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Summaries of Reviews of Literature Related to Irrigated Agriculture in Sri Lanka

Volume II

S.S. Wickramasuriya and K. Azharul Haq, editors

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INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE

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Keywords : minor irrigation / cropping systems / rice / Walagambahuwa

Study Sites : Walagambahuwa irrigation systems, Anuradhapura and Kurunegala districts

Study Period : 1976-1981

Introduction

This is a review of the experience gained in the process of introducing a new cropping system program to the poorly irrigated rice lands under minor irrigation schemes in the Anuradhapura and Kurunegala districts, based on the technology derived from the Walagambahuwa Project. Walagambahuwa is a village settlement in a minor irrigation system. The cropping system program was initiated in 1975 by the Government of Sri Lanka and the International Development Research Centre of Canada in collaboration with the Cropping Systems Network of the International Rice Research Institute. The minor reservoirs begin to fill up in late November/December at which time it is the traditional practice for farmers to commence preparing the fields for the rice crop. This practice depends solely on stored water in the reservoirs. The Walagambahuwa Project attempted to persuade farmers to begin cultivation earlier and make maximum use of the rainfall before resorting to use stored water.

Objective

To investigate the feasibility of implementing an early cultivation of rice under minor irrigation systems, making the maximum use of rainfall before resorting to using tank water.

Findings/Recommendations

The results of the Walagambahuwa experiment suggest that the unstable rice/cropping pattern previously practised under minor irrigation schemes in the Dry Zone, can be stabilized and improved if the following technology-input procedure is followed:

1. Substitute the improved three-month variety in place of the traditional four-month variety.

2. Advance the time of cultivation to September/October with the first onset of the rains instead of waiting for the reservoirs to fill, in order to utilize the incidental rainfall and prevent squander of stored water.

3. Conserve the stored water in the reservoirs only for supplementary irrigation of the first rice crop, and grow a second rice crop or other food crops during the following dry season.

4. Use moderate levels of fertilizer to boost yields.

Wijesuriya, L.T. 1990. Sri Lanka's experience in resource mobilization for system operation and maintenance: As viewed by the Irrigation Department. *In* Resource mobilization for sustainable management. Proceedings of a Workshop on Major Irrigation Schemes, IIMI, Colombo, Sri Lanka. 1990.

Keywords : farmers association / farmer agency interaction / resource management / policy location / agriculture / sustainability / Sri Lanka / Mahaweli Project

Study Sites : Nonspecific

Study Period : Nonspecific

Introduction

This paper describes the experiences of the Irrigation Department on Operation and Maintenance (O&M) of irrigation schemes. Beginning with a historical perspective, the paper describes the O&M practice, resources available for O&M, crisis and constraints of O&M, and the funding structure, with special reference to farmer involvement in O&M in some schemes. It especially describes some experiences which oriented towards handing over O&M of irrigation schemes to farmers. It has drawn many conclusions on resource mobilization for system O&M through the experiences of the Irrigation Department.

Objective

To document the Irrigation Department's experiences of O&M of schemes.

Findings/Conclusions/Recommendations

The study has revealed the following:

1. Slow change of the Irrigation Department from its construction-oriented bureaucratic tendency towards participatory management. Individuals who are capable in this regard should be encouraged and the potential of the Department with its knowledge and manpower can be geared to achieving the change towards participatory management.

2. Awareness programs are necessary for bringing about change.

3. A long-term and sustainable policy can pay better dividends.

4. Participatory management must be appreciated as a means of overcoming state financial deficiencies, especially in the case of maintenance of the schemes.

5. The handing over process should be implemented stepwise. Roles of the agency and users need frequent review.

6. Attitudes associated with the lesser attractions of O&M, or those which seek to confine irrigation engineering only to the civil post of hydraulics, have to undergo revision and change.

7. Assumptions need modification depending on the time and place. Caution should be exercised when innovations and perceptions are applied in real situations.

8. Experience of the Irrigation Department in the broad spectrum of O&M must be considered in forming new strategies and policies.

Wickremaratna, H.A. and T.D.P. Karunatilleke. 1990. Experiences of the Mahaweli Economic Agency in resource mobilization for sustainable management of major irrigation schemes. *In* Resource mobilization for sustainable management: Proceedings of a Workshop on Major Irrigation Schemes in Sri Lanka held in Kandy, 22-24 February 1990. IIMI, Colombo, Sri Lanka.

Keywords : farmers associations / farmer agency interactions / resource management / policy / agriculture / sustainability / Sri Lanka / Mahaweli Project

Study Site : Nonspecific

Study Period : Nonspecific

Introduction

This paper summarizes at the beginning the history of management of major irrigation projects during the last 75 years in Sri Lanka. Then it describes the formation of organizations for post-settlement activities in the Mahaweli Project. Further, it explains the formation of the Mahaweli Authority of Sri Lanka (MASL), the Mahaweli Economic Agency (MEA) and the Irrigation Management Organization within the MEA. Then the role of the MEA in irrigation management is explained. Finally it summarizes the advantages and disadvantages of the present organizational structure.

Objective

To document the experience of the MEA in resource mobilization for sustainable management of major irrigation schemes.

Findings/Conclusions/Recommendations

The advantages and disadvantages of the present organizational structure are as follows:

Advantages

1. The MEA has the capability to attend to settlement and post-settlement activities which are vital for irrigation management.

2. The Executive/Managing Director has the overall financial and administrative control to take decisions regarding all activities in the project with advice from the Heads of Divisions of respective disciplines.

3. The Resident Project Manager with the assistance of Deputy Resident Project Managers of the respective disciplines has the capacity to attend to all activities in the projects.

4. The feedback mechanism from farmers through Unit and Block Managers to the Resident Project Manager is very effective.

5. Water management divisions are facilitated with the current setup.

6. Responsibilities of each unit for Operation and Maintenance (O&M) are well defined.

7. Bethma cultivation was done effectively during *yala* seasons in System H with the help of the present organizational structure.

Disadvantages

1. The Chief Irrigation Engineer in the Head Office issues instructions to the project engineering staff through the Resident Project Manager who decides on the priority in implementation.

2. Sometimes, engineering staff in a project may attend to irrigation problems without investigating them properly to satisfy the block management or the Resident Project Manager who will decide on their performance.

3. Required facilities may not be given to the engineering staff to solve engineering problems properly.

4. The Deputy Resident Project Manager-Water Management (DRPM-WM) will not be able to make the best use of available resources like vehicles, labor, etc., which are under the authority of the Block Manager (BM) or the Resident Project Manager (RPM).

5. Completely avoiding the line organization is not desirable.

6. The Chief Irrigation Engineer (CIE) is not directly involved in decisions regarding engineering.

Groenfeldt, David. 1989. Guidelines for rapid assessment of minor irrigation systems in Sri Lanka. International Irrigation Management Institute (IIMI), Colombo, Sri Lanka.

Keywords : minor irrigation systems / monitoring / evaluation / project appraisal / rapid assessments

Study Site : Nonspecific

Study Period : Nonspecific

Introduction

This paper presents a set of guidelines for the rapid evaluation of an irrigation system, developed by IIMI staff in cooperation with staff from the Regional Development Division and the Badulla District Office of the Integrated Rural Development Projects (IRDPs). A One-Day Workshop on Rapid Assessment Methodologies for Minor (Small-Scale) Irrigation Systems in Sri Lanka was held at IIMI Headquarters in August 1988. Representatives who participated were from three Sri Lankan agencies: the Irrigation Department, the Department of Agrarian Services, and the Regional Development Division of the Ministry of Plan Implementation which oversees the district-level Integrated Rural Development Projects.

Objective

For IIMI staff to develop a set of guidelines for rapid assessment of minor irrigation schemes in cooperation with staff from the Regional Development Division and the Badulla District IRDP Office.

Findings/Conclusions

The IRDP process can be divided into five stages, of which the fourth stage, project evaluation, has been the focus of the assessment guidelines. However, the guidelines can also be used, in whole or in part, at other stages: presentation, feasibility/baseline studies, implementation of the project, post-project (evaluation), and post-project (monitoring)

The assessment guidelines presented in this paper were designed primarily for evaluating project impact after completion of the project. The experience from testing the guidelines in Badulla and Kurunegala demonstrated the effectiveness of the guidelines in identifying drawbacks and benefits of IRDP improvements. Measurement of benefits is not possible in such a rapid assessment, but broad trends can be revealed. The guidelines can be customized for the particular conditions of each district and the specific interests of each project office.

Gunasekara, A and S.S. Ranathunga. 1990. Experience of Irrigation Management Division in resource mobilization for system O&M. *In* Resource mobilization for sustainable management. Proceedings of a Workshop on Major Irrigation Schemes, IIMI, Colombo, Sri Lanka.

Keywords : farmers associations / farmer agency interactions / resource management / policy / agriculture / sustainability / Sri Lanka / Mahaweli Project

Study Site : Nonspecific

Study Period : Nonspecific

Introduction

This paper describes experiences of the Irrigation Management Division (IMD) in the Operation and Maintenance (O&M) of irrigation schemes with special reference to the Integrated Management of Major Irrigation Settlement Schemes, (INMAS) Program carried out under IMD. It describes rational distribution of resources, planning and programming, promotion of participatory management and mobilization of local resources for O&M, achievements of participatory system, collection of O&M rates and the reasons for the slow progress of the O&M collection scheme.

Objective

To explain the experiences of IMD on O&M of irrigation schemes.

Findings/Conclusions/Recommendations

1. O&M fee recovery system is not successful.

2. INMAS policy of participatory/joint management is a more suitable system to ensure the sustainability of the physical system.

3. Success of the joint management system heavily depends upon the effectiveness of the farmers organizations (FOs). IMD has been faced with some severe constraints in forming farmers organizations and some of them are yet to be overcome.

4. Use of independent catalysts was not done in all the projects under INMAS, and this has partly contributed to the weakness of FOs in some places. However, the Project Managers were given the opportunity for innovative action in formulating and implementing new strategies.

5. Absence of legal recognition of the FOs is another major constraint in developing them into effective self-reliant organizations which can bear greater responsibilities. Lack of political commitment also contributed to the development of FOs in some areas.

6. The absence of positive attitudes in the government agencies could be a major impediment to achieving a joint management system. The bureaucratic apathy can frustrate organizations in the taking over of maintenance responsibilities. A clear political commitment for a joint management system would erase such apathy of the government agencies.

7. In spite of the various constraints, the implementation of the INMAS Program during a five-year period has proved the validity of the concept of joint management as a solution to the O&M problem, and also as a first step towards achieving total sustainability of irrigation systems.

8. The transfer of the present agency management system would require very clear policies, a carefully designed program for such transfer, and the capacity for scrupulous implementation.

Herath, H.M.G. 1985. Impact of tubewell irrigation development in Sri Lanka: A case study. Agricultural Administration. Vol. 20, p.125-137.

