 6: Minor Schemes: Total Project Area and Estimated Paddy Production

	Command Area (ha)	Irrigable Area[1] (ha)	Cropping Intensity[2] (%)	Cultivated Area (ha)	Yields[3] (mt/ha)	Production (mt)
I - Without Project						
Tanks	17,500	14,875	111	16,511	4.04	66,733
Anicuts	7,500	6,375	165	10,519	2.88	30,241
TOTAL	25,000	21,250	138	27,030	3.46	96,974
II - With Project						
Tanks	17,500	14,875	124	18,445	4.74	87,460
Anicuts	7,500	7,125	176	12,540	3.34	41,821
TOTAL	25,000	22,000	150	30,985	4.04	129,281

[1] Estimated at 85% of the Command Area in without project situation under tanks and anicuts and also under tanks tanks with project situation and 95% under anicuts with project situation

[2] As given in Tables 1 and 2

[3] Average rice paddy yield Maha and Yala seasons; based on data given in Table 5

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Table 7: Medium/Major Schemes: Total Project Area and Estimated Paddy Production

	Command Area[1] (ha)	Irrigable Area[2] (ha)	Cropping Intensity[3] (%)	Cultivated Area (ha)	Yields[4] (mt/ha)	Production (mt)
I - Without Project	13,390	11,382	165	18,779	3.63	68,076
II - With Project	13,390	12,721	190	24,169	4.87	117,703

[1] Corresponding to 33 schemes rehabilitated

[2] Estimated at 85% of the Command Area without project situation and 95% with project situation

[3] Average Cropping Intensity based on parameters as used for Anicuts in Table 2

[4] Average rice paddy yields Maha and Yala seasons; based on data given in Table 5

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Table 8: Rice Paddy Production for Selected Farm Models (mt/ha)

	Farm Size (ha)	Cropping Intensity (%)[1] W/O Project	With Project	Cultivated Area W/O Project	With Project	Rice Paddy Yields[1] W/O Project	With Project	Production W/O Project	With Project
A - Medium/Major Schemes									
Kaltota[2]	0.6	165	168	0.66	1.01	3.63	5.00	2.39	5.04
Mahagal Wewa[3]	1.6	165	168	1.82	2.69	3.63	4.74	6.58	12.74
B - Minor Schemes									
Dorakada Liyadde (Anicut)	0.2	165	176	0.33	0.35	2.88	3.34	0.95	1.17
Kobeigane (Tank)	0.2	111	124	0.22	0.25	4.38	5.00	0.97	1.24
Mahakiri Ibbewa (Tank)[4]	0.3	111	124	0.39	0.37	4.38	5.00	1.70	1.86
Nittewa (Tank)[5]	0.4	111	124	0.67	0.50	3.38	4.23	2.25	2.10

[1] As indicated in Tables 1 and 2 for minor and mediun/major schemes respectively

[2] The farm size has increased by 50%

[3] The farm size has increased by 45%

[4] The farm size has decreased by 14%

[5] The farm size has decreased by 33%

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Table 9: Summary of Farm Incomes (LKR)

	Farm gate Price[1] Rs/kg	Production Gross Value[2]		Production Costs[3]		Net Farm Income		Incremental Net Farm Income
		W/O Project	With Project	W/O Project	With Project	W/O Project	With Project	
A - Medium/Major Schemes								
Kaltota	14.63	25,764	73,735	19,518	36,128	6,247	37,608	31,361
Mahagal Wewa	14.63	70,932	186,386	53,821	96,221	17,111	90,165	73,054
B - Minor Schemes								
Dorakada Liyadde (Anicut)	14.63	10,241	17,117	9,759	12,520	482	4,598	4,115
Kobeigane (Tank)	14.63	10,457	18,141	6,506	8,943	3,951	9,199	5,248
Mahakiri Ibbewa (Tank)	14.63	18,326	27,212	11,533	13,235	6,793	13,977	7,184
Nittewa (Taank)	14.63	24,255	30,723	19,813	17,885	4,442	12,838	8,396

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Table 10: Total Project Costs (LKR million)

