# Role of Extension in Irrigation Water Management in Sri Lanka

C. Sivayoganathan and M.I.M. Mowjood
Faculty of Agriculture, University of Peradeniya, Sri Lanka

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## ABSTRACT

**Irrigation plays a vital role in agricultural production in Sri Lanka. This paper highlights the dynamic role of extension in effective irrigation water management by farmers engaged in both surface as well as ground water irrigation. Irrigation water management to be effective should meet the perceived needs of the three major stakeholders namely the farmers, the system operators and the policy makers. The recent trend is the transfer of irrigation system management from the government agencies to the farmer organizations. The farmer organizations should, therefore, be strengthened by training and by the provision of necessary legal, economic and social supports so that they could play an effective role in motivating farmers to become partners rather than mere participants in irrigation water management. On-farm water management technologies for effective water use should be demonstrated to farmers and they be encouraged to adopt the same. The village level officers from both government and non-government agencies engaged in advising farmers in irrigated agriculture should be trained periodically so that they could perform their role effectively leading to greater agricultural productivity.**

***Key words***: Irrigation, water management, extension, Sri Lanka, empowerment

## INTRODUCTION

Irrigation plays a vital role in agricultural production in Sri Lanka. In the late 70's many major irrigation projects were implemented in addition to constructing a large number of medium sized irrigation schemes and village tanks. During the last two decades irrigation sector has gone through tremendous changes. Several government institutions (national and local) are involved in irrigation water management. The needs of the stakeholders of irrigation water management viz. the farmers, irrigation system managers and policy makers, have changed. The training needs, mechanism for technology transfer and the adoption procedure of different management policies are to be re-identified, considering the current context of water sector at both local and global levels. However, the organization of extension at the village level in Sri Lanka seems to be rather diluted and weak emphasizing only the agronomic aspects of farming and is not ready to meet the challenges in the modern irrigation water management in Sri Lanka. This paper attempts to highlight the recent trends in irrigation water management and the importance of institutional innovation in extension for efficient irrigation water management in Sri Lanka.

### Irrigation Systems

Irrigation systems under gravity irrigation in Sri Lanka can be categorized according to the size, water source and management. Major irrigation system is defined as one that has a command area of more than 1000 ha. and medium schemes between 80 and 1000 ha. Small tanks or minor irrigation systems are those having an irrigated command area of 80 ha or less (Merry et al. 1988). All these irrigation systems were established mainly for paddy production and included the following components: Source of water or water storage, water conveyance system and command area. The water source can be a small tank or a large / medium reservoir. The water conveyance system normally has several sub-systems such as main, branch, distributory (DC) and field channels (FC). The command area consists of farm plots which receive a known quantity of water through the field turnout. Major irrigation systems are managed by the central Irrigation Department and Mahaweli Authority of Sri Lanka. Medium and minor irrigation systems come under the Provincial Irrigation Department and the Department of Agrarian Development, respectively. The complexity varies among the irrigation systems and obviously a single water management policy or program will not fit all equally well.

Utilization of groundwater for irrigation became popular among farmers for various reasons. Traditionally farmers in the dry zone have relied heavily on surface water for irrigation. Because of the constraints and limitations in the use of surface water, farmers have supplemented the irrigation water from ground water, by digging large diameter, shallow wells known as agro-wells. Government

promoted the construction of agro-well through a subsidy program ( Karunaratne 2002). A survey conducted by the Hector Kobbekaduwa Agrarian Research and Training Institute (HCRTI) in 2000 reported that there were a large number of privately constructed agro-wells in the dry zone (Aheeyar and Ariyabandu 2002). Successful agro-well farmers in the dry zone claimed that they had increased their income by many folds since the introduction of agro-wells. However, the density of agro-wells, that is, the number of agro- wells per unit area, has increased creating a critical situation of over-exploitation of ground water. This emphasizes the need for training of farmers on the sustainable use of ground water through agro- wells. Training on cropping systems under lift irrigation, operation and maintenance of water pumps and micro-irrigation systems is essential for the agro- well farmers.

