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LEARNING FROM REHABILITATION PROJECTS: THE CASE OF THE TANK IRRIGATION MODERNIZATION PROJECT (TIMP) OF SRI LANKA

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LEARNING FROM REHABILITATION PROJECTS: THE CASE OF THE TANK IRRIGATION MODERNIZATION PROJECT (TIMP) OF SRI LANKA

D. Hammond Murray-Rust and P. S. Rao

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LEARNING FROM REHABILITATION PROJECTS: THE CASE OF THE TANK IRRIGATION MODERNIZATION PROJECT (TIMP) OF SRI LANKA

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1. BACKGROUND TO THE PROJECT

The Tank Irrigation Modernization Project (TIMP) was the first major rehabilitation project in Sri Lanka. Between 1950 to 1970 new projects led to a large expansion of the irrigated area. By 1970 suitable sites were scarce and attention began to be paid to improving the performance of existing systems. TIMP involved five reservoir (tank) systems in the northern part of the Dry Zone of Sri Lanka which were in particular need of rehabilitation.

This case study focusses on two of the five tanks involved in TIMP: Mahawilachchiya and Mahakanadarawa. Mahawilachchiya Tank was the first to be rehabilitated during the project; activities at Mahakanadarawa started at a later stage and benefitted from lessons learnt at Mahawilachchiya. Both systems were badly degraded even though they were only 20 years old. The conveyance system was inefficient, operations erratic, and communications between officials and farmers poor. Although both systems were designed for double cropping, only one crop could be assured with partial cultivation in the dry season. Yields were low.

Table 1. Basic Data on the Five Tanks of TIMP

Tank	Irrigable Area (ha)	Tank Capacity (mcm)	Catchment Area (sq kms)
Mahawilachchiya	1053	40.08	362
Mahakanadarawa	2429	41.94	324
Padaviya	5061	104.84	529
Pavatkulam	1781	33.30	296
Vavunikulam	2429	43.17	226

Source: Abeysekera (1984)

2. PROJECT OBJECTIVES

TIMP had a number of substantial objectives aimed at water conservation in both wet and dry seasons:

- increasing cropping intensity through crop diversification in the dry season;
- early land preparation for wet season rice, based on mechanization and dry seeding, to use early rainfall and conserve tank water for the following dry season;
- use of short duration rice varieties in the wet season;
- improved equity of water distribution through introduction of a strict rotational delivery schedules;
- redesign of the conveyance system, lining distributary and field channels, introduction of water measurement capability within the system, and construction of cross-regulators in main channels.

These objectives were developed without the benefit of site specific pre-rehabilitation feasibility studies. They represented contemporary thinking about overall solutions to problems of irrigated agriculture in the Dry Zone.

The first four project objectives were an attempt to reproduce some experiments previously carried out by the Agriculture Department at a small tank at Walagambahuwa. The results were not available at the time when TIMP was planned. The logic was that if cropping intensities were low because of severely limiting water supplies at the beginning of the dry season, then water conservation during the wet season was essential.

There was excessive staggering of land preparation for wet season rice and delayed transplanting in all TIMP systems. Farmers preferred to wait for irrigation releases rather than prepare land using rainfall, delaying the dry season crop. TIMP water saving strategies were to provide sufficient farm power to prepare land with October rainfall, dry seed rather than transplant, rely largely on rainfall for rice production, use short season (90-105 day) rice varieties, and aim to harvest by February. This would permit a prompt start to the dry season non-rice crop.

Irrigation innovations were both structural and operational. Structural improvements included the lining of all field and distributary channels, installation of cross-regulators in the main channels and installation of measuring devices at main and distributary channel level. The design of these improvements represented the first large-scale adoption of the 1-cusec channel[1] approach of the Irrigation Department, which had been first adopted in Wahalkada Tank in 1973 where very sandy soils exist and lining was needed. This led to the Irrigation Department favoring lining even though TIMP tanks do not have many sandy soils. No conveyance loss data were available.

