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SUSTAINABLE DEVELOPMENT OF WATER RESOURCES, WATER SUPPLY AND ENVIRONMENTAL SANITATION

Willingness to pay for improved irrigation services in Mahaweli system H

M. M. M. Aheeyar, Sri Lanka

The major features of the water supply and management policies adopted in Sri Lanka have been centralized planning though a public agency, supply augmentation, zero priced or under priced water and reliance on bureaucratic instruments for water supply. Bulk water allocation system has been implemented in Mahaweli system H as a pilot project since 2002 to find out a methodology, which can be used as a complete solution for water management problems in major irrigation schemes. The project provides a legal water right to users, but users have to actively participate and contribute for the sustainable operation and maintenance of secondary and tertiary canal system. The present study is aimed to estimate the value of current level of resource mobilization by farmers and farmers' willingness to pay for sustainable irrigation system maintenance in order to provide improved irrigation services in the long run. The findings of the study show that the current level of resource mobilization varies from Rs 1450-2275 per/ha/annum (US$15-23) at 2005 prices. Further farmers are willing to pay Rs 599-890 (US$ 6-9) per/ha/year in addition to the current level of resource mobilization to ensure the long-term sustainability of infrastructure and to achieve improved irrigation services. The willingness to pay value is positively related to household income, farm size, location of irrigation canal and type of major crop cultivated. The willingness to pay expressed needs to be considered by policy makers for feasible policy formulations to meet the future cost escalations and to ensure sustainability of irrigation infrastructure.

Introduction

Participatory irrigation management (PIM) policy was adopted in major irrigation systems in Sri Lanka in the late 1980s as a measure to reduce the government cost in operation and maintenance (O&M) and improve the performance of the systems. The policy emphasizes the active participation of farmers along with the government irrigation agency through irrigation management transfer of secondary and tertiary canal systems from bureaucracy to farmers (Water Users Association). However, after couple of decades of experience in PIM, it has been found that, the Water Users Association (WUA) have failed to mobilize adequate amount of resources toward O&M, and some of the maintenance responsibilities have become 'no body's' business and there is a serious under investment in irrigation system maintenance (Aheeyar, 1997, Samad and Vermillion, 1999). The situation has led to not only poor irrigation performances but also the rapid deterioration of irrigation infrastructure than the expected life period and forcing to undertake rehabilitation of the entire scheme.

The concept of Bulk Water Allocation (BWA) was introduced and pilot tested by the Mahaweli Restructuring and Rehabilitation Project (MRRP) in Mahaweli system-in order to address the water management problems in Mahaweli H area. Under the BWA, the quantity of water to be issued for a particular user and consequently distributory canal (DC) for cultivation practices in a given season is fixed before the commencement of the season which is decided based on the total irrigated land within the distributory canal command area and type of crops to be cultivated. Each WUA makes requests for seasonal water requirements and requirements for each rotation and submits to the irrigation agency. The Mahaweli water panel decides the bulk water allocation based on the water availability but there is a guarantee for the decided water quantity. Therefore, a particular user has a legal water right and also the incentive to save the water. Farmers have to manage the crop with the agreed quota of water and the irrigation agency has the responsibility of supplying the promised amount of water.

A maintenance fund has been set up at DC level with farmer contribution in order to conduct the self-management of the canal system. Farmers have to pay an O&M fee of Rs 250 per ha per year (US$ 2.5) to the respective WUAs for the sustainable O&M of the turned over distributory system. In order to manage the operation of gates and distribution of water among farmers in a timely manner, a Water Master has been appointed by farmers of each WUA and the Water Master has been paid a salary for his services from the O&M fund maintained by the WUA.

The efficient use of available water resource and equitable distribution has been one of the expectations of the BWA mechanism. Further, it is anticipated that this mechanism will result in better discipline in water management through

active farmer participation, creating a sense of ownership and attitudinal change in farmers through fabricating volumetric impression of water use while reducing the dependency on government irrigation subsidies. In this process it was envisaged that more assured irrigation water supply results in reduced risks in crop cultivation and motivates farmers to cultivate high value commercially oriented cash crops in dry seasons. The ultimate target of BWA system is to develop a well functioning irrigation management mechanism via generating tangible benefits for farmers to manage their own resources in a sustainable manner.