**Irrigation Development Programs**

The early phases of irrigation development in Sri Lanka were characterized by massive investments in new construction as against rehabilitation, the latter meaning restoration of deteriorated or even abandoned irrigation schemes to their original capacities or improving them to above their original capacities. Presently, especially after the implementation of the Accelerated Mahaweli Development Project, the scope for new construction is less and there is a shift in emphasis to rehabilitation.

The Tank Irrigation Modernization Project (TIMP) implemented in 1976 represented one of the first efforts directed at rehabilitation on a major scale. The TIMP covering five tanks and a command area of about 12,750 ha, all located in the northern dry zone, was completed in 1984 (TEAMS 1996). It introduced several innovations in agriculture and irrigation, together with supporting institutional arrangements. The objectives aimed by TIMP at water conservation included:

- ♦Increasing cropping intensity through crop diversification in the dry season,
- ♦Early land preparation for wet season paddy cultivation,
- ♦Use of short aged paddy varieties,
- ♦Improved equity of water distribution, and
- ♦Redesign of the conveyance system, lining of channels, introduction of water measurement and construction of cross regulators in main channels (Merry, Rao and Martin 1988).

Abeysekera (1986) documented the limited impact of TIMP on one of the five schemes namely Mahavilachchiya and the associated reasons. Ranatunge, Farrington and Abeysekera (1981) discussed the broader issues and lessons learned form baseline studies of the five tanks rehabilitated under the TIMP.

The command area under major irrigation schemes increased from about 100,000 ha in the early 1950s to over 300,000 ha by the late 1980s. The experiences gained from TIMP influenced the planning and design of the Major Irrigation Rehabilitation Project (MIRP). The MIRP financed by the International Development Agency (IDA) was implemented over the period 1985 to 1992. Although the project was originally designed to include Marawewa, Iranamadu, Giant's tank, Rajangane, Nachchaduwa, Huruluwewa and Kantale covering a total command area of about 46,000 ha, Morawewa, Iranamadu and the Giant's tank had to be later suspended due to security problems (TEAMS 1996).

The village / minor irrigation schemes play a vital role in the agricultural economy of Sri Lanka. The Village Irrigation Rehabilitation Project (VIRP), although originally planned to cover 1200 schemes in 18 districts (Herath et al. 1989), was later scaled down to cover only 11 districts. The project was sponsored by the World Bank and its implementation was undertaken during the period 1981 to 1990. Physical rehabilitation included:

- ♦Improvement of tank bunds and spillways,
- ♦Replacement of old sluices,
- ♦mprovement of main and field channels, and
- ♦Provision of appropriate drainage systems, control structures, turn-out structures and measuring devices (Medagama, 1986).

The rehabilitation was done mainly by the Irrigation Department and subsequent water management practices were to be undertaken by the then Department of Agrarian Services. In general the emphasis in the selection of schemes was on higher benefit-cost ratios. The command area of the scheme selected should not be less than 12 ha with at least 10 farmers benefiting from the rehabilitation.

Rehabilitation of minor irrigation schemes has been undertaken by other projects as well. Almost all Integrated Rural Development Projects included an irrigation component, especially targeted at the rehabilitation of minor schemes ( Herath et al. 1989).

The Freedom From Hunger Campaign was engaged in Village Tank Rehabilitation programme in 7 districts (Dayaratne and Moragoda 1991). Also, minor tank rehabilitation formed a major component of various other development projects such as the North-Western Province Dry Zone Participatory Development Project and the Trincomalee

Integrated Food Security Project (Sivayoganathan et al. 2003). These programmes focused not only on the technical aspects of repair and reconstruction but also on the more important socio-economic aspects.

The National Irrigation Rehabilitation Programme (NIRP) implemented during the period 1992 1998 followed the footsteps of the VIRP and MIRP in paying special attention to the problems of rehabilitation. It included rehabilitation of about 1000 minor schemes and 35 major / medium schemes. In addition to physical rehabilitation, the project paid attention to upgrading the skills of farmers and staff of implementing agencies, and to creating viable farmer organizations for maintaining the rehabilitated schemes.

## Objectives of Irrigation Water Management

Irrigation water management can be defined in different ways. In general, it involves water resource development, storage, allocation, distribution and utilization practices that are carried out to meet the needs of the farmers, the system operators and the public (Levine 1986).