The 1-cusec channel concept requires that field channel command areas are similar in size. Before rehabilitation, field channels had served anything from 10 acres (4 ha) to as much as 100 acres (40 ha) because the design had been based on topography using natural drainage channels as the limits of field channel command areas. During redesign the larger command areas were split into two, and in some cases three, independent command areas, each served by its own field channel. Existing large field channels were filled in, and replaced with two or three parallel channels each with a separate gate at the offtake from the distributary channel.

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[1] 28.3 litres per second

Operational rules were altered to fit in with the new design. Prior to rehabilitation continuous issues were made to all parts of the system, with rotations imposed in times of scarcity by closing the sluice at the main reservoir. TIMP planners assumed that water requirements were 3 inches (75 mm) per week, so that 12 hour per day operation of the 1-cusec channel would provide enough water for 28 acres (11.3 ha) during one week. Only one farmer at a time would take water, so pipe outlets to each farm were replaced to accommodate the increased flow.

Organizational innovations included the creation of Tank Committees designed to meet monthly, bring together all relevant government officers and selected farmer leaders (*vel vidanes*) to discuss irrigation and agricultural issues, plan for seasonal dates and activities, and resolve disputes.

3. PROJECT IMPLEMENTATION

Work commenced on TIMP in late 1976 with the construction of buildings, but field rehabilitation did not commence until late 1977, and most equipment did not start arriving until early 1978. Mahawilachchiya was the first of the five tanks to be tackled, the other four due to be phased in by 1980. The project was actually completed in early 1984, approximately two years behind the original timetable (Table 2).

Rehabilitation work was undertaken by the Irrigation Department. They were responsible for all aspects of design and construction, as well as subsequent operation and maintenance. The Department of Agriculture had a parallel program for the agricultural component of the program. Areas were designated for trial projects involving both agencies in all of the five tanks.

The cost of the TIMP project was about US$ 30.0 million. The World Bank (IDA) loaned US$ 5.0 million and the United Kingdom granted U$ 6.0 million. The two together financed about 48% of the total project cost net of taxes and duties.

Table 2. Construction Schedule for TIMP

Tank	Planned	Actual	Delay (months)
Mahawilachchiya	3/77-9/77	1/78-12/82	63
Mahakanadarawa	3/77-9/78	6/78-12/82	51
Padaviya	3/79-9/80	6/79-12/82	27
Pavatkulam	3/79-9/80	6/80-12/82	27
Vavunikulam	3/78-9/78	6/79-12/83	63

US$ 300,000 were provided for Technical Assistance, including provision of a water management specialist to improve the layout and design of the irrigation system, to develop operating schedules for supply system, and to train local technical personnel and farmer leaders/contact farmers on rotational irrigation. A socio-economic impact study of the project was conducted by the Agrarian Research and Training Institute.

Mahawilachchiya was treated as a pilot project for the remainder of the five tanks. It proved that the complete reconstruction and lining of all distributary and field channels throughout an entire irrigation system was more expensive and time consuming than had been anticipated. Mahawilachchiya had been planned for completion in one entire dry season. Work was not completed until 1983. It is estimated that about Rs. 22 million plus US$ 0.46 million were spent on Mahawilachchiya to rehabilitate 1000 ha. This was 29% of the rupee allocation and 12% of the dollar allowance for only 8% of the total project area. The whole TIMP programme could not have been completed within the budget, nor on time, if progress was similar to that in Mahawilachchiya.

The response to the slow rate of progress in Mahawilachchiya was to limit lining in the other four tanks to those areas where soils were particularly sandy or where parallel field channels were required to sub-divide large field channel command areas. This pragmatic approach speeded up construction activities.

There were also significant changes in the design of water delivery schedules. The flow of 1 cusec to 30 acres (12 ha) for 12 hours per day

barely meets the estimated requirement of 75 mm/week, and on lighter textured soils is inadequate. Lengthening the time of irrigation was inevitable, and the system continued to operate 24 hours a day. This was essential for the land preparation period where the combined requirements for puddling, maintenance of standing water, seepage, percolation and evaporation greatly exceed 75 mm/week. Despite mechanization, farmers preferred to wait for irrigation releases for land preparation, as there were still uncertainties about the steady onset of the rains. Water demand therefore exceeded channel capacities.