	1991 Yr 1	1992 Yr 2	1993 Yr 3	1994 Yr 4	1995 Yr 5	1996 Yr 6	1997 Yr 7	1998 Yr 8	1999 Yr 9	Grand Total
Rehabilitation & Improvement	54.5	18.4	49.7	89.7	188.6	391.1	337.0	253.1	253.9	
Farmer Organisation	0	1.4	6.2	10.2	15.1	21.3	23.8	42.2	0	
Training	0	3.2	4.2	4.2	28.9	26.3	21.3	2	0	
Environmental Protection	0	0	0	0	0	0	0	0	0	
Institutional Support & Studies	0	6.8	3.3	7.5	8.6	10.5	33.5	100.3	0	
Technical Assistance	0	19.4	24.0	33.7	32.3	41.8	93.6	122.6	0	
Vehicles & Equipment	0	0.7	14.6	8.1	31.4	47.8	0	40.3	0	
TOTAL	**54.5**	**49.9**	**102.0**	**153.4**	**304.9**	**538.8**	**509.2**	**560.5**	**253.9**	**2527.1**

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Table 11: Inflation Indicies for Local Costs

Year	Wholesale Price (Food) Index	2002=100	LKR Inflator	Derived LKR Inflator
1990	599.2	39	0.4	1.6
1991	649.1	43	0.4	1.6
1992	720.0	47	0.5	1.5
1993	770.4	50	0.5	1.5
1994	760.4	50	0.5	1.5
1995	800.0	52	0.6	1.4
1996	1040.7	68	0.7	1.3
1997	1132.2	74	0.8	1.3
1998	1223.2	80	0.8	1.2
1999	1212.4	79	0.8	1.2
2000	1187.1	78	0.8	1.2
2001	1343.1	88	0.9	1.1
2002	1526.5	100	1.0	1.0

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Table 12: Calculation of Import Parity of Rice

Year	USD/ton[1]	Prevailing Price	F & I	Exchange Rate	C.I.F. Value		Port Handling &	Farm gate price	
		USD/ton	USD	USD=LKR	USD	LKR	Transport[2]	Rice LKR	Paddy LKR
1991	314.0	314.0	25.00	42.58	339.00	14434.62	900.00	15334.62	10427.54
1992	268.2	268.2	5.36	43.83	273.56	11990.31	1067.38	13057.69	8879.23
1993	235.4	235.4	4.71	48.25	240.11	11585.21	1088.61	12673.82	8618.20
1994	267.6	267.6	5.35	49.42	272.95	13489.29	1113.94	14603.23	9930.20
1995	320.8	320.8	6.42	51.25	327.22	16769.82	1156.54	17926.36	12189.92
1996	338.9	338.9	6.78	55.27	345.68	19105.62	1202.35	20307.97	13809.42
1997	330.5	330.5	6.61	58.99	337.11	19886.12	1231.20	21117.32	14359.78
1998	304.2	304.2	6.08	64.59	310.28	20041.24	1264.65	21305.89	14488.00
1999	248.4	248.4	4.97	70.39	253.37	17834.57	1276.07	19110.65	12995.24
2000	202.4	202.4	4.05	75.78	206.45	15644.63	1385.32	17029.95	11580.37
2001	172.8	172.8	3.46	82.00	176.26	14452.99	1409.10	15862.09	10786.22
2002	191.9	191.9	3.84	92.00	195.74	18007.90	1500.95	19508.84	13266.01
2003	199.0	199.0	3.98	96.00	202.98	19486.08	1538.24	21024.32	14296.54
2004-2015	202.0	202.0	4.04	96.00	206.04	19779.84	1541.12	21320.96	14498.25

[1] Based on World Bank Commodity Price Projections, Annual Average & Forecasts as of 2003, October
Thai rice, 5% broken

[2] Calculated based on data from the Fertilizer Secretariat and data obtained from Sri Lanka Customs and dealers

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Table 13: Calculation of Import Parity of Fertilizer