The objectives of irrigation project often conflict with the wishes of farmers receiving water from the project. The farmers try to maximize the yield per unit of land as they consider land as the most scarce resource. From farmer's point of view, the water should be delivered adequately in an appropriate time and should be predictably reliable. The system operators, on the other hand, try to increase the water use efficiency by maximizing the yield per unit volume of water as they consider water as a scarce resource. So, the system operators need cooperative farmers who will stick to an operating schedule that permit them to utilize their available water resources. They also need undamaged control structures and minimum farmer conflict. The policy makers are more concerned about the investment on irrigation in terms of the budgets for new construction and for rehabilitations and the regular budgets for operation and maintenance. They need to achieve the national goals such as increased production, export earnings, and reduced import expenditures and subsidies. With the involvement of external funds there is extra pressure from the donor agencies. Therefore, if water management is to be appropriate and effective, it must reasonably meet the needs perceived by three major interest groups, the farmers, the system operators and the government policy makers.

In order to meet the demands of these stakeholders, technically sound physical structures, effective organizational setup for planning, implementation, monitoring and evaluation of operation and maintenance procedures, and long-term government policies are inevitable.

There are substantial changes with time in the water management in Sri Lanka in keeping with the changing needs of stakeholders. As the competition for the basic water resource increases due to domestic water supply, industry and power generation, pressures build up to reduce water allocations to irrigation. When this occurs, the water management practices must also change accordingly. It is thus natural that irrigation systems physically, organizationally and experientially go through changes. The responses to those changes should be developed collectively in the form of an effective and efficient water management.

## Irrigation System Management

One of the main constraints to the development of minor irrigation schemes in Sri Lanka is the continuing change that had occurred over the years and continues to occur without much regard to the beneficiaries (Panabokke et al. 2001). In ancient times the construction and maintenance of irrigation system were made possible through the observance of the principle of 'Rajakariya' by which these systems were operated and managed by the communities themselves (Goonasekera and Gamage 1999). The responsibility of management was vested with the 'Gamarala'. Irrigation headman (Velvithane) system was introduced in 1856 by a legislation called Paddy Lands Irrigation Ordinance No. 9 and was functioning satisfactorily till 1958. The cultivation committees were established under the Paddy Lands Act of 1958 and these committees were functioning from 1958 to 1977. These committees were under the Department of Agrarian Services till 1973, and later came under the Agricultural Productivity Committees (APC) that were established under the Agricultural Productivity Law enacted in 1972. The Agrarian Services Committees (ASC) were established in place of APCs under the Agrarian Services Act of 1979. Tank councils (Wewa Sabba) were established in 1980 (Gamage 1997).

The present irrigation systems operate under a different social, economic and political system. The performance of work in the present system is on the basis of wage labour and not on the principle of 'Rajakariya'. Although the basic infrastructure (tanks, paddy lands, highland including settlements and network of irrigation) was essentially the same, new dimensions have been added to the recent constructions in response to external demands

(ARTI 1991). Farmers are merely concerned about receiving water for their farm plots. Their knowledge about characteristics of the irrigation system, administrative resources and water availability in the tank is meager. The main reason for this is the lack of effective communication between the farmers and officers engaged in irrigation system management. A well-organized farmer organization (FO) can play a major role in bridging the communication gap between the farmers and the system operators.

The FOs are functioning in almost all irrigation systems for a long time. These FOs are held responsible for organizing the maintenance work on the channels as well as the tank bund and other structures. Operation and maintenance of channels include cutting shrubs or weeding and earth work on channels, lubricating and painting sluice gates and clearing the spill and turnouts. They are also responsible for implementing the decisions made at the seasonal meetings (Kanne meeting). However, most of the FOs do not fulfill the expectations regarding the operation and maintenance of the irrigation structures as a result of various internal and external factors (Sivayoganathan et al. 2003). The strength and sustainability of FOs depend on the capability of farmers and institutional, legal and social supports given to them. Two types of training should be conducted to the FO office bearers and farmer members at large:

- Technical training to enhance the capacity of the FOs to ensure proper operation and maintenance of the schemes.
- Leadership training to increase the managerial capability and organizational capacity.