The concept was seen as a strategy to achieve the expected objectives of irrigation management turnover. BWA was started as a pilot project in selected locations and now it has become a broad subject in the Mahaweli H area with the improvements made in subsequent seasons. The findings on the assessment of BWA show that, the programme has helped to increase the cropping intensity, water productivity, and farmers' income and reduction in irrigation water duty (Aheeyar at-al, 2006).

Objectives

The major objective of the study is to assess the level of resources mobilization for system O&M under the BWA programme and its implications on the sustainability of infrastructure and estimate the farmers' willingness to pay (WTP) for the improved irrigation services and to ensure sustainable management of irrigation infrastructure.

Research methods

Study sites

Mahaweli system H is one of the administrative areas of Mahaweli river diversion and settlement project and which is the first downstream area benefited by Mahaweli river diversion project. The total irrigation extent in the system H is around 31,500 ha allocated among equal number of farmers at the rate of one hectare per farmer.

The Mahaweli H system has been further divided into nine blocks for the purpose of administration, in which two blocks were selected randomly for the detailed survey, namely the Galnewa and Madatugama blocks. Two WUAs from each block were selected randomly to represent the head and tail areas of branch canals.

Methods of data collection and analytical framework

A multi stage stratified random sampling technique was adopted in selecting sample farmers for data collection considering the head and tail differences of the scheme. The total sample size was 120. In addition, necessary data also collected from literature, key informant interviews and focus group discussions.

Contingent Valuation Technique was adopted to estimate the farmers' willingness to pay for improved irrigation services. The contingent valuation method (CVM) is a survey technique that elicits values people provide on increase or decrease of benefits from natural resources at the hypothetical market condition. There are substantial literatures to explain the theoretical and empirical application of CVM (Hufschmidt et-at, 1990; Randall, 1981; Upawansa & Abeygunawardana, 1993).

Direct inquiry on irrigation fee is very sensitive among farmers and farmers may resist answering such questions. However, a traditional custom, which exists in Sri Lanka, is the giving of a certain proportion of paddy to irrigation headmen after each harvest for his services, though it is not in practice in new irrigation schemes. Therefore, farmers chosen for the survey were asked about their WTP in terms of paddy harvested in each season for improved irrigation services and sustainable O&M of irrigation infrastructure. Before posing the question, it was clearly explained to the beneficiaries about the existing status of irrigation infrastructure and expected future cost escalation and institutional context in which water resources are to be provided and funding is to be done and farmers responsibilities under agreement signed under the BWA programme. Then the WTP question was stated as follows;

"How many kg (or bushels) of paddy are you willing to provide to your WUA per hectare of cultivated land per season in addition to your current O&M fee payment and voluntary labor mobilization for maintenance and WUA activities in order to maintain the turnover irrigation infrastructure in better condition to achieve improved irrigation services".

The approach adopted in this study to find out the WTP in terms of paddy rather than cash was very successful and all farmers responded well. The WTP in terms of paddy was converted to monetary value using 2005 paddy prices prevailed in the study areas.

The factors affecting the amount of WTP and relationship between variables were established developing a multiple regression model. The following nine independent variables were identified and information was collected from sample farmers.

Total farming income (Inc) – Rs/year
Total low land extent (low land) – ha
Major dry season crop (crop) – Other field crops = 1, Rice = 0.
Age (Age) – Years
Education (Edu) – No. of years
DC location (DCloc) –- Tail =0, Head =1
Type of farming (Farm) – Full time = 0, Part time= 1
Labour contribution for meetings (Labmeet) – No. of days/season
Labour contribution for maintenance (Labmain) – No. of days/season

The willingness to pay estimate was regressed as WTP as a function of listed ten variables.