Keywords : tubewell irrigation / irrigation department

Study Site : Mulankovil Youth Settlement Scheme

Study Period : Six months in 1981-1982

Introduction

The impact of tubewell irrigation in the Mulankovil Youth Settlement Scheme in Sri Lanka is investigated in this study. The main criteria on which the performance was evaluated were the impact on employment, income and crop production. The study showed that the Youth Settlement farms obtained higher incomes per unit area in comparison with an old colonist scheme. In terms of employment, it was apparent that the deep tubewells in the Youth Scheme have generated a significant demand for labor. The efficiency of use of inputs investigated using various criteria also confirmed the Youth Settlement Scheme to be much better than the colonist scheme. However, there was further potential for improvement of the performance of the Youth Scheme. The main problems appeared to be inadequate water supply, frequent breakdown and lack of spare parts. Attention to these aspects could further enhance the potential of tubewell schemes.

Objective

To evaluate the degree to which subsidiary food crop production, generation of employment and income of the settlers have increased.

Findings/Conclusions/Recommendations

1. Farmers in the scheme have out-performed the colonists in terms of cropping intensity and the level of employment generation.

2. The average business income level is about Rs 6,760 per hectare (ha) in the Youth Scheme, which is very high in relation to the average income levels of many occupations in Sri Lanka.

3. More than 50 percent of employment generated required hired labor.

4. There is low income inequality in the Youth Scheme although the profit index is lower.

5. Major constraints are irregular delivery of water and lack of parts for the tubewell system to effect immediate repairs in case of a breakdown.

7. The study suggests that with careful control of the project, some development goals could be achieved.

Herath, H.M.G. 1985. Impact of tubewell irrigation development in Sri Lanka: A case study. Agricultural Administration. Vol. 20, p.125-137.

Keywords : tubewell irrigation / irrigation department

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Nikahetiya, S.B.R. 1986. Organizing farmers for agricultural development. Paper presented at Workshop on Water Management in Sri Lanka. Agrarian Research and Training Institute (ARTI), Colombo, Sri Lanka.

Keywords : agricultural productivity / infrastructure / delivery / mechanism / receiving mechanism / agrarian services committees / farmer representative / Galgamuwa

Study Site : Galgamuwa

Study Period : 1986

Introduction

There is a necessity to transfer information, knowledge and modern technology to the rural sector to enhance agricultural productivity. To achieve this, the need to set up efficient delivery mechanisms and receiving mechanisms, is vital. This is achieved by setting up Agrarian Services Committees at the divisional levels with field officers and elected farmer representatives.

Objectives

The objectives of the project are as follows:

1. To develop a mechanism for the efficient and continuous transfer of information, knowledge and modern technology to the rural sector with an equally efficient and continuous feedback from the people.

2. To set up a combined, government-semigovernment-private sector infrastructure or "delivery mechanism" capable of this efficient transfer of information and knowledge, together with the distribution of the necessary supplies and services in a package to the people.

3. To set up a "receiving mechanism" at the village level to obtain maximum benefit from the delivery mechanism, and plan and execute development programs.

Research Findings

Unless unanimously elected, a contest always causes two factions to emerge in the village and for party politics to enter the scene. The majority of the farmer representatives have been elected after keen

contests. Therefore, there is always a faction in the village opposed to the representative in whatever work he does.

Most people join farmer groups with the expectation of satisfying his or her personal needs or goals. Most often, group members discover that their needs or goals differ from those of the group. Then disinterest and inactivity set in and finally result in the disintegration of the groups.

The local officials from a number of state institutions have been brought together to work as a team. However, local officials are forced to function within the framework of their own institutions.

Though there is at least a semblance of coordinated action at the divisional level through the Agrarian Service Centre, there is very little or no coordination among village-level workers from the various departments and institutions, and thus isolated activity still prevails.

Conclusions

If the problems discussed under findings are seriously considered by the various departments and institutions involved and corrective measures taken, farmers organizations at tract level under the leadership of the farmer representatives would be a success. Farmer participation in planning for production would then be a reality.

Upasena, S.H. 1982. The cropping systems and water management studies carried out at Walagambahuwa Minor Tank Settlement Scheme in the Dry Zone of Sri Lanka. Paper presented at Workshop on Water Management in Sri Lanka, Colombo, Sri Lanka, 20-22 January 1982.

Keywords : water management / cropping system / minor tank / settlement schemes / Dry Zone / Sri Lanka

Study Site : Walagambahuwa Tank Village

Study Period : 1976-1981

Introduction

Walagambahuwa Tank Village is a small, traditional settlement scheme associated with a small tank along the inland valley. The primary occupation of the people in the tank village is agriculture. Rainfall is the primary source of water, which is conserved in the tank and used as the principle water resource of the village.

Objectives

To determine the outcome of the following cultivation practices:

1. Advancing the cultivation of the *maha* rice crop to mid-October with the onset of rain, in order to mature the crop with incidental rainfall in maha.

2. Using the 3 to 3 1/2-month variety of rice so that the crop would mature with the minimum of supplementary irrigation from the tank.

Research Findings

Appropriate timing and a rice variety of shorter duration would have eliminated the irrigation water requirement during the maha season completely. When the total rate of loss of water from the tank is known, specially for yala, the extent of crop cultivation can be projected at the beginning of yala so that it would match the available supply of water in the tank.

Recommendations/Conclusions

1. Water management of a small or minor tank is really the management of sequential cropping in terms of an appropriate date of planting, selection of suitable age groups and the variety of crop or crops grown.

2. A well-designed cropping pattern could be practiced successfully under the minor tank which could at least double the productivity of this category of rice lands at least by 100 percent.

3. System management of water under the minor tank needs minimum attention. On-farm water management and farmers organizations within the command area should be strengthened. The existing network of field channels needs to be redesigned in order to assure higher efficiency of water use.

Madduma Bandara, C.M. 1977. A study of the practice of well irrigation in the country around Vavuniya in Northern Sri Lanka. Sri Lanka Journal of Social Sciences. p.65-88.

Keywords : well irrigation / Vavuniya / Sri Lanka

Study Site : Vavuniya

Study Period : 1977

Introduction

The field survey was conducted during the middle of the dry season of 1977. A total of 361 farmers were interviewed with the aid of a pre-designed questionnaire and their responses were recorded. The Following areas were covered under the study:

1. Environmental setting.
2. Wells: history, location, and physical and constructional characteristics.
3. Water pumps and other water lifting mechanisms.
4. Irrigated lands: physical and tenurial or irrigated lands—physical characteristics and tenure.
5. Crops and cultivation practices.
6. Income from land under lift irrigation.

Objectives

1. To monitor the developments taking place in agricultural practices based on well irrigation in the area.
2. To understand farmers' attitudes and perceptions regarding the practice of well irrigation.
3. To explore and plan for the paths along which possible future development should take place.

Research Findings/Recommendations

Although no comparative information is available, field observations indicate that the level of income of an average farmer practicing well irrigation was generally higher than that of his counterpart in the *purana* village, who did not practice well irrigation.

It can be noticed that the present level of income could be greatly improved through a more scientific siting of wells, a more rational choice of crops, and the provision of more infrastructural and other facilities such as initial capital and farm implements, particularly pump sets and related services.

Conclusions

1. The degree of risk involved in excavating wells in hard rock areas like Vavuniya is brought out by the likelihood of encountering the bed rock, the proportion of wells that run dry during the dry season, and the extent of irrigated crops around.

2. One of the important reasons for not cultivating the entire block of land around the well was inadequacy of labor. This indicates that more unemployed people can be absorbed into agriculture based on well irrigation.

3. Some 61 percent of farmers thought that their investment is worthwhile, and a large majority of them (96%) recommended the use of well irrigation in other parts of the Dry Zone if water is adequately available.

Upasena, J. and P. Abeygunawardena. 1992. Determinants of farmer participation in irrigation management: The case of Kimbulwana Oya Scheme. Tropical Agricultural Research. Vol. 4.

Keywords : farmer participation / irrigation management / Kimbulwana Oya Scheme

Study Site : Kimbulwana Oya Scheme

Study Period : Yala season 1989

Introduction

The poor performance of irrigation schemes in Sri Lanka is attributed to many factors. Incorporating farmer participation to the management process has been suggested as a remedy. A reason for this suggestion is that earlier, views of the bureaucrats have often been imposed on farmers. On the other hand, farmer participation may reduce the budgetary burdens of the government on Operation and Maintenance (O&M) of irrigation systems while the direct benefits of increased productivity will go to the farmers.

Objectives

To identify factors influencing farmers to contribute labor to O&M work in the Kimbulwana Irrigation Scheme.

Research Findings

Variables such as age of farmers, location of field canals, main canal and bank of the scheme, were positively related to the labor for O&M activities. The farmer group, education, and male labor force in the family indicated negative relationships. The variable settler type indicates the negative attitude of the old settlers towards O&M activities.

Conclusions

According to the final result, there are twelve variables which explain the variation in labor contribution of farmers to O&M work.

Under the present financial crisis in the country, it is highly unlikely that the government will be able to allocate sufficient funds to maintain the vast amount of irrigation structures in the country. If the existing

structures are not maintained, eventually a large number of farmers will suffer. Therefore, farmer participation through labor contribution to O&M activities was introduced. Without more focussed or targeted policies, it may be extremely difficult to get all farmers to contribute equally to O&M activities in the irrigation scheme.

Ranasinghe, A.P. and R.S. Wijesekara. 1990. Effective geophysical prospecting for location of irrigation wells. *In* Gunawardena, E.R.N. (ed.). Irrigation and water resources: Proceedings of a symposium. Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka. p.158-172.

Keywords : geophysical prospecting / irrigation wells / Sri Lanka

Study Site : Sri Lanka

Study Period : 1980/1982

Introduction

In Sri Lanka, scientific surveys for locating groundwater was practiced in the late 1960s only in the limestone belt. Drilling of tubewells over a 100-meter depth has also been done during this period though to a very limited extent. However since 1978, tubewell drilling for the supply of rural water has expanded greatly, where surface geophysical techniques have been used for the rapid identification of the fracture zone in the basement complex.

Objectives

1. To describe the methodologies involved in the electric, electro-magnetic and magnetic methods of locating geohydro-stratigraphic structures.

2. To show the usefulness of the above three methods in different hydrological regimes and to elaborate on the most effective and often applicable methods in groundwater prospecting.

Research Findings

Vertical Electrical Sounding (VES) can be effectively used to locate sites with thick overburden, i.e., selecting sites for dug wells for irrigation or domestic purposes. This method is fast, simple and cost effective and it can give an indication about the quality of groundwater at the site.

The resistivity profiling method is fast and effective in identifying large as well as small fracture zones.

The electro-magnetic method can be effectively used to take a conductivity profile of the ground.

VES curves are effectively used in locating fracture zones in hard rocks.

Although locating successful bore holes in sedimentary area is possible using hydrological methods alone, the use of geophysics may increase the success rate.

Conclusions

Geophysical methods can be effectively used to locate successful wells in hard rock areas as well as in sedimentary areas. The geophysical prospecting methods are essential to maintain a high success rate in locating wells in hard rock areas. Electrical prospecting seems to be the most effective, fast, reliable and cost-effective method among the geophysical methods and in hard rock terrains. The use of electro-magnetic methods together with electrical methods, may reduce the time involved in investigations.