The arrival of the water management consultant in 1980 assisted in the preparation of revised operational schedules. Each channel had a schedule drawn up which calculated the number of hours per week needed to deliver 75 mm. This schedule was posted on boards in the field that indicated the exact time of irrigation for that field channel. Because the discharge was to be kept constant, many field channel gates were scheduled to be closed during the night, something that proved difficult to implement or enforce. In reality the schedule was largely ignored and farmers continued to take water when they could.

4. ASSESSMENT OF PROJECT IMPACT

Assessment of project impact has been made difficult for two reasons: the lack of detailed monitoring, and high variability in water conditions during and after the project. There neither was, nor could be, a guarantee that water supply would be adequate during the rainy season, particularly during the early part of that season. Similarly, availability of water for the whole command during the dry season could not be ensured. Although water measurement devices were installed at the head of every channel no records were kept of gauge readings since their main purpose was the initial calibration and it was thereafter assumed that the flow was approximately 1 cusec. By 1986 virtually all measuring devices were broken or missing. The only way to assess water consumption is at system level.

Similarly, there are only limited agricultural data, and these are only detailed for Mahawilachchiya. Given the fluctuation in water supplies in

the reservoir, it is hard to determine to what extent agricultural benefits derive from rehabilitation rather from increases in water supply. Table 3 shows the data available on cropping intensity.

Mahawilachchiya and Mahakanadarawa show starkly contrasting water supply situations. At Mahawilachchiya, originally chosen because of severe water shortages in both wet and dry seasons, the water supply has improved independently of the project. Development of the Right Bank of Mahaweli "H" Block, started in 1983, has resulted in drainage increases into Modaragam River which feeds Mahawilachchiya Tank. In 1983 water was in short supply. However, during the 1983/84 wet season, there was so much rainfall that only one season was possible in that year, since farmers found it too wet to prepare the land and broadcast the second crop. Drainage into the tank now normally permits two rice crops per year throughout the system.

The water situation in Mahakanadarawa has worsened. Since 1980, independently of TIMP, many village tanks within the catchment have been rehabilitated, and this appears to have reduced inflow into the reservoir (Kariyawasam, 1983). By 1986 water was only sufficient to irrigate 800 ha in a late wet season crop out of the total command area of 2429 ha. No dry season crop was possible during 1986.

Table 3. Cropping Intensities in the Project Area

(a) Wet Season	78/79	79/80	80/81	81/82	82/83	83/84	84/85	85/86
Mahawilachchiya	96	93	93	93	100+	100	100	100
Mahakanadarawa	67	58	58	0	0+	100	63	32
Padaviya	100	84	80	79	61+	*	*	*
Pavatkulam	60	68	74	20	8+	*	*	*
Vavunikulam	70	80	66	77	73	*+	*	*

(b) Dry Season	1979	1980	1981	1982	1983	1984	1985	1986
Mahawilachchiya	0	50	42	36	0	0	100	100
Mahakanadarawa	0	0	0	0	0	0	0	0
Padaviya	*	*	1	2	37	*	*	*
Pavatkulam	0	0	0	0	0	*	*	*
Vavunikulam	7	24	*	27	33	*	*	*

Note: * data not available + First season after rehabilitation

Sources: 1978-83: Abeysekera (1984); 1984-86: Authors' interviews

5. ANALYSIS OF EXPERIENCE

TIMP has contributed significantly to the understanding of the requirements of rehabilitation projects in Sri Lanka: good aspects have been adopted subsequently, poorer aspects modified and not merely repeated elsewhere in the hope they will happen to be successful next time around. Many lessons learned have been incorporated into planning and implementation of two major rehabilitation projects in Sri Lanka: the World Bank supported MIRP, and the USAID supported Irrigation Systems Management Project in several different schemes in north central districts.

5.1 Agricultural Innovations

a. Dry Tillage, Dry Seeding and Short Duration Varieties:

This package requires mechanization, timely water supplies, and varieties that ripen in 3 to 3 1/2 months. Tractors were made available, but water conditions were never such that farmers were induced to change from traditional practices. Water is now plentiful at Mahawilachchiya; so farmers have been able to get two rice crops, even with staggered planting. At Mahakanadarawa water supply is too unreliable for farmers to risk land preparation before the reservoir has partially filled. Dry sowing is now rare.

