Economic Impacts of Irrigation Water Management: Huruluwewa Major Irrigation Scheme

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ABSTRACT

The Huruluwewa major irrigation scheme situated in the north central dry zone of Sri Lanka is frequently subjected to water scarcity. The Irrigation Department (ID) and the Irrigation Management Division (IMD) jointly manage the scheme's irrigation and related socioeconomic resources, respectively. The management of field-level irrigation infrastructure and other related water activities is the responsibility of the relevant farmer organizations (FOs).

As the scheme is frequently subjected to water deficiencies, the Project Committee (PC), the water management council of the scheme, has paid the utmost attention to water saving strategies. From 1993 to 1998, the Shared Control of Natural Resources (SCOR) Project facilitated several water management strategies in this scheme through the PC. Crop diversification, especially during yala, was one of the major strategies adopted for water management in this scheme. Though crop diversification increased the economic benefits while saving irrigation water, farmers still tend to cultivate paddy.

In yala 1998, the PC and the Hurulu Janatha Farmer Company jointly implemented a crop diversification program, mainly to produce soybean and maize to be sold to the Thriposha Company. As the tank water storage was not sufficient to cultivate the entire command area, it was planned to cultivate soybean and maize, on a shared basis, only in 1,417 hectares. Though the PC promoted soybean and maize, both high-value, low-water- consumptive crops, farmers have cultivated mainly paddy (60%). As a result, the incremental water requirement was 73 percent higher than the expected amount and farmers in the scheme collectively lost Rs 13.7 million from products alone because they did not adopt the proposed cropping pattern.

The Huruluwewa major irrigation scheme is in the jurisdiction of the Galenbidunuwewa Divisional Secretariat Division of the Anuradhapura District in the North Central Province of Sri Lanka. The irrigation scheme has been planned to provide irrigation facilities for 4,453 hectares. However, this objective is achieved intermittently due to insufficient rain, which was the only source of water. As the scheme is frequently subjected to drought conditions, a trans-basin water-transferring canal was constructed to feed the reservoir to provide supplementary irrigation requirements of the scheme. However, the water scarcity problem could not be addressed through this intervention.

The irrigation system management is twofold. The management of the reservoir and the main distribution system is the responsibility of the Irrigation Engineer (IE) and the coordination of agricultural and socioeconomic activities at the project level and initiating farmers for

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joint management are the responsibility of the Project Manager (PM) of the IMD. Some of the management functions at the field level have been transferred to the relevant FOs, which are directly responsible to the PC. The PC is a joint-management committee established for the successful implementation of project activities. Major responsibilities of the PC are planning and implementation of integrated water management activities.

Though the scheme is frequently subjected to water-stress conditions, several years of experience in this irrigation scheme shows that the PC's collective decision for water saving has not been adopted by the farmers. Since the most possible production actions have not been implemented, farmers and the responsible authorities have faced irrigation problems. Therefore, this study will attempt to quantify these inefficiencies in monetary terms.

The hypothesis of the study was that the diversification of water for low-water-use, high-value crops would result in less consumption of water while rewarding the farmers with a high value of product per unit of water and land.

METHODOLOGY

The irrigation scheme has not received an adequate water supply for cultivation. Therefore, several water-saving strategies have been attempted through the PC. Among the water-saving methods, diversification of low-value, high-water-consumptive crops to high-value, low-water-consumptive crops is suggested to increase irrigation economic efficiency that has already rewarded more income per drop of water (Seckler 1996). The aims of crop diversification are to reduce cost of production, to increase income through high-value products, and to enhance water saving by using low-water-use crops. This paper will present an analysis of water use for different crops, the subsequent productivity levels, and the comparative economic benefits for different water use categories.

In yala 1995 and 1998, the SCOR action-oriented integrated water management program was implemented in the Huruluwewa watershed. The major concern of this program was to introduce high-value, low-water-use crops. With regard to water use efficiency, two cropping scenarios were evaluated. Cropping pattern scenario 1 was actually practiced in the field instead of cropping pattern scenario 2 that was proposed for the season.

Scenario 1: The actual crop establishment in the command area in yala 1998.

Scenario 2: The simulated cropping pattern for yala 1998.