Gunawardena, E.R.N, A. Jeyabalasinkham and C.S. Atputhanathan. 1990. The use of intercepter drainage technique in alleviating water logging in irrigation systems. *In* Irrigation and water resources: Proceedings of a symposium. Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka. p.123-138.

Keywords : drainage technique / water logging / irrigation systems

Study Site : Mahaweli System C of Sri Lanka

Study Period : December 1986-August 1987

Introduction

Intensive cultivation in the Dry and Intermediate Zones depends mainly on irrigation, as water supply is the primary limitation to expanding agriculture. To overcome this limitation many irrigation projects were completed. However, an examination of these irrigation schemes indicate significant water losses, which often lead to water logging and significant losses in the crop yields. In order to remedy the situation, it is necessary to understand the factors which are responsible for water logging.

Objectives

To identify the causes for water logging and to recommend measures to alleviate the problem of water logging.

Research Findings

The water balance study shows that the seepage from unlined irrigation channels was the source of excess water which caused the water logging problem. From the study it was found that the horizontal flow has to be intercepted in order to avoid water logging. Therefore, the monitoring was continued after the construction of an interceptor drain across the slope of the catchment. The evaluation of the severity of water logging before and after the construction of the drain has shown that the interceptor was effective in alleviating the waterlogging problem.

Conclusions

In the Mahaweli System H, the feasibility of using artificial drains to control high water tables was also studied in 1981. It was found that the principal recharge of groundwater comes from flooded basins and

irrigation ditches which tallied with the finding of this study. However, the drainage problem in systems C and B in particular, appears to be more when compared with System H. Intercepter drains are useful in alleviating the water logging problem in such situations.

Abeysekera, W.A.T. 1993. Tank Irrigation Modernization Project. *In* Rehabilitation of irrigation systems in Sri Lanka: A literature review. IIMI, Colombo, Sri Lanka.

Keywords : tank / irrigation / modernization / research / Sri Lanka

Study Sites : Vavunikulam, Pavatkulam, Mahawilachchiya, Makanadarawa, Padaviya

Study Period : 1976-1982

Introduction

The project covers irrigable land in the North Central Dry Zone which has been previously restored in the early 1950s. The area is affected by severe droughts, at least once in 4 to 6 years, causing major setbacks to its agricultural production. The project was identified in 1973, and implemented during 1976 to 1982.

Objective

The basic goal of the Tank Irrigation Modernization Project (TIMP) was to increase agricultural production in the irrigable land in the project area through increased land use intensity and the adoption of a package of irrigation and agricultural innovation. The TIMP Plan projected a major increase in the annual cropping intensity of the irrigated land within a period of 5 years. It was aimed at conserving irrigation water stored in the reservoir and maximizing the use of maha rainfall, thereby increasing agricultural potential.

Research Findings

The main problems identified in the project were as follows:

1. Inefficient use of maha rainfall, and wasteful use of irrigation water by farmers.

2. Poor agricultural extension facilities.

3. Unsatisfactory farm roads, causing problems in marketing.

Recommendations

1. The agricultural component recommended the preparation of rice lands under dry soils condition.

2. Advancing the sowing time of rice to benefit from initial maha season rains that would otherwise be unutilized.

3. Unterminated seed rice as a substitute for the conventional system of sowing germinated seed rice under wet condition.

4. Cultivation of short-duration varieties during the maha season to reduce the irrigation period.

Unless the farmers are convinced of sustained and substantial economic benefits, they would not accept a new improvement program.

Dewendra, T.O. and G.U. Gunasekara. 1982. The study of lift-irrigated agriculture in Sri Lanka. Marga Institute, Colombo, Sri Lanka.

Keywords : irrigated farming / evaluation / surface irrigation / cost-benefit analysis / Sri Lanka

Study Sites : Anuradhapura, Batticaloa, Jaffna, Kurunagala, Mannar, Matale, Mullaitivu, Polonnaruwa, Puttalam

Study Period : 1982

Introduction

Within the terms of reference given by the Water Resources Board for this study, an attempt has been made to gather data and provide an analysis of basic features of lift irrigation in Sri Lanka in the past and as practiced today. The investigation sought to collect information about group schemes and individual schemes separately.

Objectives

The study was undertaken to examine and make recommendations on the following:

1. Dry Zone Lift Irrigation Schemes (LIS) in operation.
2. Reasons for failure of LIS.
3. Possibility of using different sources of surface water.
4. Contribution of such schemes to the national economy including the generation of employment.
5. Cost/benefit analysis of already established LIS.

Research Findings

1. The information was scattered. The problems of farmers in lift irrigation group schemes are similar to those of rice cultivators. The most common problem is the sharing of water coming from one common source in irrigation channels.

2. Only some farmers choose their crops on the basis of the sustainability of the soil and consideration of the limited water supply.

3. The traditional system of domestic agriculture in Sri Lanka can be broadly identified.

4. Most farmers were dissatisfied with their lift irrigation system.

Recommendations

In order to stabilize and expand the acreage under lift irrigation, the following course of action is recommended:

1. Pay special attention to schemes that are not functioning. Rectify any shortcomings in schemes that are functioning to ensure greater self reliance on the part of farmers and sustainability.

2. Take immediate action to introduce a proper information and monitoring system to detect any shortcomings.

3. Encourage individuals to utilize lift irrigation devices for agricultural purposes.

4. Coordinate research and development programs to cover Dry and Wet Zones.

Wickramasekera, P. 1981. Water management under channel irrigation: A study of the Minipe Settlement. Water Management Research Project, Sri Lanka.

Keywords : water management / channel irrigation / Sri Lanka

Study Site : Minipe

Study Period : 1979/1980

Objectives

1. Examine the existing water use and management practices in rice cultivation with special attention to their underlying causes.

2. Analyze the existing institutional and organizational framework for water management with special emphasis on the participation of beneficiaries.

3. Relate the findings to existing knowledge on other schemes, and thereby discuss policy implications.

Research Findings

1. Although there are some damages to irrigation structures, the system is relatively free from major problems arising from farmer indiscipline.

2. Several factors affect water management:

    a. Unauthorized rice cultivation,
    b. Complicated tenurial arrangements,
    c. Farm Technology,
    d. Inter-agency coordination, and
    e. Role of the irrigation bureaucracy.

3. An informal system of organizations for water management has emerged.

Recommendations

1. Main channel management for the benefit of stages III and IV:
    a. Cultivation of Other Food Crops (OFCs) during the yala season, and
    b. Introduction of "bethma" system.

2. Effective system management requires reliable data on system operation. The water flow measurements available are not adequate. The data on deliveries in the main channel should be measured as a first step, and data on actual extent of irrigated area under each channel and their composition should be systematically collected.

3. A systematic rotation system during the yala season will serve a very useful purpose.

4. Unauthorized cultivation: A firm and clearcut policy on encroachments will be required.

5. Maintenance and rehabilitation.

6. Farmer participation will be crucially important.

7. What the best institutional form is, is a controversial issue.

8. Organization for effective water management.

Wijetunga, D.R. 1986. *Wew-Sabha* and people's participation in small irrigation systems. *In* Participatory management in Sri Lanka's irrigation schemes. Proceedings of the Workshop on Participatory Management in Sri Lanka's Irrigation Schemes. IIMI, Kandy, Sri Lanka.

Keywords : participatory management / small scale / irrigation schemes / Sri Lanka

Study Sites : Anuradhapura, Monaragala, Trincomalee, Matale and Puttalam

Study Period : 1979-1986

Objectives

To improve the quality of life of the people living in those parts of the *wewa* (tank) country.

Research Findings

1. Plots are small and scattered.

2. Restoration with own hands—In the case of wewa restoration, no machinery of any type is used and no contractors are employed. The work is done manually. On the one hand it enables participatory living and on the other it helps motivate the people and prepare them to be active farmers in the management of their own lands and the wewa.

3. Repair and maintain irrigation system—In the case of wewas restored with assistance from the Board, maintenance of the irrigation system is done by the farmers.

4. Regulation and control of water issues—Easily manageable for small farming families.

5. Plan and regulate cultivation—Plan on the basis of rainfall expectation.

6. Plan and participate in agriculture development.

7. Plan and participate in community development and social welfare.

8. Organizational inputs and marketing facilities—Provided with interest-free loans to obtain agricultural inputs.

Recommendations

9. Land consolidation and reallocation are necessary to increase productivity of land and to augment the income of the poorest sections.

10. Responsibility for planning and implementing of the plan must remain with the farmers and the wewsabhas, i.e., farmers with technical knowledge and capacity for generating funds to pay for repair and maintenance of the wewa and its irrigation scheme.

***Weeramunda, A.J. 1985. Report on water management at Kimbulwana Oya Scheme: A case of* technical leadership and farmer participation. ARTI Research Study No. 81, Sri Lanka.**

Keywords : water management / technical leadership / farmer participation / irrigation system / Sri Lanka

Study Site : Kimbulwana-Kurunagala District

Study Period : 1984/1985

Introduction

This study has adopted a holistic approach paying attention to several different factors such as social aspects of management, the socioeconomic background of farmers, attitudes of officials, demographic factors, agronomy and implications of system management.

Objectives

1. To describe and analyze the current water management system with a view of forward education factors contributing to its success.

2. To determine the extent of farmer participation in water management.

3. To examine the strength and weakness of the system at present.

4. To indicate what problems remain and to suggest remedial action.

Research Findings

The water management of the Kimbulwewa Oya Scheme has the following attributes:

1. Disciplinarian in structure and character.

2. Disciplinary outlook with elements of participation and persuasion: The officials made provision for some representatives to participate in the process of decision making with respect to timing of water issues, deciding on the cultivation calendar, arbitrating disputes and enforcing rules and sanctions.

3. Efficient water management system: Efficiency is evidenced in both technical and sociological aspects of water management.

4. Farmers and officials perceive water management as a success.

5. The system is based on bureaucratic leadership.

6. The long-term viability of the present system of management is doubtful.

Recommendations

1. Officials would have to develop a greater sensitivity to the needs and perceptions of farmers from all sectors and all age groups.

2. Farmers and farmer representatives would have to enlarge their technical and managerial skills.

3. Identify segments within the village farmer population who are willing to shoulder the responsibility of water management.

4. A system of rewards should be identified to benefit those who are involved in the managerial process. Rewards should be material and non-material.

Lundquist, J. 1984. Irrigated agriculture and ecodevelopment: Adjustments in farming systems to suit environmental and social requirements. University of Linkoping, Linkoping, Sweden.

Keywords : irrigated farming / farming systems / environment / social aspects / research projects / water management / tanks / irrigation efficiency / organization of work / nongovernmental organization / farmers' attitudes / Sri Lanka

Study Site : Miwellewa-Anuradhapura District

Study Period : 1983

Introduction

Studies of two different farming systems under irrigation in the Dry Zone of Sri Lanka will form the basis of this research program, one system with a village tank and the other with a large modern canal irrigation system.

Objectives

1. Examine and analyze the variation in water supply and usage over a command area in time.

2. Illustrate the connection between the distribution usage pattern of water and trends in land tenure and intensity in land use.

3. Identify and diagnose the major characteristics and functions of the water users association.

Research Findings

1. Shortages of water due to:
    * Greater land preparation for cultivation, and
    * Headman obtaining water for his own lands.