The package depends on the relationship between rainfall and filling of the tank. Prior to the project, water was not released until the tank had started to fill rapidly. If the Irrigation Department tried to get an earlier start, then farmers refused to plough. Farmers remain reluctant to risk dry seeding prior to what may be "false rains". The Department of Agriculture has changed its opinion on the package: their experiments at Walagambahuwa Tank were successful under closely monitored conditions but were difficult to sustain. Policy in the country is now to ensure a good wet season paddy crop, use irrigation water for both land preparation and crop growth, and plant the more robust and yield-stable 4 to 4 1/2 month varieties which are less susceptible to fluctuations in water supply. Policy has changed partly because the development of the Mahawelhi areas means there is no longer the same pressure to intensify rice production elsewhere. The new policy seems more in line with farmers' preferences in this area, where farmers are concerned to safeguard their main food crop.

The project enabled many farmers to obtain either 4-wheel or 2-wheel tractors. However, the concerns of Ranatunga et al. (1981) that water, not farm power, was the constraint to land preparation appear to be fully justified.

b. Crop Diversification

Uncertainty over water and lack of marketing arrangements were major constraints to adoption of non-rice crops (Table 4). The Irrigation

Department had had no experience with system operation requirements to support non-rice crops and there were complaints that excess deliveries resulted in overirrigation. Water management was difficult since it had to be adapted to two markedly different soils: the upper soils were highly suited to non-rice crops, but the valley bottoms were better suited to rice due to poor internal drainage and high water tables. Tail end farmers cannot fully control their water supply. Actually, preference and practice is for constant flows at low levels rather than rotation between channels.

Table 4. Expected Benefits and Actual Performance at Mahawilachchiya

	Area (ha)			Yield (t/ha)		
	Before (1978)	With Project	Actual (1985)	Before (1978)	With Project	Actual (1985)
(a) Wet Season						
Rice	770	990	1050	1.85	2.35	(3.50)
Cereals	none	60	none	none	2.00	none
Cropped Area	770	1050	1050			
Crop Intensity	0.73	1.00	1.00			
(b) Dry Season						
Rice	80	365	1050	1.75	3.50	(3.50)
Cereals	none	120	none	none	2.70	none
Pulses	20	40	none	0.85	1.60	none
Cropped Area	100	730	1050			
Crop Intensity	0.10	0.69	1.00			
(c) Annual						
Cropped Area	870	1780	2100			
Crop Intensity	0.83	1.69	2.00			

Note: figures in parentheses are estimates

Sources: TIMP Appraisal Report (1976); authors' interviews

It is ironic that while TIMP was intended to support widespread crop diversification, some other systems originally designed for rice are now highly diversified in the dry season. The Mahaweli Authority has offered high support prices non-rice crops in "H" Block. In the TIMP areas pricing and marketing were never developed to support project objectives, and crop diversification is only found in parts of the three more northerly tanks where soils are too sandy for rice production.

5.2 Irrigation Innovations

The package of irrigation innovations reflected the belief at the beginning of the project that the majority of irrigation water management problems were at farm or field channel level, and that wastage of water had to be discouraged at that level if the full benefits were to be obtained from limited water supplies. The irrigation innovations were based on the belief that farmers would switch from one season of 4 months rice to dry ploughing and dry seeding of 3 month rice in the wet season, and non-rice crops in the dry season. When these agricultural innovations were not adopted, the new design created several difficulties.

a. Field Channel Rodesign and Reconstruction

The strategy adopted at Mahawilachchiya in the first phase of TIMP was to completely redesign and reconstruct field channels. The new rectangular-sectioned channels have proved unsatisfactory because water demand for land preparation for wet sowing of rice is greater than the capacity of the channels. The result is that staggering of land preparation remains a serious problem, not because of draft power limitations (although these may also still be present for some farmers) but because of competition for water. The new channels were expensive to construct, and took longer to complete than anticipated.