Empowerment of farmers is necessary for their active involvement in water management. The farmers should be motivated to become partners rather than mere participants in irrigation water management. A sense of ownership in the minds of farmers about their irrigation system can be built-up through active participation in decision-making and implementation. In this regard, it is worth noting that the food-for-work approach employed by the Integrated Food Security Project in the development of minor tanks in Trincomalee district encouraged farmer participation and contribution, which in turn was expected to promote a sense of ownership (Sivayoganathan et al. 2003). Having educated the farmers about the irrigation systems and the need for their proper maintenance, it is necessary to convince them on the need for their active participation in the maintenance process. Unity and understanding among farmers have to be promoted.

Several case studies were reported on management transfer. Merey (1996) has elaborated the differences between systems that are controlled and managed by local user organizations and systems that are owned and controlled by government agencies. The performance of government controlled systems is consistently lower on several dimensions than that of local self-governing systems. The relative performance was measured in terms of cropping intensity, technical efficacy of infrastructure and adequacy of water supply. Other studies have also documented improvements in irrigation performance when government controlled systems were transferred to farmers partially as self-governing systems (Kloezen et al. 1997; Bandaragodo1998; Vermillion and Garces-Restrepo 1996; Vermillion and Garces-Restrepo 1998; Johnson 1997; Vermillion 1997; Walisundera undated). Farmers' understanding of the system function, operation and maintenance play a major role in management transfer of the irrigation systems.

## On-farm Water Management

The objective of on-farm water management is to increase the water productivity and water use efficiency. Water productivity can be defined agronomically as kilograms of dry matter produced per volume of water supplied. Water use efficiency is defined as the amount of water used (transpired) by the plant relative to total water input into the system. The latter definition is more appropriate because it is a measure of water losses within the field and in the conveyance system.

On-farm water management programs promote the rehabilitation of field irrigation and drainage systems, and the introduction of more effective field methods through land leveling and sprinkler or micro irrigation systems. In most countries irrigation agencies have little experience and interest in on-farm water management, while in most cases agricultural extension workers have no expertise in water management.

## Water availability

Water availability depends on the rainfall patterns of the area and the storage capacity of the reservoir or tank. Erratic nature of rainfall and capacity reduction in tank by siltation make it difficult to predict the water availability. The area under cultivation in any given season is calculated based on the amount of water available in the tank at the beginning of the season, anticipated rainfall plus diversion. Water requirement of a crop is estimated from the

transpiration by the crop and direct evaporation from the soil surface. To the extent the rainfall satisfies a significant fraction of crop water requirement, the water management relaxes. Irrigation should be supplementary to rainfall particularly in the 'Maha' season. Therefore, farmer has to make day-to-day decisions in the field. This is rather difficult if the farmer is unaware of crop water requirement and soil moisture characteristics.

Adequacy of irrigation water refers to the sufficient volume of water available to cultivate a full paddy-growing season without allowing stress in respect of paddy plants during critical periods. Farmers attribute inadequate water supply to insufficient water rotations and do not consider wastage of water as the cause for an inadequate supply of irrigation water. Water distribution from the FC to the farm plots can be handled effectively by the farmers. Water rotation at the FC should be maintained collectively by farmers through farmer representatives. Water delivery from DC to FC is the responsibility of the Irrigation Department or the Mahaweli Authority of Sri Lanka.

**Water distribution**

Irrigation offers a great potential for increasing production and reducing the risk of crop failure. Irrigation water is not made available at the right time and in the right quantities to all the farmer's fields that are located within the command area. It is well known that in the major irrigation schemes, the lack of water for the tail-enders of the scheme is a problem that has not yet been satisfactorily resolved. Even distribution of water within the fields is important in on-farm water management because it reduces the water wastage in two ways:

- ♦It reduces the duration of the irrigation to a farm plot.
- ♦It reduces the deep percolation at the entry to a field.