2. Socioeconomic variation due to:
    * Farmers being in trouble due to the prevailing political economy, and
    * Persons with land near the channel getting more water.

3. Uncertainty of securing sufficient water.

Recommendations

Careful analysis of the structure of land ownership/control consideration: Prices and levies on land and intensity of land recording.

Abeysekera, W.A.T. 1993. Gal Oya Water Management Project (GWMP). *In* Rehabilitation of irrigation systems in Sri Lanka: A literature review. IIMI, Colombo, Sri Lanka.

Keywords : Gal Oya Project / water management / Sri Lanka

Study Site : Gal Oya

Study Period : 1979-1985

Introduction

The Gal Oya Water Management Project (GWMP) was initiated with the assistance of the United States Agency for International Development (USAID) and involved the rehabilitation of one of the largest irrigation schemes in Sri Lanka. The feasibility study was completed in 1979 and the project was implemented through December 1985.

Objectives

GWMP was designed with the following objectives:

1. Developing the institutional capacity of the Irrigation Department (ID).
2. Physical rehabilitation and preparation of a water management plan to reduce water losses.
3. Training of ID personnel, officials in the agricultural sector and farmers.
4. Developing farmers organizations.
5. Conducting socioeconomic research.

Research Findings

1. Unrealistic assumptions during the planning phase.
2. Weak or inadequate database.
3. Limited impact of rehabilitation on agricultural production.

4. Use of original design specifications in rehabilitation.

5. Poor coordination among line agencies.

6. Limitations in benefit-cost evaluation.

Recommendations

1. Inputs from water users association are useful. Farmer input is essential in preparing the general management and work plan.

2. Operation and Maintenance (O&M) procedures should be determined as part of the overall management and work plan. Specific requirements of the operational plan must be included in the design criteria.

3. Training should be given as early as possible.

Abeysekera, W.A.T. 1993. Major Irrigation Rehabilitation Project (MIRP). *In* Rehabilitation of irrigation systems in Sri Lanka: A literature review. IIMI, Colombo, Sri Lanka.

Keywords : irrigation / rehabilitation / Sri Lanka

Study Sites : Iranamadu Tank, Giant Tank, Morawewa, Huruluwewa Tank, Rajangana

Study Period : 1985-1992

Introduction

Major Irrigation Rehabilitation Project (MIRP) was planned to be implemented in the period 1985-1990. It was later extended to mid-1992. The original project plans covered seven major irrigation systems. In three of these schemes (Morawewa, Iranamadu and Giant Tank), rehabilitation was not possible due to civil disturbances.

Objectives

Primarily aimed at increasing agricultural production through water control and management. The specific objectives are as follows:

1. Rehabilitation of irrigation systems for optional water use.
2. Development of institutional organization.
3. Rehabilitation of roads and regularization of encroached lands.
4. Strengthening agricultural support services and input supply.
5. Understanding investigations on catchment management and socioeconomic studies.

Research Findings

1. Nonavailability of data required for designing canal layers, preparing irrigation water delivery schedules, irrigable areas, etc.
2. Inadequate attention paid to the causes of earlier failures and deficiencies in irrigation schemes.

3. Rigid adherence to a standard design, leaving little room for adaptation that suits specific local situations.

4. Very sophisticated and expensive control and measuring devices installed in the plot, which require high-level management and operational capabilities that can be expected at the farm level.

Recommendations

1. Irrigation and institutional development strategies are needed.

3. Crop improvement strategy: A short-duration variety can be introduced for the dry season.

Abeysekera, W.A.T. 1993. Uda Walawe Rehabilitation Project (UWRP). *In* Rehabilitation of irrigation systems in Sri Lanka: A literature review. IIMI, Colombo, Sri Lanka.

Keywords : Uda Walawe / rehabilitation / farmer participation / irrigation / Sri Lanka

Study Site : Uda Walawe

Study Period : Nonspecific

Introduction

The Uda Walawe Rehabilitation Project (UWRP) was initiated in the 1960s, and rehabilitation work was begun in 1985 with funding from the Asian Development Bank (ADB). It was expected to be completed in 1993. The project was being implemented only on the right bank of the Walawe which is managed by the Mahaweli Authority of Sri Lanka. In the 1980s, the UWRP drew increased attention mainly because of its poor performance in realizing the original project targets. Although this was implemented in the 1970s, the project failed to achieve its objectives. A feasibility study for rehabilitating the system under a new project was undertaken.

Objectives

The objective of the rehabilitation project was to improve irrigation water use efficiency in the scheme mainly through reducing conveyance losses using improved water control delivery facilities.

Research Findings

1. Rice would remain as the dominant crop in most of the project area in the future. No improvements in rice yields are possible since the yields are close to maximum potential.

2. Unless the main and branch canal conveyances system is reasonably established first, it is difficult to seek for farmer participation in Operation and Maintenance (O&M) of this system.

Recommendations

1. Institutional development: Achieve farmer participation in system management and operation.

2. Irrigation development.

3. Agricultural development: A move towards crop diversification in areas where water availability is inadequate for rice.

Abeysekera, W.A.T. 1993. Irrigation Systems Management Project. *In* Rehabilitation of irrigation systems in Sri Lanka: A literature review. IIMI, Colombo, Sri Lanka.

Keywords : irrigation system / irrigation management / Sri Lanka

Study Sites : Minneriya, Giritale Tank, Polonnaruwa, Gal Oya Right Bank

Study Period : Nonspecific

Introduction

The project agreement was signed in August 1986. It attempts to implement an Irrigation Systems Management Project (ISMP) approach centered on farmers organizations, and to list alternative rehabilitation procedures that would be cost effective.

Objectives

The project aims at developing the national institutional capacity to manage and operate major irrigation systems and to establish strong farmers organizations that are capable of meeting in the irrigation system.

Research Findings

1. Project management is weakened by a lack of authority over other line agencies and a lack of cooperation from officials in the line agencies.

2. Critical insights that would also shed some light into the functioning of local institution in the ISMP schemes.

Recommendations

The following important issues need attention:

1. Overall policy implications of ISMP.

2. Farmers organizations.

3. Training enhancement.

4. Operation and Maintenance.

5. Financial management.

6. Research.

7. Monitoring and evaluation of feedback.

McCornick, P.G. 1989. Methodology for assessing the performance of irrigated agriculture. Water Management Synthesis (WMS) 2, Sri Lanka.

Keywords : irrigated farming / irrigation efficiency / performance evaluation / methodology / research / indicators / case studies

Study Site : Small-scale irrigation systems, Sri Lanka

Study Period : 1982-1987

Introduction

Irrigation studies conducted by the Water Management Synthesis (WMS) 2 Project has been analyzed. These included diagnostic analysis workshops, irrigation sector reviews and project design papers. All three approaches were adopted to develop an understanding of the existing state of an irrigation system, identify the system's strengths and constraints, and if necessary recommend improvements.

Objectives

1. Develop an understanding of the methodologies used by the WMS 2 Project to evaluate irrigation systems.

2. Determine how these methodologies can be more effectively utilized in the future.

Research Findings

1. Inadequate farmer participation in system management.

2. Limited technical capacity in the government irrigation agency.

3. Poor communication between farmers and the government agencies.

4. Inadequate coordination among the agencies serving irrigated agriculture.

5. Poor condition of the physical control structures.

Recommendations

1. The research attempted to develop a systematic approach to select or formulate methodologies for the study of irrigation system performance. The systematic approach can provide the analytical base in the subject area of irrigation system diagnosis and improvement, and can be used to study irrigation system performance.

2. The study of irrigation system performance should be approached so as to improve farmer welfare through increased agricultural production according to a specific set of objectives, namely, water control, agricultural productivity, resource conservation and return on investment.

3. After the identification of goals and management objectives, the study should analyze system performance to see whether the objectives are achieved. This is done by comparing actual system performance with desired system performance often derived by management objectives. To evaluate actual and desired system performance, the irrigation system performance study must first identify performance.

4. If the objectives are not achieved, the study should identify factors that contribute to low performance. Strategies can then be formulated and implemented to improve system performance.

Palm, O. 1984. Irrigation water and nutrient balance: Progress report. *In* Lundquist, J. Irrigated agriculture and ecodevelopment: Adjustments in farming systems to suit environmental and social requirements. University of Linkoping, Linkoping, Sweden. p.B1-B12.

Keywords : irrigation / water management / nutrient balance / Sri Lanka

Study Site : Mahailuppallama Agricultural Research Station, Mahailuppallama

Study Period : 1982-1984

Introduction

A very important question to study is the function of irrigation water in nitrogen balance, the nitrogen coming from organic material in different farmer systems. It is also necessary to see to what extent local resources are used.

Objectives

* To evaluate water application, nutrient supply and balance.

* To determine the consequences on the water regime if alternative sources of nutrients are to be used.

Research Findings

* Chena cultivation in traditional villages is of great importance.

* Large variations between seasons and between villages due to a lack of irrigation water.

Conclusion

The field experiments are planned to continue for many years. There can be a starting point in establishing long-term fertility experiments in Sri Lanka on rice cultivation with different nitrogen sources.

* The nutrient loss in soil must be restored in order to have sustainable agriculture, either through organic matter or chemical fertilizers.

Fernando, Dunstan. 1990. Role of Freedom From Hunger Campaign in the improvement of minor irrigation systems in Sri Lanka. *In* Dayaratne, M.H.S. and Gamini Wickremasinghe (eds.). Role of non-government organizations in the improvement of minor irrigation systems in Sri Lanka. IIMI, Colombo, Sri Lanka.

Keywords : minor irrigation systems / Freedom From Hunger Campaign / rehabilitation and restoration

Study Site : Nonspecific

Study Period : Nonspecific

Introduction

The Freedom From Hunger Campaign (FFHC) is a public cooperation established in 1973 under the Ministry of Agriculture. Its development philosophy emphasizes the following:

1. People's participation and rural poverty alleviation.
2. Promotion and encouragement of labor-intensive projects.
3. Changing chena cultivators into settled farmers by providing permanent land with facilities for irrigation.
4. Assisting the poor to enhance their living standards.

Objectives

To describe the role of the FFHC in the improvement of minor irrigation systems in Sri Lanka.

Findings/Conclusions/Recommendations

The strategy adopted by the FFHC to achieve its objectives in so far as the minor irrigation systems are concerned, has been renovation and restoration of village tanks in the Dry Zone. The activities involved may be divided into two categories, namely, refurbishment and rehabilitation of ancient tanks. Following a request from a village, a socioeconomic survey is conducted by the FFHC which is followed by a

feasibility study. On the basis of these steps, a preliminary selection is made where availability of land is also ensured. A tank bunt/capacity survey will then be made and clearance of the Department of Agrarian Services and the Irrigation Department is obtained. After going through these stages, *wew sabhas* (tank committees) will be formed and tank renovation and restoration work will commence.

The FFHC enters into a partnership with the farmers, gathering them into the wew sabhas, and helps these organizations plan and implement their own development programs. All the earthwork is done by the wew sabha members to whom a payment is made by the FFHC.