Year	F & I[1]	Exchange	Port	UREA		N (46%)	T S P		P (47%)	M O P		K (60%)
	USD	Rate	Handling &	FOB	Farm gate	Farm gate	FOB	Farm gate	Farm gate	FOB	Farm gate	Farm gate
		USD=LKR	Transport[2]	Price[3]	Price[4]	Price	Price[3]	Price[4]	Price	Price[3]	Price[4]	Price
			LKR/ton	USD/ton	LKR/ton	LKR/kg	USD/t	LKR/t	LKR/kg	USD/t	LKR/t	LKR/kg
1991	25.00	42.58	900.00	241.90	12,264.60	26.66	241.90	12,264.60	26.09	109.00	6,605.72	11.01
1992	25.00	43.83	1015.58	140.00	8,947.53	19.45	166.00	10,087.11	21.46	145.00	9,166.68	15.28
1993	2.61	48.25	1049.81	155.00	9,354.33	20.34	126.00	7,955.08	16.93	110.00	7,183.08	11.97
1994	2.97	49.42	1053.35	145.00	9,065.87	19.71	160.00	9,807.17	20.87	140.00	8,818.77	14.70
1995	4.20	51.25	1125.38	260.00	15,365.63	33.40	210.00	12,803.13	27.24	160.00	10,240.63	17.07
1996	4.23	55.27	1158.74	260.00	16,462.92	35.79	215.00	13,975.77	29.74	160.00	10,935.92	18.23
1997	3.01	58.99	1122.91	146.91	10,666.55	23.19	179.75	12,603.78	26.82	124.50	9,344.59	15.57
1998	2.72	64.59	1136.85	106.35	9,081.84	19.74	177.50	13,677.41	29.10	124.50	10,254.14	17.09
1999	2.55	70.39	1164.64	90.10	8,586.04	18.67	167.39	14,026.48	29.84	124.50	11,007.45	18.35
2000	2.55	75.78	1322.51	119.51	11,471.86	24.94	140.28	13,045.81	27.76	122.00	11,660.55	19.43
2001	2.51	82.00	1364.21	118.06	12,150.65	26.41	135.90	13,613.53	28.96	122.00	12,473.73	20.79
2002	2.44	92.00	1434.80	120.00	13,599.28	29.56	126.00	14,151.28	30.11	120.00	13,599.28	22.67
2003	2.85	96.00	1500.80	160.00	18,034.72	39.21	155.00	17,554.72	37.35	113.00	13,522.72	22.54

[1] Since 1993 the value shown is only the insurance charge which is 0.2% per ton of the C&F value

[2] Since 1993 the value include cost & freight (C&F)

[3] Port handling & transport charge includes the following: unloading charge of LKR 20/mt + insurance 0.002 on C&F value + 2% customs duty + steavedoring charge USD 5.7 per mt + Sri Lanka shipping administrating charge LKR 7,500 + Port development Duty 1% on C&F value + other charges USD 2 per mt

[4] Farm gate price includes the profit margins of both the wholesale and the retail dealers (In 2003 it is LKR 700 for whole sale and LKR 200 for retail dealer per ton

SRI LANKA: NATIONAL IRRIGATION REHABILITATION PROJECT (Cr. 2260-CE)
ECONOMIC RE-EVALUATION

Table 14: Net Incremental Value of Production (LKR million)

	With Project	Without Project
A. Production[1] (mt)		
Minor Schemes	129,281	96,974
Medium/Major Schemes	117,703	68,076
TOTAL	246,984	165,050
B. Economic Price of Rice Paddy[2] (LKR/kg)	13	13
C. Gross Value of Production (LKR million)	3,275	2,189
D. Production Costs/ha[3] (Economic Prices) LKR	36,575	32,858
E. Total Area Cultivated[4] (ha)	57,545	45,809
F. Total Production Costs (Economic Value) LKR million	2,105	1,505
G. Net Value of Production (LKR million)	1,170	683
H. Net Incremental value of Production (LKR million)		487

[1] Tables 6 and 7
[2] Table 12
[3] Tables 3 and 4

SRI LANKA: NATIONAL IRRIGATION REHABILITATION PROJECT (Cr. 2260-CE)
ECONOMIC RE-EVALUATION

Table 15: Economic Rate of Return (ERR)