The concept of the 1-cusec channel has remained with the Irrigation Department since TIMP, but it has been substantially modified. There are more simple control structures in MIRP (which, provided farmers are allowed to operate them, increase flexibility without increasing staffing needs). Channels have traditional trapezoidal cross-sections and a bigger

freeboard to accommodate peak demand. Twice the normal flow can be sent down when necessary. These modifications have largely eliminated the need for parallel field channels, and lining is limited to areas where soils are particularly sandy.

b. Rotational Scheduling

The original design limited irrigation deliveries to 12 hours per day, so that no farmers would have to irrigate at night. Operational plans were never developed by design staff and, at first, O&M staff were never trained to implement the rotation. It proved impossible to operate the system in daylight hours only. The flow of 1 cusec to 30 acres for 12 hours per day barely met the estimated requirement of 75mm/week, and on lighter textured soils was inadequate. In 1980, when the water management specialist arrived, training was started and schedules revised. Although the revised schedule was based on a continuation of the 75 mm/week water delivery requirement, with slight modifications for changes in evapotranspiration, field channel discharges were if necessary adjusted downwards from a 1-cusec norm and time lengthened to accommodate the actual size of each field channel command and to ensure gates only had to be opened and closed during daylight.

In MIRP the scheduling process has undergone modifications that result in a more manageable plan. Design discharges are more variable, some modifications have been made to allow for soil differences, and gate openings and closing are all in daytime. During land preparation the schedule is not implemented so that as many farmers as possible can prepare land at the same time.

c. Farmer Rotations and Pipe Outlets

The design of TIMP proposed that water be distributed to two farmers at any time on a field channel, starting at the tail end. This system has not been widely adopted, farmers generally preferring to adopt a wide variety of sharing techniques that reflect local conditions and the relative cooperativeness of neighboring farmers. It would also seem that farmers here prefer, and find less labour-demanding, a continuous trickle for a longer time than larger slugs at infrequent intervals.

d. Main Channel Cross-Regulation

The installation of cross-regulators has been a major benefit to water elevation control in the main channels of the systems. When discharges have to be reduced, it is possible to maintain heads or, if necessary, use them to demarcate the extent of the area permitted for irrigation in times of considerable water shortage. Cross-regulation is being provided in several other systems at the present time.

e. Water Measurement Activities

TIMP was the first effort in the country to provide full measurement capacity at all levels in the system. Parshall flumes were installed downstream of tanks, and weirs and gauges installed below all distributary and field channel turnout. At present, gauges are missing, weir boxes broken, and no measurements are recorded except for issues into main channels from the tank. Lack of measurement means that precise water delivery is not possible, and the fine tuning indicated in the schedule cannot be implemented. It is not possible to verify the assumption that demand is more or less uniform at 75 mm/week.

f. Reliability and Equity of Water Distribution

The lack of a detailed monitoring program makes it impossible evaluate changes in reliability and equity of water distribution. The overall water situation in Mahawilachchiya has improved dramatically since Abeysekera (1984) conducted his post-project evaluation, and our observations and interviews in 1986 indicate a much greater degree of satisfaction than reported by him.

Abeysekera (1986) reported that farmers in tail end areas appear to have benefitted from the introduction of parallel, lined field channels that specifically serve lower portions of what were once larger command areas. The redesign may have increased problems for some farmers who were in the middle of a field channel command area and who are now at the tail end of a shorter field channel. During normal irrigation, between transplanting and harvesting, the channels appear to have adequate capacity.

The situation in Mahakanadarawa is more complex because not all channel sections were reconstructed or lined, and overall water supply remains poor. A different approach has therefore been adopted to try to improve equity, which utilizes the traditional principle of *bethma* which is used in other irrigation schemes when water is in short supply. *Bethma*, which has its origins in village tanks, involves dividing the command area into two or three zones. In good years all zones receive water, but in bad years collective decisions are made to restrict irrigation to one or two zones. Head zone farmers are obliged to let others farm part of their land at no charge.