As of June 1989, the FFHC had completed 135 tanks out of a targeted 222. About 3,000 farmer families are estimated to benefit from the program.

Among the major constraints identified in the FFHC program are:

1. Lack of experienced technical staff.

2. Need for introducing new methods and techniques.

3. Need for flexibility in the FFHC management.

4. Insufficiency of funds.

5. Absence of a well-established maintenance fund.

6. Lack of coordination with similar organizations.

7. Delays in communication between the head office and the projects.

8. Need for decentralization of the management.

The primary lesson that has been learnt in the process relates to the need for organization of village tank rehabilitation work simultaneously with community development work.

Fernando, Nihal. 1991. Technical options in irrigated agriculture for the future. Economic Review, People's Bank, Colombo, Sri Lanka.

Keywords : irrigated farming / technology / irrigation / irrigation equipment / Sri Lanka

Study Site : Nonspecific

Study Period : Nonspecific

Introduction

This reviews in part the development of irrigation and agricultural technology in Sri Lanka, the policy framework and the external environment within which the technological advancements have taken place and some specific technological options for the future.

Objective

To understand the role of irrigation in alleviating the constraints of nature in order to make water available at a desired location at a required time for food production under appropriate economic conditions.

Findings/Conclusions

1. Although many technological options are available for the future, the adoption of such options is constrained by many factors. Prominent among them are the lack of:

   a. An integrated national technology policy for the food processing sector,

   b. Technical knowhow,

   c. Research geared towards national interest, and

   d. Coordination among the universities and research institutions.

2. The private sector should be supported by the state to undertake research and agro-industrial development.

3. Research is needed to identify a wide range of crops that can be grown for export markets.

4. Agricultural technology in future should develop to extend new crop species and varieties through genetic engineering.

5. Formation of farmers organizations and increased participation of the private sector in irrigation.

Sumanarathna, N. and P. Abeygunawardena. 1993. An economic evaluation of salinity problem in Inginimitiya Irrigation Project. Proceedings of a Symposium on Irrigation and Drainage held in Beijing, People's Republic of China, 24-27 May 1993.

Keywords : Inginimitiya Irrigation Project / Sri Lanka

Study Site : Inginimitiya irrigation systems

Study Period : 1991 (Secondary data from Land Use Policy Planning Division of the Ministry of Lands, Irrigation and Mahaweli Development)

Introduction

Salinity is a major problem in many large-scale irrigation projects. Each farmer in the Inginimitiya Irrigation Project is given one hectare (ha) of land for rice cultivation. The total area of the project is approximately 2,700 ha. Fifteen blocks were selected randomly and field measurements were taken to study the severity of the salinity problem. Two approaches based on (a) effect on productivity, and (b) preventive expenditures, were used to assess the economic viability of the alternatives used to correct this problem.

Objectives

To investigate the economic feasibility of solving the problem of salinity in the Inginimitiya Irrigation Project.

Findings/Conclusions/Recommendations

The present value of the losses due to the salinity problem in the project is about Rs 21 million over a period of 20 years, whereas the preventive expenditure is about Rs 152,814 and 12 million for four options, respectively: (a) improvement of drainage systems, (b) application of gypsum and organic matter, (c) installing an underground pipe system, and (d) provision of additional water for leaching. Except for the application of gypsum, it was found that correcting the problem of salinity is economically feasible. Out of all options tested, the improvement of the conventional drainage system was found to be the most economically acceptable solution. Therefore in future, as a preventive measure for the salinity problem in the Inginimitiya Scheme, improvements in the drainage canal system can also be included in the Operation and Maintenance activities organized by the project management.

Herath, H.M.G. 1985. Efficiency of resource use in a tubewell irrigation scheme in Sri Lanka. Agricultural Mechanization in Asia, Africa and Latin America. Vol. 16, No. 4. p.39-42.

Keywords : tubewell irrigation / resource management

Location : Mulankavil Colonization Scheme

Study Period : 1981-1982

Introduction

The efficiency of resource use in the 0.8 and 2.0 hectare (ha) farms with tubewell irrigation facilities was investigated in this study using a Cobb-Douglas production function framework. Field data relating to production input use and prices were collected through a field survey.

Objective

To compare the efficiency of resource use in 0.8 ha and 2.0 ha sized farms using aggregate production functions.

Findings/Conclusions/Recommendations

1. Irrigation water, capital and labor are used more efficiently in the 0.8 ha farms than in the 2.0 ha farms. Land use intensity is also very high in the 0.8 ha farms. In the 2.0 ha farms, land, labor and irrigation water are underused.

2. Most of the factors are not used efficiently both in the 0.8 ha and 2.0 ha farms.

3. Any expansion of production should involve expansion of area in the 0.8 ha farms.

4. In the 2.0 ha farms, expansion of output is possible by further use of labor and irrigation water and reduction of capital inputs.

Amarasekera, Nalini. 1991. Environmental consequences of Menik Ganga Diversion. The Island. Upali Newspapers Ltd., Colombo, Sri Lanka, 26 June 1991.

Keywords : diversion / rivers / irrigation systems

Study Site : Kirindi Oya Project

Study Period : 1992

Introduction

The Kirindi Oya Irrigation and Settlement Project (KOISP) has been in operation for the past five years although the Lunugamvehera reservoir has not filled up to the expected level. During this period it has met with a number of problems due to shortage of water. In an attempt to obtain sufficient water, a new project is being considered to divert water from another river, the Menik Ganga, into this reservoir. A feasibility study funded by the Asian Development Bank (ADB) has recently been completed but does not include an EIA (Environmental Impact Assessment). Because of increasing public involvement, it has been decided to carry out a socioeconomic study with an environmental component to it.

Objective

To determine the environmental consequences of the proposed project.

Findings/Conclusions/Recommendations

This article urges for an environmental assessment of the proposed project due to the following major reasons:

1. The construction of the Lunugamvehera Reservoir, into which the diverted water would flow, did not consider the environmental impacts before the scheme was undertaken.

2. Thirty years discharge data for the Menik Ganga indicate that the volume of water is not sufficient for diversion as it is located in a drier part of Southern Sri Lanka.

3. The Menik Ganga flows through the heart of one of Sri Lanka's major national parks and its diversion would have adverse impacts on the flora and fauna of this park.

4. Kataragama, located downstream of Menik Ganga, is a very important sacred city which needs a water supply throughout the year for the use of pilgrims.

The proposed Menik Ganga Diversion Project would be no exception in creating possible serious impacts on both the natural and social environment.

It must be emphasized that an EIA has become an integral part of diversion projects due to government commitment and concern for environmental protection. Therefore, a large-scale water transfer project such as the Menik Ganga Diversion should be subjected to a thorough EIA even if this is costly and time consuming.

Jungeling, Inge. 1990. NGO as facilitators in minor irrigation development: A case study from Hambantota District, Sri Lanka. *In* Dayaratne, M.H.S. and Gamini Wickremasinghe (eds.). Role of nongovernmental organizations in the improvement of minor irrigation systems in Sri Lanka. IIMI, Colombo, Sri Lanka.

Keywords : minor irrigation systems / nongovernmental organizations

Study Site : Hambantota District

Study Period : 1988-1989

Introduction

The paper evaluates the involvement of NGOs in minor irrigation development in the Hambantota District. Initially, the paper explains the role that can be played by an NGO to bridge the gap between grass roots-level government agencies and water users. Subsequently the paper draws attention to the capacity and mission of NGOs and the necessity of clearly stating what is expected from NGOs.

Objective

To assess the roles played by the Sarvodaya Shramanada Movement in a tank rehabilitation project under the Norwegian (NORAD) funded Hambantota Integrated Rural Development Program.

Findings/Conclusions/Recommendations

Any involvement of NGOs in such development programs needs careful consideration about what the NGO is supposed to initiate, how the objectives and the approach of the NGO suit the strategy of the program, and what is expected from the supporting agencies. If the intervention process is managed by an organization separate from the NGO itself, that organization should be responsible for ensuring that the strategies of the different participants (water users, NGOs, and agencies involved) are compatible with the end results envisaged. This leads us back to the question about what is expected from water users in terms of commitment, resource mobilization and actual responsibilities in irrigation management, and what service can be expected from the Department of Agrarian Services over the long term (and not on a project basis). There is a need to clarify these responsibilities in the first place.

Irrigation Management Policy Support Activity. 1991. Irrigated agriculture and irrigation management in Sri Lanka: Vision for the next decade and beyond. IMPSA Policy Paper No. 1. Ministry of Lands, Irrigation and Mahaweli Development, Colombo, Sri Lanka.

Keywords : vision / goals / policy / participatory management / facilitator/ self-management / Sri Lanka

Study Site : Nonspecific

Study Period : 1990-1991

Introduction

This paper is a product of the Irrigation Management Policy Support Activity (IMPSA). Under this program, ten Policy Papers were scheduled to be prepared and processed for presentation to the Government of Sri Lanka. Each Policy Paper is a concise statement of the recommendations of the Irrigation Management Policy Advisory Committee (IMPAC). This document is the first of these ten Policy Papers. IMPSA was initiated by the Ministry of Lands, Irrigation and Mahaweli Development of Sri Lanka (S/MLI&MD) in association with the Ministry of Agricultural Development and Research of Sri Lanka (S/AD&R).

Objective

To assist the Government of Sri Lanka in the implementation of its accepted policy of participatory management in irrigation and settlement schemes, in order to improve productivity and profitability in the irrigation sector.

Research Findings

This Policy Paper observes that Sri Lanka's irrigated agriculture sector is at a turning point. The goal set several decades ago, for self-sufficiency in rice, has been nearly achieved and the gains made will be consolidated. A basis has been established to move forward to modernize the agricultural sector. Further progress requires a new vision, new goals and the adoption of new policies, institutional arrangements, and technologies. This paper has expressed a broad vision for the future as a basis for new and realistic goals.

Recommendations/Conclusions

This study recommends a vision of a diversified, productive and sustainable irrigated agricultural sector, which can meet domestic food requirements, cater to the export market and also employ large numbers of people at a suitable income level. It can be an engine for growth for the modernization of Sri Lanka's economy and can provide the economic basis for further improving the quality of rural life so valued by the people. The central component of the vision is that farmers will be organized into strong associations to manage irrigation systems and other outputs, as well as to market their produce. The role of the government would be that of a facilitator and provider of basic services towards achieving this goal.

The foundations for achieving these expectations have already been established and therefore it is necessary to seize the opportunity and move forward, building on the present capacities and resources, and guided by a positive vision of the future.

Irrigation Management Policy Support Activity. 1991. Institutional framework for management of irrigation systems and building farmers organizations. IMPSA Policy Paper No. 2. Ministry of Lands, Irrigation and Mahaweli Development, Colombo, Sri Lanka.

Keywords : turnover / agency changes / research / coordination / farmers organizations / training and education / monitoring and evaluation / institutional framework

Study Site : Nonspecific

Study Period : 1990-1991

Introduction

This paper is a product of the Irrigation Management Policy Support Activity (IMPSA). Under this program, ten Policy Papers were scheduled to be prepared and processed for presentation to the Government of Sri Lanka. Each Policy Paper is a concise statement of the recommendations of the Irrigation Management Policy Advisory Committee (IMPAC). This document is the second of these ten Policy Papers. IMPSA was initiated by the Ministry of Lands, Irrigation and Mahaweli Development in association with the Ministry of Agricultural Development and Research.