Cont……ERR

(LKR million)	Yr 1 1991	Yr 2 1992	Yr 3 1993	Yr 4 1994	Yr 5 1995	Yr 6 1996	Yr 7 1997	Yr 8 1998	Yr 9 1999	Yr 10 2000	Yr 11 2001	Yr 12 2002
INVESTMENT COSTS	46.3	42.4	86.7	130.4	259.2	458.0	432.8	476.4	215.8	0	0	0
O&M Costs	5.0	5.0	5.0	5.0	15.4	15.9	16.4	16.6	16.8	17.1	17.3	17.3
NET INCREMENTAL VALUES	0.0	0.0	0.0	0.0	69.6	149.8	224.8	284.1	324.7	365.3	442.7	487.0
	-51.3	-47.4	-91.7	-135.4	-205.0	-324.0	-224.4	-208.9	92.0	348.2	425.4	469.7
	1%											

(LKR million)	Yr 13 2004	Yr 15 2005	Yr 16 2006	Yr 17 2007	Yr 18 2008	Yr 19 2009	Yr 20 2010	Yr 21 2011	Yr 22 2012	Yr 23 2013	Yr 24 2014	Yr 25 2015
INVESTMENT COSTS	0	0	0	0	0	0	0	0	0	0	0	0
O&M Costs	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3
NET INCREMENTAL VALUES	487.0	487.0	487.0	487.0	487.0	487.0	487.0	487.0	487.0	487.0	487.0	487.0
	469.7	469.7	469.7	469.7	469.7	469.7	469.7	469.7	469.7	469.7	469.7	469.7

Annex C. Farm Survey Questionnaire

OED Farm Survey Questionnaire

Note. This instrument should only be applied to households that have been in existence for at least five years. The "household" refers to any persons sleeping together under the same roof and eating from the same pot; it may include persons who are temporarily residing elsewhere (but who are expected to return).

0. Identifiers	
Questionnaire No.	
District	
Village	
Name of Irrigation Scheme	
Date of Interview	
Name of Interviewer	

I. Information about Household Head *(HH)*		
1. Age		
2. Sex		
3. Number of years living on this home lot		
4. How did the HH obtain this home lot? (1=Original settler; 2=Inherited; 3=Purchased; 4=Other)		
II. Household Composition *(Refers only to persons who have lived in the household for at least 9 of the past 12 months)*		
	N of Males	N of Females
Indicate number of persons in each sex/age group		
Below 5 years		
6- 15 Years		
16- 40 Years		
41- 60 Years		
Over 60 Years		
Incapacitated: All ages		
Literate (All those aged 16 years and above)		
Employed (All those aged 16 years and above)		
III. Location of All Children of Household Head not Now Resident *(Refers to persons who have not lived in the household for more than 3 of the past 12 months)*		
	Location of Males	Location of Females
Child 1		
Child 2		
Child 3		
Child 4		
Child 5		
Child 6		

IV. HOUSEHOLD WEALTH INDEX	
CATEGORY	***Mark with "x" all that apply***
A. Housing	
1. Tile or other improved roofing ***plus*** more than four rooms	
2. Tile or other improved roofing, four or less rooms	
3. Thatch or *cadjan* roofing	
B. House Facilities	
1. Refrigerator	
2. Pedestal/Table Fan	
3. Video Deck	
4. TV	
C. Means of Transport	
1. Four-wheel tractor ***and/or*** truck	
2. Two-wheel tractor	
3. Motorcycle	
4. Bicycle	
D. Livestock	
1. Team of two trained buffalo or oxen	
2. Two or more dairy cows	

V. Trends in the Household Economy		
	Now	**Five Years Ago**
1. Does the household have a formal title to any of the land that it farms ***(i.e. one that allows for the household to legally sell this land)***? (Yes/No)		
2. How much land is owned by this household? (ha)		
3. How much land rented in or otherwise received? (ha)		
4. Taking together all the land that is owned, rented in or otherwise received, what is the area under irrigation? (ha)		
5. How much land is land rented out or otherwise given to others? (ha)		
6. What area is planted in paddy during the *maha* season? (ha)		
7. What is the *average* paddy yield (over three *maha* seasons)? (kg/ha)		
8. What area is planted in paddy during the *yala* season? (ha)		
9. What is the *average* paddy yield (over three *yala* seasons)? (kg/ha)		
10. What is the total area planted in other field crops, taking together the *maha* ***plus*** the *yala* seasons? (ha)		