In the 1986 dry season in Mahakanadarawa water was judged to be sufficient for only one third of the command area (800 ha out of 2429 ha). Each head end farmer was allowed to cultivate one third of his 1.2 ha holding, and two tail end farmers allocated temporary rights to the other 0.8 ha. This appears to be equitable, but in practice there are severe problems for tail end farmers. Their homes are up to 15 km from their allocated land that it is difficult to move animals, care for crops and manage water. Head end farmers can often cultivate all their land. However, various arrangements may be made with tail end farmers, such as sharing arrangements, or the head ender might buy the cultivation right back.[2]

g. Water and Land Allocation

The rotational irrigation schedule included in the project objectives calls for irrigation rates of 75 mm per week, plus approximately 200 mm for land preparation. Allowing for the project efficiency design of 72%, the total seasonal requirement is 1320 mm. In Mahakanadarawa the irrigable area for the 1985/86 wet season was determined using the long-standing Irrigation Department estimate of 6 acre-feet/acre (1830 mm). In this respect traditional water allocation principles described in detail elsewhere (Murray-

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[2] Contrast this with the innovative *bethma* in Mahaweli "H" block where land reallocation is within the confines of a single distributary channel serving about 100 ha. The distance problem does not arise, farmers are generally known to each other and there is very little leasing back of land by head end farmers.

Rust and Moore, 1983) appear not to have changed despite the intentions of the project to conserve water and extend the dry season irrigated area.

In Mahawilachchiya the abundance of water means that there is no reason to restrict the cultivated area: the tank capacity of 40.08 mcm permits the whole area of 1053 ha to be irrigated with a seasonal supply of 3800 mm.

5.3 Institutional Innovations

a. Irrigation Department Organization

TIMP was conceived in Colombo and all initial designs were undertaken using the facilities available at the Irrigation Department Headquarters. However, designs had to fit local conditions and needed adjustments in the field to the existing functioning irrigation system. The Project Director soon found that slow design work was impeding the rate of progress of the project, and that equipment use and construction were being delayed.

The transfer of design activities from Colombo to a town nearer to the project is the first case of major devolution of design within Sri Lanka, and has been copied in the MIRP and Gal Oya Projects.

b. Farmer Representation and Tank Committees

The establishment of Tank Committees under TIMP was the first effort in Sri Lanka to involve farmers formally in the management of major irrigation systems. The first step was to create a Tank Committee, since the pre-seasonal meeting held in every irrigation system to discuss the cropping timetable, etc, was not an effective institution for regular management. It involved all farmers and as many as 50 government officials. In practice it was a rally for rubber-stamping government proposals. The new Tank Committees were intended to be more democratic and to meet more frequently. However, the farmers were "represented" by the *vel vidanes*, who were selected by a government department, and who were potentially outnumbered by government officials.

TIMP used the *vel vidane* to undertake several water management tasks, including implementation of the rotational schedule, representation of

farmers at the Tank Committee, and liaison with government officers. *Vel vidanes* were not universally popular, their appointment sometimes being for political favour, and, with about 12 field channels each, they had too large an area to manage effectively. A second improvement, therefore, was to establish a more hierarchical arrangement, where all farmers holding title to an allotment elected a field channel representative who would be responsible for arranging water distribution, and be the contact person for dealing with the Irrigation Department officers. He was also the representative to the Tract Committee which in turn elected a representative to the Tank Committee. Because these changes came about during the project, farmers had had no mechanism to participate in aspects of design or construction. The Tank Committee was still very large, and biassed in favour of government officers, and still proved ineffective for management of the Tanks.

The model, however, has been modified and is now being adopted nationwide within the Project Manager system. This is being implemented by the Irrigation Management Division created in 1984. The main differences from the TIMP Tank Committees are that farmers and government officers are equally represented, that the tasks are more clearly specified, and that they have some degree of authority. In MIRP formation of farmer organizations has preceded design and construction work, and there are examples from Nachaduwa of incorporation of farmers' suggestions into design and location of structures.

The greatest difference between Tank Committees and the Project Manager Systems lies in the pre-seasonal decision-making process. Before and during TIMP, there were few discussions before the meeting: government officers came to the meetings with plans that were then "approved" by farmers without significant change. Under the Project Manager System, the proposals made to the seasonal meeting have been discussed in monthly meetings by officers and farmer representatives, brought back to, and discussed with, other farmers, and modifications made before being presented to the seasonal meeting for approval. Preliminary indications suggest this system is more effective than the Tank Committee, although the Tank Committees did represent an important stage in the evolution of a more democratic process for irrigation management in Sri Lanka.