Objectives

To describe the institutional arrangements required for irrigation management at policy and field levels in all types of schemes to implement the long-term policy statement contained in Policy Paper No. 1.

Recommendations/Conclusions

This Policy Paper categorizes recommendations under the following subheadings:

Turnover

The Government should implement self management by farmers organizations at least in all systems which are less than 400 hectares (ha), of command area by the year 2000, and bring under joint management all schemes more than 400 ha at the earliest possible time. The implementation of this program should be in phases, at various levels. In order for the turnover program to be successful, there must be a clear and open budgeting and accounting system at scheme level, operated jointly by the agency and the farmers organizations, through the Project Management Committee (PMC). Decisions

on expenditure of funds provided by the Government will be taken by the Project Committee (PC) subject to clear criteria that would be developed and agreed upon for establishing priorities.

Agency Changes

The agencies should obtain professional management assistance to carry out a strategic planning process. The agencies should restructure their management processes including decision making, authority structure, communications and incentives. Each agency needs to establish a strong Institutional Development Unit (IDU) staffed by appropriate and experienced persons, for promoting institution building and for facilitating changes. Each agency should establish a high-level "Working Group" or task force to plan, encourage and guide the process of change.

Research

A Research Management Unit should be set up in the Irrigation Department (ID) to develop a capacity for identifying research needs, carrying out the research, and communicating and utilizing the results. In developing new technologies for irrigation, a Joint Research Committee should be instituted, with participation from both the ID and the Department of Agriculture. The Committee should also include the Mahaweli Authority, Irrigation Management Division, Department of Agrarian Services, Agrarian Research and Training Institute, International Irrigation Management Institute, Universities and the private sector.

Coordination

A Central Coordination Committee on Irrigation Management should be instituted at the national level, chaired by S/MLI&MD and include the S/AD&R together with the relevant officials of both Ministries and representatives of other agencies involved in irrigation management.

Suitable coordinating bodies should also be set up at the lower levels by the Central Coordinating Committee. In jointly managed schemes, coordination at the project level will be done by means of the Project Management Committee and the Sub-Project Management Committee. For village schemes, coordination should be effected through a committee composed of representatives of the cluster of schemes falling within a defined hydrologic boundary.

Building Farmers Organizations (FOs)

Institutional organizers should be used as a catalyst in the transformation process related to building FOs. Selection of farmer representatives by consensus or election should be the choice of the FOs. The term of office of farmer representatives should also be a matter for individual FOs to decide. However, specifying the holding of re-elections on a regular basis appears to be a useful arrangement. FOs at lower levels should federate themselves up to the project level. In the case of large (jointly managed) schemes, this could be done by the formation of committees composed of DCO farmer

representatives at the sub-project and project levels. Irrigation agencies could enlist the assistance and participation of NGOs in building FOs on the conditions indicated in the paper.

Training and Education (T&E)

A national training policy is needed in respect of the development of farmers organizations and the institution of the participatory management process. It should ensure that training is essentially based on needs, and reaches beyond the technical aspects of irrigation and agriculture. Each department/agency dealing with FOs should develop its own master plan for training. This should be done with effective feedback from the FOs. Adequate financial support for T&E activities should be provided by the Government or by outside donor agencies. FOs should also be able to seek and receive financial assistance from outside sources for training needs over and above the training inputs from line agencies.

Monitoring and Evaluation (M&E)

M&E system of performance must be developed at each level as part of a larger information system related to an overall implementation plan. The M&E system should not demand heavy recurrent additional costs, and must be implementable through the new institutional arrangements for irrigation management. The M&E should be a function of the O&M division of each irrigation agency. Each agency should have M&E units at the national, provincial and project levels for effecting proper coordination. A sub-committee of the central coordinating committee on irrigation management should function as a task force for monitoring progress of the implementation of the participatory management policy and turnover process.

Legal Issues

Urgent legal provision is needed for effective implementation of the participatory management process. This should be done through the proposed amendments to the existing Agrarian Services Act and the Irrigation Ordinance. It will be necessary to formulate a new Water Resources Act and a new Irrigation Ordinance to incorporate the other changes proposed in Policy Paper No. 1 of IMPSA. This activity should commence with the institution of a multi-disciplinary core group of persons to initiate and steer the process in accordance with the suggestions made in this paper.

Karunanayake, M.M. and S.L. Thilakasiri. 1979. Lift irrigation at Rajangana: Some problems of cultural adaptation. Economic Review. Peoples' Bank, Colombo, Sri Lanka, March 1979.

Keywords : cultural adaptation / lift irrigation / group activity / Rajangana Irrigation System

Study Site : Rajangana

Introduction

Even though gravity irrigation is common in Sri Lanka, nearly 2,000 hectares (ha) of highland in the Rajangana Irrigation System are provided with lift irrigation facilities. The source of water is the Rajangana Reservoir. Other field crops are being grown in the highlands under lift irrigation.

Objectives

To find problems of cultural adaptation that limit the successful application of lift irrigation to Dry Zone peasant agriculture and to suggest corrective measures.

Research Findings

At Rajangana, cultural adaptation is made difficult by a combination of factors. The fact that the background of the settlers does not provide the cultural condition necessary for lift irrigated agriculture is a basic problem. It was found that a high percentage of the settlers (20%) had previously no involvement in agriculture. The majority had previous experience in gravity irrigation and flooding of fields but the technique of flow differs from lift irrigated agriculture.

The cultural adaptation to lift irrigation is also made difficult by the frequent failure of the headwork and the distributary system. The potential for chena cultivation, the settlement layout and the difficulty of adhering to the specified crop system are further factors retarding adaptation.

Recommendations/Conclusions

It is necessary to establish greater coordination with the workshop at Anuradhapura, which undertakes the maintenance and service of pump sets. Another important factor is to educate settlers in the correct methods of irrigated agriculture. It will also be necessary to introduce a group approach to lift irrigation. This will result in the fostering of social cohesiveness and a sense of commitment to lift irrigation. It is also pertinent to mention that in lift irrigation in particular, greater care should be exercised in the

selection of settlers. A two-way flow of communication could be maintained between the bureaucracy and the settlers to provide a satisfactory framework for the implementation of lift irrigation.

on expenditure of funds provided by the Government will be taken by the Project Committee (PC) subject to clear criteria that would be developed and agreed upon for establishing priorities.

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representatives at the sub-project and project levels. Irrigation agencies could enlist the assistance and participation of NGOs in building FOs on the conditions indicated in the paper.

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Karunanayake, M.M. and S.L. Thilakasiri. 1979. Lift irrigation at Rajangana: Some problems of cultural adaptation. Economic Review. Peoples' Bank, Colombo, Sri Lanka, March 1979.

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Research Findings

At Rajangana, cultural adaptation is made difficult by a combination of factors. The fact that the background of the settlers does not provide the cultural condition necessary for lift irrigated agriculture is a basic problem. It was found that a high percentage of the settlers (20%) had previously no involvement in agriculture. The majority had previous experience in gravity irrigation and flooding of fields but the technique of flow differs from lift irrigated agriculture.

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It is necessary to establish greater coordination with the workshop at Anuradhapura, which undertakes the maintenance and service of pump sets. Another important factor is to educate settlers in the correct methods of irrigated agriculture. It will also be necessary to introduce a group approach to lift irrigation. This will result in the fostering of social cohesiveness and a sense of commitment to lift irrigation. It is also pertinent to mention that in lift irrigation in particular, greater care should be exercised in the

selection of settlers. A two-way flow of communication could be maintained between the bureaucracy and the settlers to provide a satisfactory framework for the implementation of lift irrigation.

Merrey, Douglas J. 1992. Overcoming artificial institutional barriers: Linking Farming Systems Research (FSR) with Irrigation Management Research. Paper presented at the Asian Farming System Symposium, Colombo, Sri Lanka.

Keywords : linkages / interdisciplinary / client orientation / system approach

Study Site : Nonspecific

Study Period : Nonspecific

Introduction

The Department of Agriculture is responsible for the conventional agricultural research in Sri Lanka. Farming systems research also comes under the purview of the Department of Agriculture. Several institutions are engaged in irrigation management research, which is a new research area.

Objective

To asses the linkages between "normal" agricultural research, including Farming Systems Research (FSR) and irrigation management research (IMR), and to identify institutional solutions to strengthen the linkages.

Research Findings

There is a serious gap between "normal" agricultural research, including FSR, and IMR. FSR and IMR share many characteristics, such as being interdisciplinary, field based, client oriented, and system oriented. Nevertheless, the minimal number of linkages between the two research traditions is retarding progress in improving the performance of irrigated agriculture. The paper suggests an institutional explanation for this problem and proposes institutional solutions.

Internationally, the entry of IIMI and other natural resources-oriented research centers into the Consultative Group on International Agricultural Research (CGIAR) System will facilitate a convergence of the IMR and FSR traditions. At the national level, this paper suggests four options for improving the FSR-IMR linkages in Asian countries. These are not mutually exclusive: one, several or all of them could be considered.

Recommendations/Conclusions

To improve the FSR-IMR linkages, the first option is to build on the strong agricultural research tradition found in Asian countries and broaden it to include IMR. Broadening further to include IMR would involve addressing new issues above the farm or tertiary level and would require changing the disciplinary mix to include social and management sciences.

The second option is to develop an enhanced research capacity in the irrigation management agencies, and to ensure that the capacity encompasses both agricultural and irrigation management. For instance, with IIMI's collaboration, the Sri Lanka Irrigation Department has formed an Irrigation Research Management Unit, through which it hopes to build a capacity to identify research needs, carry it out and make use of it. The proposed research topics cover both agricultural and irrigation management aspects.

A third option which has been considered in several larger Asian countries but never implemented is the establishment of some type of a national irrigation management institute.

Finally, countries can reconsider the separation of irrigation and agriculture at ministerial level.

Peabody, N.S. 1984. Lift Irrigation Project, Sri Lanka (Credit 121 CE): Impact Evaluation. Draft Consultancy Report, World Bank.

Keywords : lift irrigation / target groups / Rajanganaya

Study Sites : Polonnaruwa, Rajanganaya, Nagadeepa, and Vaunikulam

Study Period : Nonspecific

Introduction

Even though gravity irrigation is common in Sri Lanka, command areas in some irrigation systems are provided with lift irrigation facilities. In most of the instances the source of water is the same reservoir that provides water for gravity irrigation. Other field crops are being grown in the highlands which come under lift irrigation.

Objective

To discuss the Lift Irrigation Systems (LIS) Project and its impact from the perspective of the farmers who were supposed to benefit from the project, based on existing documentation and field visits to three of the four project sites.