$WTP = \beta_0 + (\beta_1 Inc + \beta_2 Lowland + \beta_3 Crop + \beta_4 Age + \beta_5 Edu + \beta_6 DCIoc + \beta_7 Farm + \beta_8 Labmeet + \beta_9 Labmain)$

Results and discussions

Level of resource mobilization for operation and maintenance

Sustainability of irrigation infrastructure largely depends on the proper maintenance of the system from primary level (head system) to tertiary level (farm gate). The task needs mobilization of beneficiary labour time and cash.

Table 1 shows the level of resource mobilization by farmers in kind and cash for the system O&M. The value of mobilized labour ranges from Rs 1000 to Rs 1775 per ha per annum. The amount of cash mobilized by farmers to WUAs is about Rs 500 per ha per annum. The amount of cash mobilized for system O&M is a significant feature in resources mobilization under BWA compared to various past attempts of cash collection for O&M by WUA's and government agencies for turned over irrigation channels in major irrigation schemes. Aheeyar (1997) found that, the value of cash and materials mobilization by farmers towards WUA's for O&M is desperately low and sometimes it was recorded as zero.

Table 1: Annual Cost of Irrigation Water to Farmers

Cost Items	Loc 1	Loc 2	Loc 3	Loc 4
Average Value of voluntary labour (Rs/ha)	1424.50	1772.50	1032.00	1445.00
Average Cash contribution (Rs/ha)	487.50	500	467.32	500.00
Total Irrigation cost (Rs/ha)	1912.00	2272.00	1447.32	1945.00

Loc- Location

Source: Authors' Survey data (2005)

The value of the resources requirements for adequate O&M activities as estimated by TEAMS (1991) in major irrigation schemes is Rs 914 per ha/year in 1990 prices. This is equivalent to Rs. 2726 in 2003 prices. However the estimated total value of mobilized resources towards the system O&M in the Mahaweli system H under the BWA programme ranges from Rs 1450 to 2275 in 2005 prices. The finding highlights the mobilization of resources is a little lower than the TEAMS' estimate. Although the estimated resources value mobilized at present is little lower than the TEAMS' estimate made in 1990. The present contribution may be sufficient due to the rehabilitation of the system recently.

Farmers were queried about their perception on the following statement that "the level of resource mobilization for system O&M by the WUA is sufficient to ensure physical sustainability of infrastructure". About 26 per cent of farmers 'strongly agree' with the statement and about 71 per cent of farmers 'agree' with the statement. Only 3 % of farmers disagree with the statement.

However, the maintenance requirement will increase over time with the aging of infrastructure and therefore the current level of resource mobilization may not be sufficient in future. Therefore, the study made an attempt to assess the farmers' willingness to pay (WTP) for sustainable O&M of turnover irrigation system towards WUA in addition to their current level of cash and labour mobilization.

Willingness to Pay (WTP)

The average annual estimated WTP is ranges from 52 kg of paddy to 77 kg of paddy /ha/annum. This is equivalent to the monetary value of Rs 599/ha to 890/ha/annum (US$ 6-9) at 2005 paddy prices. It is noteworthy to mention that the WTP values estimated is in addition to the current level of labour and O&M fee contribution. There were only 8 farmers not willing to provide anymore other than the current level of resource mobilization. Tables 2 show the WTP values obtained in selected locations (Loc). The higher values of standard deviations of WTP show the high variation in the amount willing to pay by various farmers.

Table 2: WTP for system O&M (Rs/ha/year)**

Name of the FO	Loc 1	Loc 2	Loc 3	Loc 4
Mean	889.73	826.55	885.09	599.30
Maximum	2500.70	2500.7	3751.06	2500.7
Minimum	250.07	0	0	0
Std deviation	678.48	749.12	918.03	551.1

Source: Authors' Survey data (2005)

The amount that farmers WTP to the respective WUAs towards system O&M is an impressive point compared to the past attempts to collect O&M fee through the centralized financial agency, which had an unsuccessful short life of 4 years. The existing WTP is needed to be captured by the authorities to cope with anticipated future cost escalations and increasing maintenance requirements of aging rehabilitated infrastructure.