DATA COLLECTION

The SCOR research team carried out a field-data collection program. For this purpose, a data collector was employed in the field to collect data on water issues, land preparation, crop establishment, cost of production for different crops, and yield levels. The tank water issue was taken from the records available in the ID. The records available in the IMD, Department of Agrarian Services, and the Department of Agriculture were reviewed for secondary information where necessary.

Scenario 2 is a simulated cropping pattern, which is based on the data available with the Department of Agriculture, the ID, and other agencies involved in water management, notably the IMD.

SCOR'S INTEGRATED WATER MANAGEMENT (IWM) EFFORT

The Shared Control of Natural Resources (SCOR) Project, a watershed management project for the Huruluwewa and Nilwala watersheds, implemented several production and protection strategies to optimize production while maintaining a sustainable resource base. Among these SCOR strategies, diversification of crop establishment in the irrigated area was the major action-oriented program. Timing of land preparation and timing of crop establishment were two other strategies of the SCOR-IWM effort. The available data are not sufficient to predict water use efficiency and economic efficiency due to these interventions, except for crop diversification. Tables 1 and 2 below present the crop establishment and recommended cropping patterns, respectively, in the Huruluwewa watershed during yala 1998 while table 3 shows the parameters used for comparison of benefits of the two cropping scenarios. Annex 1 shows the farm budget for both cropping scenarios.

Table 1. Cropping pattern of the command area in yala, 1998 (scenario 1).

Crops	Extent (ha)	%	CI (in %)	WU (ac-ft)	Production (Metric tons)	Value (Rs '000)
Soybean	610	35.7			1,129	22,344.30
Paddy	1,026	60.1			3,283	31,190.40
Maize	29	1.7			35	297.54
Black gram	29	1.7			29	287.10
B. onion	14	0.8			168	4,989.60
Total	1,708	100	38	22,000		59,108.94

Note: ac-ft=acre-feet.

Table 2. Recommended cropping pattern of the command area in yala, 1998 (scenario 2).

Crops	Extent (ha)	%	CI (in %)	WU (ac-ft)	Production t	Value (Rs '000)
Soybean	1,080	67			1,998	39,560.4
Maize	540	33			648	6,998.4
Total	1,620	100	36	16,000		46,558.8

Table 3. Parameters used for comparison of benefits of the two cropping scenarios.

Efficiency parameters	Scenario 1	Scenario 2
Water use (ac-ft/ha)	13	10
Cropping Intensity (%)	38	36
Productivity (Rs /ha)	34,607	28,740
Cost of production (Rs/ha)	20,199	12,700
Net return (Rs /ha)	14,407	16,039

In implementing the expected crops in the field, the farmers agreed with the proposed cropping pattern at the PC meeting held for planning yala cultivation but did not adhere to the proposed pattern. The Hurulu (Janatha) Farmer Company (HJFC), fully owned by the farmers in Huruluwewa, guaranteed the price for the products. In spite of this guaranteed price, the farmers still tend to grow high-water-consumptive, low-value, less-risky crops, especially paddy. Table 1 shows that the extent cultivated with paddy is the highest percentage during this season. Because the tank water level was not sufficient for paddy cultivation and because of the risk of the El Nino weather situation, the proposed cropping pattern did not include paddy.

ECONOMIC IMPACT OF CROP DIVERSIFICATION FOR IRRIGATION EFFICIENCY

The major criterion adopted for irrigation water management during this season was the crop diversification to enhance production (rupees per water unit) mainly to supply soybean to the Thriposha Program to which the HJFC had agreed. However, the objective of the company was only partially successful as the farmers did not adhere to the PC decision to cultivate soybean and maize. Due to the inability to implement the proposed crops in the field, the water level of the tank was more depleted than expected and the irrigation authorities faced the risk of water scarcity at the end of the season. On the other hand, the HJFC's management faced the problem of product scarcity for the Thriposha Program. The following section of this report will quantify the impacts in monetary terms.