V. (continued)	**NOW**	**Five Years Ago**
11. If livestock are reared, are the milk or any other livestock products produced by the household *sold?* (Yes/No)		
12. How many cows are owned by the household? (N)		
13. Does the household graze the cows it owns on land belonging to other households? (Yes/No)		
14. Does the household use its land to graze cattle belonging to other households? (Yes/No)		
15. Does the household trade in products it does not produce (that is, *buying to sell*)? (Yes/No)		
16. Does the household receive an income from tank-based fishing or aquaculture? (Yes/No)		
17. Does the household receive an income renting out tractors and/or plow teams that it owns (Yes/No)		
18. Do *any* household members spend more than 3 months per year working for a wage in the locality (still residing at home)? (Yes/No)		
19. Do *any* household members spend time working for a wage outside the locality (residing away from the household)? (Yes/No)		
20. Is the income that the household receives from selling the farm products it produces ***larger*** than the income from all other sources (wages, trading etc.)? (Yes/No)		
21. Is fuel for cooking derived ***mainly*** from collecting firewood from common land? (Yes/No)		
22. Has this household experienced crop damage as a result of elephants trampling planted areas? (Yes/No)		

VI. Farm Technology Level*		
	Now	**Five Years Ago***
1. Is the land farmed by the household equipped with ***any*** of the following: drip irrigation; spray irrigation; irrigation pump? (Yes/No)		
2. Does the household have a well on its land? (Yes/No)		
3. What ***proportion*** of the paddy seed used each year (maha ***plus*** yala) is improved? (1=More than 50%; 2=50% or less)		
4. Is the paddy mechanically transplanted/row seeded? (Yes/No)		
5. What is the total volume of fertilizer (all types) applied to paddy cultivation each year (maha ***plus*** yala)? (Kgs)		
6. Are herbicides and/or pesticides applied to paddy cultivation? (Yes/No)		
7. In what percentage of the cultivated area is straw applied as a fertilizer each year (maha **plus** yala) (%)		
8. Are bird roosts installed in the land farmed by household? (Yes/No)		

VII. Assessment of Irrigation			
	Satisfied	**Fairly Satisfied**	**Not Satisfied**
1. How satisfied are you with the supply of water you receive from the irrigation system?			
2. How satisfied are you with the overall design of the irrigation system (headworks, main canal, distributary and field canals)? *			
3. How satisfied are you with the way that irrigation water is shared between farmers in the system?			
4. How satisfied are you with the arrangements for maintaining the headworks and main canals?			
5. How satisfied are you with the arrangements for maintaining distributary and field canals? *			
6. How satisfied are you with the rehabilitation works that have been carried out in the past five years? ***(Leave blank if no such work was done)***			

VIII. Assessment of the Farmer Organization*			
1. Name of Farmer Organization ***(FO)***			
2. Year that FO was legally constituted			
3. Status (1=Handed Over; 2=Not Handed Over)			
	Satisfied	**Fairly Satisfied**	**Not Satisfied**
4. How satisfied are you with the job done by the FO in organizing rehabilitation of the irrigation system? ***(Leave blank if no such work has been conducted over the past five years)***			
5. How satisfied are you with the job done by the FO in organizing regular maintenance work? ***(Leave blank if FO does perform this function)***			
6. How satisfied are you with the assistance that the FO provides in supplying farm inputs (e.g. fertilizer, seed)? ***(Leave blank if FO does not perform this function)***			
7. How satisfied are you with the assistance that the FO provides in marketing paddy? ***(Leave blank if FO does not perform this function)***			
8. How satisfied are you with the assistance that the FO provides in helping its members get access to credit? ***(Leave blank if FO does not perform this function)***			
9. How satisfied are you with the information that the FO provides about the use of funds at its disposal?			
10. How satisfied are you with the FO's ability to help settle disputes between members (e.g. over access to water)?			