Factors affecting willingness to pay for operation and maintenance

Results of the regression analysis conducted to find out the relationship between farmers' willingness to pay and the farmers' socio economic features are presented in table 3. The positive and significant coefficient of total family income indicates that beneficiaries having a higher income are willing to pay more for improved irrigation services and are more concerned on sustainability of irrigation infrastructure. The similar results obtained for the total low land extent cultivated show that the farmers who cultivate a larger lowland extent have expressed greater willingness to pay. Positive and significant co-efficient for the major crop cultivated in the dry season suggests that respondents who are engaged in high return commercial cash crop cultivation are willing to pay more for improved irrigation services.

The positive relationship with total family income, farm size and cultivation of cash crops indicate the needs of strategies to commercialize small farm agriculture which will increase the capacity and willingness of farmers to mobilize more resources towards irrigation system maintenance. Therefore, intensification of land use through promotion of an appropriate cropping system and integration of different

income generating components into the farming system is more suitable for the system.

Negative co-efficient for DC location (head end or tail end) indicates that tail end farmers are willing provide a higher amount of money for improved services. The higher value of willingness to pay by tail end farmers is mainly due to assurance and reliability of water for them under the BWA compared to past which has helped them to earn more income.

Table 3: Estimation of the regression model

Variable	Co-efficient	Statistics
Constant	23.534	4.65
Income	0.221	3.34***
Dry season crop	3.760	1.80*
Low land extent	3.924	3.43***
Age	0.005	0.057
Education	0.213	0.783
DC location	-4.003	-1.924**
Type of farming	-3.467	-0.971
Labour contributions (meetings)	-0.474	-2.388***
Labour contribution (maintenance)	0.278	0.392

***Significant at 1 percent level, **significant at 5 percent level, *significant at 10 percent level

Conclusions

The irrigation sub-sector in Sri Lanka has been heavily subsidized over the years; therefore farmers have a mentality of depending on government financial allocations for the management of the irrigation system. The attempts made in the past to recover the partial cost of irrigation system maintenance through the centralized financial agency were failures.

The present study finding suggests that farmers have mobilized a substantial amount of resources for irrigation system maintenance with the implementation of the concept of BWA, which provided tangible benefits to motivate farmers for resource mobilization. The programme was implemented with the assured water supply yielding tangible benefits to the beneficiaries and the financial resources were mobilized through local farmer centered WUAs that gave the motivation and confidence over the programme.

In addition to the current level of resource mobilization willingness to pay for the improved irrigation services is an impressive point that needs to be considered in the future policy formulation of sustainable irrigation maintenance. Willingness to pay is positively related to total family income, farm size, type of crop cultivated and location of the irrigation canal. These parameters have a direct linkage with commercialization of small farm agriculture, and therefore need to be considered in the designing, developing and maintaining irrigation infrastructure under the concept of sustainability. The willingness to pay expressed by farmers should be captured considering the future cost escalations and gradual deterioration of rehabilitated infrastructure.

The major lessons of the experiences are that comprehensive devolution policy for the irrigation sector and assured water supply can encourage farmers to invest in the long-term sustainability of their irrigation infrastructure. In addition, to realize the benefits of the devolution policy, it must provide attention to create self-reliant local organizations in terms of social, financial and technical perspectives for better local management. Economics of irrigated agriculture is a key aspect in motivating farmers in mobilizing or willing to mobilize cash and materials for irrigation system maintenance. Therefore the irrigation management transfer should widen up the focus beyond mere cost recovery but in helping and creating an environment to generate the necessary development impulses for increasing agricultural productivity, establishing marketing linkages and the appropriate scale of production in the area.

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Contact addresses

M.M.M. Aheeyar, Research Associate,
Hector Kobbekaduwa Agrarian Research and Training Institute, Colombo, Sri Lanka
hartiiar@sltnet.lk