6. CONCLUSIONS

TIMP was the first major rehabilitation project in Sri Lanka. Despite numerous criticisms, and particularly over the appropriateness of the agricultural innovations, a number of important lessons have been learned. Within Sri Lanka there is now much more emphasis on the operational and institutional side of projects, and less on the physical reconstruction. There is a greater effort to incorporate operational criteria into designs, and train engineers in operational innovations. However, in some respects, TIMP was an expensive way to learn that greater attention had to be paid to management, operation and maintenance. There are also some signs that progress in this area still needs to be made.

There has been little or no increase in maintenance budgets, despite efforts to allocate irrigation service fees for maintenance in the systems where the money was collected. After one successful year, fee collection rates have dropped to low levels because maintenance works were not undertaken.

The same is true for operation, where there have been cuts in the field staffing of the Irrigation Department due to financial difficulties. At Mahakanadarawa the number of Irrigators, responsible for operating gates within the system, has been reduced from 16 to 8, and there are now only 3 Work Supervisors instead of 4 to cope with maintenance. The Irrigators work for 12 hours per shift, so the four on duty at any time have to cover all 50 offtakes from the main channel and 200 field channel gates. This is clearly an impossible task, and it is therefore not surprising that it is difficult to regulate discharges, and sustain the measurement programme. This is an example of the way the operational system may constrain design choices: for good design, the operational mode has to be selected first.[3]

There can be little doubt that overall the project has had benefits, and that some of these have been sustained for the past three years. However, there is no reason to feel complaisant: the project stressed redesign and

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[3] *It is probably worth also pointing to the desirability of incorporating as much flexibility as possible to meet unanticipated changes in water supply, government policies, price and marketing changes, etc. In this example, trapezoidal cross-sections are more flexible than rectangular ones.* Ed., Mary Tiffen.

construction at the expense of maintenance, operation and monitoring, and there is every likelihood that rehabilitation will be necessary within the next 15-20 years.

The experience of TIMP stresses the need to have good information concerning past operation of an existing project before rehabilitation. For this consultation with the users is helpful. The least successful aspects of the project were largely associated with imposition of assumptions on the designers rather than spending time assessing the real constraints to improved performance. Physical solutions, notably lining and mechanization, proved not to be effective and did not result in improved system management.

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REFERENCES

Abesekera, W.A.T. 1984. A preliminary assessment of the performance of a major irrigation rehabilitation programme: the case of the Tank Irrigation Modernization Project. Research Study No. 60. Agrarian Research and Training Institute, Colombo, Sri Lanka.

Abeysekera, W.A.T. 1986. Improvement of irrigation performance in Sri Lanka: the experience at Mahawilachchiya Settlement. Unpublished Ph.D. thesis. Cornell University, Ithaca, New York.

Irrigation Department. 1983. Tank Irrigation Modernization Project: Completion Report. Ministry of Lands and Land Development, Government of the Democratic Socialist Republic of Sri Lanka.

Kariyawasam, C. 1983. Hydrology study of Mahakanadarawa Tank. Mimeo. Agrarian Research and Training Institute, Colombo, Sri Lanka.

Murray-Rust, D.H. and M. Moore. 1983. Formal and informal water management systems: cultivation meetings and water deliveries in two Sri Lankan irrigation systems. Cornell Studies in Irrigation No. 2. Cornell University, Ithaca, New York.

Ranatunga, A.S., J. Farrington and W.A.T. Abeysekera. 1981. Some issues confronting the rehabilitation of major irrigation systems in the Dry Zone. Research Study No. 44. Agrarian Research and Training Institute, Colombo, Sri Lanka.

World Bank. 1976. Appraisal of the Tank Irrigation Modernization Project. Washington, D.C.

World Bank. 1984. Appraisal of the Major Irrigation Rehabilitation Project. Washington, D.C.