CHANGE OF WATER USE

The major crop in the cropping pattern scenario 1 was paddy. However, paddy cultivation was not planned for this season due to high-water-consumption and the HJFC needed a consignment of soybean to provide raw material (soybean) for the Thriposha Program. In addition to the main objective, water storage of the tank at the end of the season was also considered for the farmers to be able to cultivate an early crop in the next maha season. It was with the expectation of these objectives that the cultivation for yala 1998 was planned. However, the IMD, the agency responsible for implementing PC decisions, failed to implement the PC decision resulting in incremental water use.

At the time of planning for yala 1998, the water level of the tank was 42,000 ac-ft. For the cropping scenarios proposed for this season 16,000 ac-ft of water issues and 24,000 ac-ft of water storage of the tank were expected at the end of the season. However, for the cropping pattern observed during this season 22,000 ac-ft of water issues from the tank and 18,000 ac-ft of water storage were needed at the end of the season (figures 1 and 2). Therefore, the incremental water requirement due to cropping pattern scenario 1 instead of scenario 2 was 73 percent. Actual water issues during the season were much higher than the expected levels (figure 3). The farmers of the command area have missed the opportunity of cultivating an excess extent during this season due to the mismanagement of irrigation water.

CHANGE OF CROPPING INTENSITY

The failure to adopt the proposed cropping pattern in the field resulted in an incremental Cropping Intensity (CI). The scheduled cropping pattern for yala 1998 has only 36 percent CI. The observed cropping pattern of the command area has a CI of 38 percent. This means that the farmers have established a greater extent than that planned for yala 1998. However, the farmers have an incremental CI of only 2 percent for the 73 percent incremental water use.

CHANGE OF FINANCIAL BENEFITS

The proposed crops for this season were high-value soybean and maize crops. Further, the HJFC has guaranteed the prices for these products while other companies too have offered competitive prices for them. However, the main crop established was paddy with a low-value and comparatively high cost of production. Though the prices for paddy were not assured, farmers chose to grow paddy for various other reasons. Cropping scenario 1 gave a net income of Rs 14,407/ha. But the proposed crops would have generated Rs 16,039/ha with a market assurance. In addition, the farmers would have contributed their support for the HJFC. However, due to the failure to adopt the proposed cropping pattern, farmers in Huruluwewa collectively lost Rs 13.7 million during this season.

DISCUSSION AND SUGGESTIONS

The farmers in the Huruluwewa command face two major problems: water shortage and lack of sufficient income. The SCOR watershed management strategies and approaches focused mainly on alleviating these problems. Among several water management techniques considered was the diversification of crops from high-water-consumptive to low-water-consumptive and low-value to high-value yields. Crops for yala, 1998 were planned according to these major concerns. However, the farmers did not adhere to the proposed cropping pattern in their fields due to different socioeconomic reasons. The situation became so bad that excess water flowed along the canals at the early stage of cultivation.

Figure 1. Huruluwewa operation simulation study in yala 1998 for Model 01 cropping pattern.