IX (i) Incomes (On Farm)			
	Paddy	**OFCs**	**Livestock**
1. Cultivated Area (Ha./ 2-Season)			
2. Production (Bu. /Kilos./ 2-Season)			
3. Amount Sold (kg. /2-Season)			
4. Gross Income (Rs./ 2-Season)			
5. Gross Cash Income (Rs./ 2-Season)			
8. Total Input cost* (Rs./ 2- Season)			
9. Net Income (Rs./ 2-Season)			

IX (ii) Incomes (Off- Farm)	**(Rs./2-Season)**
1. Rentals (from hiring out tractor, thresher, sprayer, buffalo, and leasing out land)	
2. Hiring out labor (farm work)	
3. Other	
4. Costs of repair and maintenance	
5. Other Costs	
5. Gross Cash Income	
6. Net Cash Income	

VI (iii) Incomes (Non- Farm)	**(Rs./Month)**	**(Rs/ 2-Season)**
1.Government Sector employments: Civilian		
2. Government Sector employments: Armed Forces		
3.. Organised Private sector employments		
- Factory Workers		
- Others		
4. Wage work		
5. Self employment		
6. Employment abroad		
7. Other:		
8. Gross Cash Income		
9. Costs		
10.Net Cash Income		

Annex D. Basic Data Sheet

NATIONAL IRRIGATION REHABILITATION PROJECT (CREDIT 2260-CE)

Key Project Data *(amounts in US$ million)*

	Appraisal estimate	*Actual or current estimate*	*Actual as % of appraisal estimate*
Total project costs	29.6	24.6	83
Loan amount	13.2	13.7	104
Cofinancing	7.0	6.4	91
Cancellation	49.8	44.7	90

Cumulative Estimated and Actual Disbursements *(US$ million)*

	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99
Appraisal estimate	2.0	3.9	9.4	15.0	20.6	25.6	29.6	-
Actual	-	2.2	2.7	4.3	7.8	11.3	19.3	24.6
Actual as % of estimate	-	56.4	28.7	28.7	37.9	44.1	65.2	83.1
Date of final disbursement: May 11, 1999								

Project Dates

	Original	*Actual*
Identification/Preparation	September 1989	December 1989/January 1990
Appraisal	February 1990	November/December 1990
Negotiation	August 1990	April 22-25, 1991
Approval		July 24, 1991
Effectiveness		October 21, 1991
Mid-term review		May 1995
Credit closing	June 30, 1998	December 31, 1998

Staff Inputs *(staff weeks)*

	Actual Weeks	*Actual US$000*
Preparation to Appraisal	14.3	33.4
Appraisal	51.1	77.7
Negotiations through Board Approval	30.9	47.3
Supervision	148.2	286.3
Completion	10.0	45.0
Total	158.2	331.3

Mission Data

	Date (month/year)	*No. of persons*	*Specializations represented*	*Performance rating*	
				Implementation status	Development objectives
Identification/ Preparation	December 1989/ January 1990				
Appraisal	November/ December 1990	6	-		
Supervision 1	May 1991	4	IE (2), AE (2)	1	1
Supervision 2	October 1991	5	IE (2), AE (2), T	1	1
Supervision 3	April/May 1992	2	IE (2)	2	1
Supervision 4	September 1992	3	IE (3)	2	1
Supervision 5	March/April 1993	3	IE (2), AE	2	2
Supervision 6	November 1993	2	IE, AE	2	2
Supervision 7	July 1994	4	IE (2), AE, SS	U	U
Supervision 8 (MTR)	May 1995	5	IE (3), AE (2)	U	U
Supervision 9	April/May 1996	3	IE, AE (2)	S	U
Supervision 10	November/ December 1996	2	E, IE	S	U
ICR	June/July 1998	2	E, IE	S	U

Specializations represented: AE: Agricultural Economist; E: Economist; IE: Irrigation Engineer; SS: Social Scientist; T: Training Specialist.

Performance ratings: S: Satisfactory; U: Unsatisfactory.

Other Project Data

Borrower/Executing Agency:

FOLLOW-ON OPERATIONS

Operation	***Credit no.***	***Amount (US$ million)***	***Board date***
Sri Lanka - North-East Irrigated Agriculture Project	3301-CE	27.0	December 2, 1999
Sri Lanka – Mahaweli Restructuring and Rehabilitation Project	3058-CE	57.0	April 14, 1998