Research Findings

Of the 6,500 acres served by the LIS, not more than 42 percent of the acreage has ever been used for chili or onion cultivation. It is highly unlikely that the LIS will be used more productively in the future, except in Rajangana. It is observed that the LIS can contribute substantially to increase farmers' incomes and the national supply of chilies. Overall, the LIS was a failure. It was conceived as a crash program, prepared without an adequate database about the farmers' conditions or institutions involved. The LIS failed to provide irrigation water adequately, dependably or equitably. The project did not consider adequately the constraints under which farmers worked. Most of the farmers were still trying to establish themselves on their settlement sites. The project did not provide the institutional support or involve farmers in project implementation, except as laborers, and made no provisions to transfer responsibility of the schemes to farmers. The LIS fell apart at the implementation stage and many necessary programs never materialized or were late in coming or were ineffective. The supervision process seems to have missed opportunities to see the project as a whole and to help develop mechanisms to achieve the desired results.

Recommendations/Conclusions

Before site selection, an assessment should be made of the capabilities, constraints, resources, local institutions and the settlement history of prospective target groups. Institutional responsibilities and relationships should be specified clearly and reasonably during appraisal. The project design elements should be reviewed more carefully to ascertain their appropriateness for target groups. The choice of the lead agency has profound implication for the implementations of a project and its ultimate impact. The LIS was an upland agricultural development project, not merely an irrigation project. Therefore, the choice of a different implementing agency may lead to an emphasis on the broader objectives of the project as a whole, not merely on one aspect such as construction, and it may have a more positive impact. The supervision should be pragmatic and serious. If recommendations are important, they should be followed up. If not they should be dropped. Some thought must be given to establishing procedures to enable supervision to become more effective.

Siriwardena, S.S.A.L. 1992. Complexity and diversity of producers' strategies in resource management: The reality of the "local arena" of settlement management in a settlement of the Mahaweli Irrigation Project in Sri Lanka. Research Department, Peoples Bank, Colombo, Sri Lanka.

Keywords : farmer groups / turnout groups / credit associations / Mahaweli Irrigation System / settlers / farmers organizations

Study Site : System C of the Mahaweli Irrigation System

Study Period : Nonspecific

Introduction

The acceleration of the Mahaweli Project with a view to completing it within a shorter period introduced a new management system. The Resident Project Manager headed a multidisciplinary team of officials at project level. The same disciplines were included at the block level. The Unit Manager is the grass roots-level official. The farming community includes the new settlers as well as re-settlers. This paper analyzes the encounters at the interface between the farming community and agency personnel.

Objectives

To analyze the ways in which local officials and farmers in a settlement area of the Mahaweli Irrigation Scheme of Sri Lanka attempt to come to grips both organizationally and cognitively in the adoption of their own management practices. The study also examines how different types of settlers develop strategies for dealing with new circumstances they faced due to the operation of an externally imposed management system.

Research Findings

According to the report of the committee on farmers organizations in the Mahaweli Project, many attempts to organize farmers in the Mahaweli Settlement Scheme have failed. The systematic establishment of farmer groups for irrigated agriculture in the Mahaweli Project commenced in 1979. Farmer groups were organized in the Mahaweli Project on the basis of turnout areas with provision for the participation of officers and farmer representatives from these areas.

Farmer representatives, according to the Committee Report, had no share in the management of water at the higher levels of the systems. The second attempt to form farmers organizations was based on

the concept of community development societies. These societies were established for the purpose of associating settlers in decision making at the unit level. Here, the farmer representatives were mainly confined to participating at meetings with project officials. The post of president of the society was held ex-officio by the unit manager. Therefore, any further attempt on organizing farmers will not succeed since officials are also directly or indirectly involved in creating management functions according to their interests. Farmers on the other hand have accumulated knowledge and experience through confrontation, negotiation, developing strategies and experimentation. Therefore, local structures that are being developed through regular actions, responses and reactions of settlers and their households cannot be avoided or controlled.

The paper describes these micro-enterprises which emerged from local processes.

Recommendations/conclusions

The only reliable alternative available for improving the entrepreneurial capability and the self-regulatory system of management by the farmers, is to form settler unit "Savings and Credit Associations." These should function on a "Joint Liability" and group guarantee system of unit level credit operation, together with strong support of a compulsory production share-based savings contribution.

Savings and Credit Associations should not be artificially formed. It may be important to promote already existing informal methods of savings and credit operation such as "*Seettu* Loans" and "Death Donation Society" concepts. The seettu system is a self-regulated and economically bonded method of informal group credit operation. By making use of this type of local concept of lending and saving, the economic behavior of individuals can be knitted into the social fabric of the group. Similarly, Death Donation Societies are formed by local groups to generate their own social security fund. Therefore, the poor should not be compelled to "save" money as depositors, instead they should be encouraged to contribute towards their own "Economic Security Fund."

Raby, Namika and Douglas J. Merrey. 1989. Professional management in irrigation systems: A case study of performance control in Mahaweli System H, Sri Lanka. IIMI, Colombo, Sri Lanka.

Keywords : open system / integrated management / control by exception / Mahaweli System H / administration / Sri Lanka

Study Site : Kalankuttiya Block-Mahaweli System H

Study Period : 1987-1989

Introduction

The acceleration of the Mahaweli Project with a view to completing it within a shorter period introduced a new management system. Almost all the government services to the settlers were channelled only through the divisions of the Mahaweli Authority, and the other government departments played a minor role except for agricultural research. The Resident Project Manager headed a multi-disciplinary team of officials at project level. The same disciplines were included at the block level. The Unit Manager was the grassroots-level official.

Objective

To document the management systems of the Mahaweli Economic Agency (MEA) of the Mahaweli Authority of Sri Lanka, focussing on the Kalankuttiya Block in Galnewa Project in the period 1986/1987, during a water crisis resulting from a severe drought.

Research Findings

The MEA is an open and flexible organization with a willingness to incorporate change. The people's dimension of management has not been implemented very effectively but the agency has gone ahead with implementing "integrated management." At the micro-level, the study finds a strongly developed set of control tools for financial and production control, and the sporadic presence of "control by exception."

The authors find an absence of performance monitoring and control, dominance of administrative routing and a lack of independent authority of the Block Manager.

Recommendations/Conclusions

Microsystem planning seems to be ad hoc in character. System Operators require a communication of changes. A telephone and computer link with the computer division of the Colombo-based Water Management Secretariat (D) seems an easy and obvious suggestion.

In the case of System H, the mode of operation best suited for the project level is the administrative mode, that is management in a bureaucratic style.

A coordinating mechanism at project level for the allocation and distribution of water with the Project Engineer at the helm is necessary.

The "unit" is the lowest level of management and yet the point of maximum impact on field operations. The distribution of water must be functionally integrated with agricultural inputs, credit and marketing. The absence of performance monitoring and controls is most actively felt here.

It is often said that crop production in an irrigation system depends on water as the crucial independent variable. In System H during a drought year, the total amount of water made available was more than adequate. Some problems arose because water was not delivered in a reliable and timely manner. The authors' conclusion is that MANAGEMENT—broadly defined—and not water per se is the key independent variable determining the productivity of irrigated agriculture. Agencies responsible for managing public irrigation systems therefore have a unique opportunity to contribute to achieving the twin goals of increasing agricultural productivity and raising farmer incomes by improving the performance of their own management systems.

Irrigation Management Policy Support Activity. 1991. Achieving high performance: Strategies for Operation and Maintenance and Rehabilitation and Modernization of irrigation systems. IMPSA Policy Paper No. 3. Ministry of Lands, Irrigation and Mahaweli Development, Colombo, Sri Lanka.

Keywords : levies / fund management / Rehabilitation and Modernization / Operation and Maintenance / Sri Lanka

Study Site : Nonspecific

Study Period : 1990-1991

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Recommendations/Conclusions

1. Strategies for Operation and Maintenance (O&M)

Turnover. Responsibilities for O&M of the entire irrigation system in self-managed systems and of the secondary and tertiary canals in jointly managed systems, should be turned over to farmers organizations (FOs).

Irrigation levies. Farmers should be exempted from paying irrigation service levy to the government, in return for taking over systems and sub-systems for self management. Until the systems and sub-systems are taken over for self management by the FOs, the farmers in major irrigation systems should pay a stipulated irrigation levy. The government should establish strong and prompt legal support to enforce levy payment. Any other beneficiaries besides the farmers who benefit from the irrigation schemes, should also contribute to O&M of the schemes.

Incentives. Incentives should be given to FOs that take over O&M as compared to those that do not.

Funds for Main System O&M. The government should take the responsibility for O&M of the main system. However, decision making should be done jointly by the FOs and the irrigation agency.

O&M should be given the highest priority in the matter of allocation of funds in the irrigation sector. The government should persuade international donor agencies to support this policy.

Agency Reorientation. The irrigation agencies should be reorganized with appropriate structural and institutional modifications to ensure strong commitment and capacity to implement effectively the policy of participatory management.

Monitoring and Evaluation (M&E). The O&M of the main system as well as secondary and tertiary sub-systems should be monitored. The FOs should actively participate in data collection, monitoring and perhaps data analysis and evaluation. The results of M&E should be linked to planning of rehabilitation projects.

Fund Management. The government should develop appropriate O&M fund management systems in which the budgeting, fund acquisition and spending process is transparent enough not only to the credit officers but to the FOs and the farmers as well.

Uniform O&M Policy. The policies for O&M should be adopted uniformly throughout the country.

2. Strategies for Rehabilitation and Modernization (R&M)

Rehabilitation Projects. Ongoing rehabilitation programs should be implemented in such a manner that they are responsive to the real needs of farmers, are cost-effective and act as a vehicle for building and strengthening the FOs which would take over increasing management responsibilities. O&M programs should be cost effective and essentially, the farmers should actively participate in the activities of the various phases of these programs.

Institutional Strengthening. The technical processes of O&M should be integrated with institutional processes for organizing and mobilizing farmers and agency officials for self and joint management of irrigation systems.

Cost Sharing. Farmers should share the cost of O&M programs with the government. Ongoing R&M programs should be used as grounds to experiment with different strategies for cost sharing.

Support Services. Adequate support services required for implementing the new participatory approaches in R&M should be provided by the government.

Selection Criteria. The national and provincial irrigation agencies should develop criteria for selecting and prioritizing projects for R&M. These will include the existence of strong FOs, willingness of farmers to share R&M costs with the government, and equity. Technical and economic considerations will also apply.

Macro-Planning. A database and associated plans for planning and implementing R&M programs should be developed by national and provincial irrigation agencies.

New Technologies. Research and development on cost-effective new technologies and techniques should be a priority in the future. A joint research committee represented by the irrigation and agricultural agencies, universities, research institutes and private sector establishments should provide research policy guidelines and coordinate and monitor research programs related to irrigation management.

Irrigation Management Policy Support Activity. 1991. Achieving high productivity in irrigated agriculture: A program of Research and Development (R&D) for technology generation and diffusion. IMPSA Policy Paper No. 5. Ministry of Lands, Irrigation, and Mahaweli Development, Colombo, Sri Lanka.

Keywords : irrigation institutions / performance / rehabilitation and modernization / technology generation / diffusion / Sri Lanka

Study Site : Nonspecific

Study Period : 1990-1991

Introduction

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Objective

To prepare policy guidelines related to Research and Development (R&D).