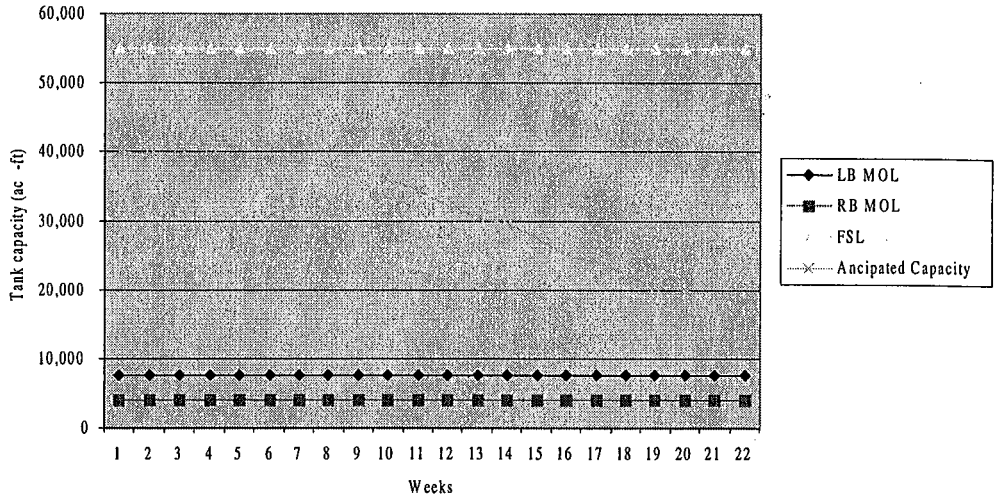
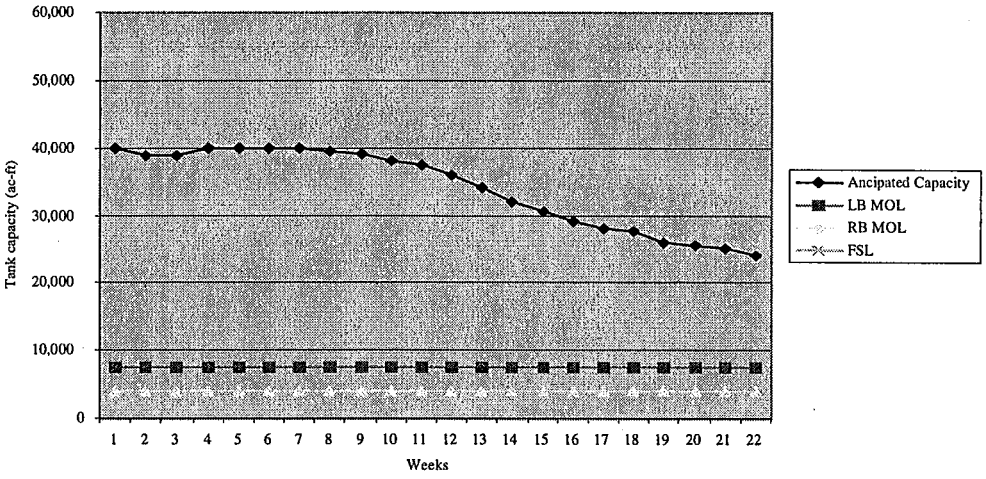
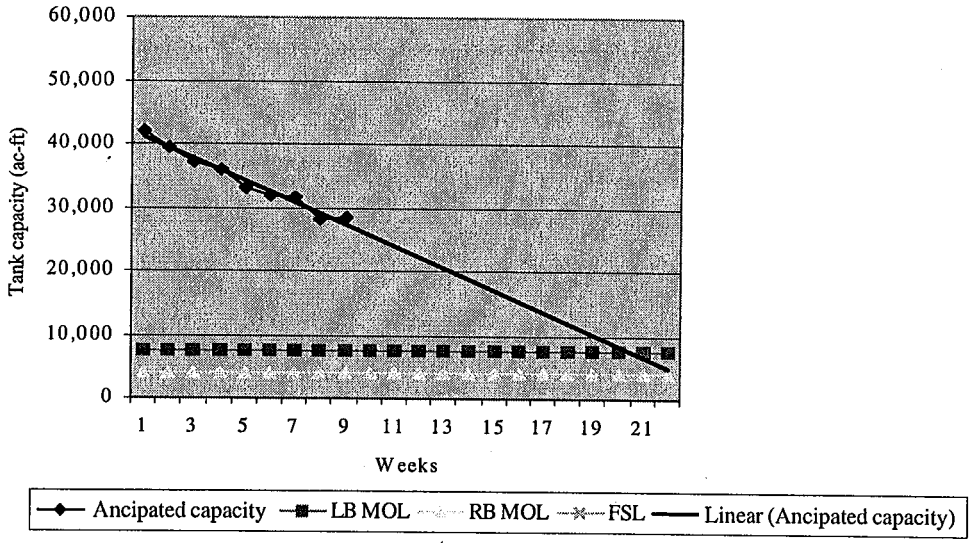


Figure 2. Huruluwewa operation study in yala 1998 for Model 02 cropping pattern.



The nonadoption of the proposed cropping pattern resulted in an additional amount of water use by the farmers in Huruluwewa. This has further reduced the water storage of the tank at the end of the season. The PC expected a certain amount of water to be retained for an early maha cultivation since farmers had experienced success in maha, 1997/98. The water issue of the tank in respect of scenario 1 was 73 percent higher than the expected water requirement for scenario 2. However, the CI has been increased only by 2 percent. It was observed that most of the water issues for crops had been drained out. The opportunity cost of water waste could have different values that could be used for an additional crop extent during the season, storage in the tank for use in the next season, for fishery or recreational purposes, and for basic human needs, etc.