Uneven levelling of land and high percolation and seepage due to texture of soil are the main reasons for uneven distribution of water within the field. In most irrigation schemes, paddy is being grown under flooded conditions irrespective of land, soil types, drainage conditions, topography and amount of water available. In terms of agronomy, it has been observed that some of the lands that have been provided with irrigation water are not suitable for irrigation, particularly for paddy cultivation, and that the farmers' preference to have water running all the time through the paddy fields is due to their knowledge of this incompatibility. In these circumstances, much water is being dumped on the land and wasted. The water saving techniques have to be demonstrated to the farmers showing that less water would not mean decrease in yield but in fact could help increase yield. Participatory training and extension is an effective tool to establish the appropriate structure to assist and advise farmers in irrigation water management. This can be carried out on an individual basis for each farmer on his own field as well as for a group of farmers who jointly manage a hydraulic unit like FC and share water from the same source as a village tank. Farmers need to be educated on the following:

- ♦Crop water requirements
- ♦Crops suited to different classes of land
- ♦Design of surface irrigation methods (lengths, widths and slopes for furrow and basin irrigation) and best procedures for irrigation (stream size, flows, application and frequency of application)
- ♦Developing landscaping methods suited to the soils, topography and farm sizes in the irrigation projects
- ♦Water balance and hydrology
- ♦Water delivery and measurement structures for water control as well as for supplying the water requirements of farmers.

**Modern irrigation methods**

Pressurized irrigation systems such as sprinkler and drip irrigation systems are becoming more and more popular among farmers because of several advantages over the traditional irrigation systems. Micro-irrigation is one of the emerging technologies for efficient use of water. Presently, there are more than 10 private companies importing and selling the hardware of the micro-irrigation system. Government subsidies and loans from banks are available for micro-irrigation. However, only a small percentage of farmers have succeeded with micro-irrigation. It has been reported that, of the farmers who adopted micro-irrigation techniques, nearly 90% preferred micro- sprinklers rather than drip, because of its visible nature in applying water (Aheeyar and Ariyabandu, 2002). Therefore, such social issues should be considered in promoting drip irrigation systems. Continuous monitoring on social acceptance and technical difficulties is essential. Since the micro-irrigation system was introduced recently, agronomical and technical advice must be provided to the farmers through extension services of government or non- government organizations. Adequate number of competent officers is not available at the field level to advise the farmers. At the same time, farmers are not in a position to reach out to the private sector individually, to solve their

problems. Therefore, the ideal alternative solution is to channel the extension advice through the FO leadership.

### Training of Trainers

Training and extension is an important tool for developing the knowledge and skills of farmers and FO office bearers to undertake management responsibilities and develop more profitable irrigated agriculture. Training has to be directed to developing skills in financial and administrative management, and technical operation and maintenance of the system. The village level officers who could serve as trainers presently include Agricultural Instructors, 'Grama Sevaka Niladaris', Agrarian Research and Production Assistants, and Agrarian Development Officers in addition to Water Masters. These officers should be trained periodically on the following, in addition to the technical know-how so that they could perform their function more effectively:

- ♦Interpersonal relationship
- ♦Leadership development
- ♦Attitude changes
- ♦Community mobilization
- ♦Participatory approach
- ♦Conflict management

The methods, techniques and devices used in the induction and in-service training of the officers should provide learning experiences to change their attitudes, enhance their knowledge and develop the required skills (Sivayoganathan and Goonasekera 1992). The officers who are being trained should be in a position to perform the jobs on which they have been trained, with proficiency without the assistance of the trainer.

## CONCLUSION

The effective and sustainable use of water for agriculture has become a global priority of vital importance, requiring urgent and immediate solutions in view of intensifying competition. There still exists a large gap between the availability of technologies for effective water use and adoption of these technologies. One of the reasons for this gap is that relatively little attention is paid to establishing an effective support system to assist farmers in the adoption and proper operation of new techniques and technologies. At the same time, the policies of management of irrigation system are directed more towards the transfer of management to farmers. Farmers, therefore, have to be well equipped to face the new challenges and responsibilities. However, the extension service is in temporary disarray and the village level officers are not equipped adequately to advise and support the farmers on matters related to irrigation management. As a result, the impacts of the investments in many irrigation projects and on the cultivation inputs of farmers are considerably lower, in terms of production, water savings and sustainability both economically and environmentally. Irrigation advisory/extension services by public, co-operative or private agencies collaboratively can play an important role in assisting farmers to adopt new techniques and technologies for more efficient water use and increased production individually and collectively.

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