Figure 3. Comparision of expected water requirment with observed water issued in Huruluwewa during 1998 yala.



In a financial sense, change of crops in the field, paddy instead of soybean and maize, has generated low income for the farmers. The production cost of soybean and maize is comparatively lower than that of paddy. Therefore, the net income lost is about Rs 2,000/ha and farmers in the command area collectively lost Rs 13.7 million. In addition, the HJFC failed to supply their agreed quantity of soybean and maize to the Thriposha Program, which could have indirectly benefited farmers (shareholders).

SUGGESTIONS FOR ECONOMIC EFFICIENCY IN IRRIGATION WATER MANAGEMENT

On the basis of study results, the following suggestions are made.

1. Crop diversification is one of the alternatives to enhance production, "more money per drop of water."
2. Collective decision for the benefits of the farmers should be implemented in order to have irrigation and economic efficiencies in irrigation schemes.
3. Monitoring water issues in respect of timely crop water requirement should be followed to avoid unnecessary water losses.
4. The crop diversification is one of the alternatives to enhance production, "more money per drop of water."
5. Collective decision for the benefits of the farmers should be implemented in order to have irrigation and economic efficiencies in irrigation schemes.
6. Crops should be selected on the basis of water availability and maximum returns per unit of resource use that could be used for high-value crops, which incur less cost of production.

Annex 1

FARM BUDGET

Huruluwewa

1 COMMAND AREA 4453.00 Ha

		Model 02					Model 01				
2 CULTIVABLE AREA (ha)		Maha 0.00			Yala 1620.00		Maha 0.00			Yala 1708.00	
3 PRODUCTION AND VALUE		Area	Yield	Prodn	Price	Value	Area	Yield	Prodn	Price	Value
Maha		(ha)	(Mt/ha)	(Mt)	(Rs)	(Rs)	(ha)	(Mt/ha)	(Mt)	(Rs)	(Rs)
Paddy		0.00	0.00	0	8,967	0	0.00	0.00	0	9,500	0
Soybean	0.90	0.00	0.00	0	22,000	0	0.00	0.00	0	22,000	0
Maize	0.90	0.00	0.00	0	9,500	0	0.00	0.00	0	9,500	0
Black gram	0.90	0.00	0.00	0	33,000	0	0.00	0.00	0	11,000	0
Big onion	0.90	0.00	0.00	0	11,000	0	0.00	0.00	0	33,000	0
Yala											
Paddy		0.00	0.00	0	8,967	0	1026.00	3.20	3,283	9,500	31,190,400
Soybean	0.90	1,080.00	1.85	1998	22,000	39,560,400	610.00	1.85	1,129	22,000	22,344,300
Maize	0.90	540.00	1.20	648	12,000	6,998,400	29.00	1.20	35	9,500	297,540
Black gram	0.90	0.00	1.00	0	33,000	0	29.00	1.00	29	11,000	287,100
Big onion	0.90	0.00	12.00	0	11,000	0	14.00	12.00	168	33,000	4,989,600
4 TOTAL FOR THE YEAR		1,620.00		2646		46,558,800	1708.00		4,644		59,108,940
5 CROPPING INTENSITY			36 Percent					38 Percent			
6 PRODUCTION COSTS (Rs)		SCF									
Seed		0.90				1,632,960					1,841,057
Fertilizer						149,594					2,598,214
Agrochemical		0.65				484,380					2,735,941
Hired labor		0.90				5,360,580					7,743,249
Family labor		0.90				8,004,420					8,793,482
Services		0.90				4,699,620					8,398,287
Miscellaneous		0.90				243,000					2,391,300
O & M charges		0.90				0					0
7 TOTAL COSTS						20,574,554					34,501,530
8 INCREMENTAL COST											13,926,975
9 NET BENEFIT FROM SCHEME						25,984,247					24,607,411
10INCREMENTAL NET BENEFIT FROM SCHEME											(1,376,835)

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