Recommendations/Conclusions

Research Goal

The overall goal of irrigated agricultural research must be the production of research results that can significantly influence the actual practices in the field, leading to greater productivity, profitability and sustainability without causing environmental degradation. The research results must be useful to all parties connected with irrigated agriculture, namely, farmers, managers, designers of irrigation systems, consultants, policy makers, donors and other users.

Research Areas

In order to achieve the vision foreseen in IMPSA Policy Paper No. 1, the following broad areas are identified for research:

1. Institutions for irrigation management.

2. Improving irrigation systems performance and management.

3. Rehabilitation and modernization of irrigation systems.

4. Irrigation and drainage technology.

5. Agricultural technology.

6. Resource management.

7. Irrigation and environment.

Investment in Research and Development

It is recommended that at least two percent of the irrigation-related Agricultural Gross Domestic Product (AGDP) be set apart for irrigated agricultural research. Of this amount 30 percent, 50 percent and 20 percent must be allocated for irrigation research, agricultural research, and socioeconomic and institutional research related to irrigated agriculture, respectively.

Irrigation Research Design

Irrigation research has to be carried out in close collaboration with planners, designers, implementors and operators of irrigation systems, including farmers.

Prioritizing Irrigation Research

The following are the main considerations for prioritizing irrigation research:

1. Define research priorities with reference to the needs of the main clients (farmers) and formulate research programs on the basis of these priorities.

2. Treat the irrigation system as the basic unit of analysis to identify research issues, employ a systems perspective to study these units and make systems performance the primary concern in choosing research issues.

3. Aim to provide research results to a wider audience including the Ministries concerned with planning, finance, agriculture and irrigation, provincial councils and local authorities, irrigation professionals, and farmers.

4. Understand the socio-political and economic changes that the research results would bring about in established practices and procedures of irrigation systems planning, design, operation, maintenance and management, before research is undertaken

5. Attempt to match the research program as closely as possible with the research facilities and resources available to achieve the desired results.

Dissemination of Technology

Capacity for dissemination of technology should be built up.

Implementing Institutions

Establish a Research Management Unit (RMU) within the Irrigation Department.

Implementing Strategy

The National Irrigation Rehabilitation Project (NIRP) will be used as a vehicle to develop the RMU.

Irrigation Management Policy Support Activity. 1991. Human Resources Development (HRD) in the irrigated agriculture sector: Achieving the potential. IMPSA Policy Paper No. 6. Ministry of Lands, Irrigation and Mahaweli Development, Colombo, Sri Lanka.

Keywords : training / human resources development / coordination / Sri Lanka

Study Site : Nonspecific

Study Period : 1990-1991

Introduction

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Objective

To prepare policy guidelines for human resources development.

Recommendations/Conclusions

Plans and Strategies for HRD

Each irrigation agency should internally develop its mission in terms of the overall goals for irrigated agriculture. The staff at all levels of the organization should be involved in the preparation of plans and strategies for the development of human resources. A separate HRD division should be set up in each agency with sufficient authority to develop and implement HRD programs as necessary.

Staff Reorientation

The HRD programs should promote inter-disciplinary team work and encourage staff to seek training in related disciplines other than their own.

Finance

It is suggested that the quantum of funds set apart for this purpose should be a percentage of the agency's total budget for personal emoluments and on a sliding scale commencing at 5 percent of the first million rupees and 1 percent for each additional one million rupees, subject to a minimum overall rate of 2 percent.

Training

Each irrigation agency should build up a core group of trainers to impart the necessary skills to agency staff and to members of farmers organizations. The assistance of established local and foreign institutes should be mobilized for the training of trainers. The HRD programs should provide for trainers to expose themselves to field situations and practitioners to be posted for training assignments.

Agency staff must also be afforded overseas training opportunities based upon the agency's HRD programs and not merely on the short-term objectives of the donors. Where such facilities are offered under foreign donor-funded projects, they should also be used to meet the long-term needs of HRD. There should be a link between research and training.

Coordination of the HRD Activities

It is necessary to ensure coordination of the HRD activities of the various irrigation-related agencies, including those within the provincial councils. Training which is a primary component of the HRD Program should be coordinated at the national level by the proposed Central Coordinating Committee on Irrigation Management (IMPSA Policy Paper No. 2).

In major irrigation schemes, all training activities should be coordinated by a special sub-committee of the Project Management Committee.

Irrigation Management Policy Support Activity. 1991. Promoting profitable irrigated agriculture: Trade and fiscal policies. IMPSA Policy Paper No. 8. Ministry of Lands, Irrigation and Mahaweli Development, Colombo, Sri Lanka.

Keywords : market economy / tariff / agro-industries / trade and fiscal policies / Sri Lanka

Study Site : Nonspecific

Study Period : 1990-1991

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Objective

To prepare policies for trade and fiscal policies for agricultural produce.

Research Findings

A major objective of irrigated agricultural policy in Sri Lanka over the past several decades has been to achieve self-sufficiency in staple food crops, especially rice. Sri Lanka is now striving to create a market friendly environment.

Recommendations/Conclusions

Macroeconomic Policies

Implement a consistent set of macroeconomic policies in the agricultural sector.

Promote an investment pattern that encourages the efficient use of existing irrigation infrastructure while simultaneously expanding it.

Lower the present high tariff levied on spare parts for agricultural equipment.

Work out a system of support towards the utilization of organic and green manures.

The government should develop an effective system to monitor production planning. This should involve the estimation of requirements of various agricultural commodities, the identification of areas for their production ensuring continuous monitoring of yield and output, and making use of this information to assess import requirements. The buyers and producers including farmers organizations should be brought together in deciding the production plan of an area. The Ministry of Agricultural Development and Research should initiate this and coordinate the efforts.

Policy Coordination

A steering committee at the national level should be established comprising the irrigation, agricultural, trade and industrial ministries and private organizations including representatives of apex farmers organizations to formulate policies and coordinate efforts in the area of agro-industrial development.

Market Promotion

Increasing reliance on markets to guide agricultural production and resource allocation is required. The development of a system to collect, analyze and disseminate market information is necessary.

Farmers Organizations

Promote the involvement of farmers organizations in trade and marketing, so that inputs including credit and other services could be channeled through these organizations.

Provision of Facilities and Incentives

The development of a more vigorous and responsive research and extension system is required. Continuous research must be carried out in critical areas such as yield increase, cost reduction, methods of achieving higher profits and post-harvest technologies.

Development of Infrastructure

An institutional mechanism to coordinate research and development and training should be worked out.

The establishment of a "one stop business center" by the government from which possible investors could obtain all information necessary to establish agro-industrial ventures is needed.

Activating the Paddy Marketing Board to purchase rice and other crops at least in a limited quantity during critical periods should be considered.

Credit

Make available credit, even non-subsidized but accessible to all sectors of the farming community for agricultural production and marketing, with less formalities.

Irrigation Management Policy Support Activity. 1991. Macro-Irrigation Investment Policy. IMPSA Policy Paper No. 9. Ministry of Lands, Irrigation, and Mahaweli Development, Colombo, Sri Lanka.

Keywords : investments / food security / macroeconomy / Sri Lanka

Study Site : Nonspecific

Study Period : 1990-1991

Introduction

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Objective

To prepare policy guidelines for macro-irrigation investment.

Recommendations/Conclusions

A Framework for Future Macroeconomic and Investment Policy

The policy of public investment allocation will be for the Operation and Maintenance (O&M) of existing capital assets, before embarking on new projects. However, in those areas where the private sector cannot undertake on its own, due to lack of capital or technology, public investments will seek to fill the gaps.

A Framework for Future Irrigation Investment Policies

1. Investment in complementary software can be more productive than investment in hardware alone.

2. Investment should not be viewed solely as the responsibility of the government. The potential role of the private sector in investment should be duly recognized and encouraged.

3. The government public investment plan for irrigated agriculture will be about 9 percent of the Gross Domestic Product (GDP) in the next few years. As the total public investment ranged from 10 to 13 percent of the GDP through 1994, the investment for the irrigated agriculture sector will be about 1 percent of the GDP, which is an acceptable level.

Public Investment Priorities

It is necessary to reallocate the total available funds for the irrigated agricultural sector according to the order of priorities. In addition to direct investment, funds will also be required to improve infrastructure facilities.

Complementary funds will be necessary for investment and this should be available from the private sector. One component of this requirement in respect of O&M and system rehabilitation will come from farmers' contributions. Commercial firms could contribute to the provision of infrastructure and for O&M or rehabilitation of irrigation systems in which they are given an opportunity to participate on a commercial basis.

In future, allocation of public funds for irrigation should be made in a manner that would clearly itemize specific programs such as human resources development, institutional strengthening, modernization, research and development, etc.

Land and Water Conservation

It is recommended that ministries and agencies dealing with land and water conservation should ensure that necessary proposals are formulated and submitted to the government for appropriate funding.

Private Investments

The major options available for private sector investments are provisions of goods and services which directly support existing agricultural enterprises, processing of agricultural products, agricultural diversification, research and development.

Substantial direct investment in the development of the complementary infrastructure in the immediate future will have to be borne by the government.

The government should create appropriate conditions at the macroeconomic level and in the agricultural sector to attract private investments. At the macroeconomic level, the government should demonstrate its capability to provide national economic stability and security from civil unrest. The government should develop and communicate to the private sector a well-articulated plan for the development of the agricultural sector. It should also take effective measures to coordinate the implementation of the plan through the establishment of a "one stop information center" and a coordinating mechanism to ensure collaboration between the public and the private sector in determining policies. The government should

clearly spell out its policy on food security and crop diversification and elaborate on strategies to implement it.

Irrigation Management Policy Support Activity. 1991. Modernizing the irrigation agricultural sector: Transformations at the macro-institutional level. IMPSA Policy Paper No. 4. Ministry of Lands, Irrigation, and Mahaweli Development, Colombo, Sri Lanka.

Keywords : mission / institutional development / reorganization / collaboration / Sri Lanka

Study Site : Nonspecific

Study Period : 1990-1991

Introduction

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Objective

To prepare policies on modernizing irrigated agriculture and recommend necessary transformations at the macro-institutional level.

Recommendations/Conclusions

The government should rationalize and simplify the existing institutional framework. The study covers the Irrigation Department (ID), Irrigation Management Division (IMD), Department of Agrarian Services (DAS) and the Mahaweli Authority of Sri Lanka (MASL).

Irrigation Department and Irrigation Management Division

ID's mission should be to develop water resources for irrigated agriculture and provide technical and management services to water users for the optimum use of the country's water resources. This must be done with special reference to irrigation management for the effective implementation of the government's participatory irrigation management policy.

ID should be reorganized to be an effective multi-disciplinary and performance-oriented decentralized irrigation management department working through interdisciplinary teams.

The main features of the proposed new organizational structure of the ID are as follows:

The change of designation of Head of the Department to Director General. The person filling this position should be very senior and have a recognized and broad experience in irrigation and water resources and should have experience that demonstrates leadership skills. Two sub-departments, one for irrigation management and the other for technical services, each headed by a Director should also be established.

The Director General will be supported by separate units leading with public and parliamentary affairs, planning and monitoring human resources development, coordination of services to Provincial Councils, and finance and administration.

The Director for Irrigation Management will be responsible for implementing the participatory management policy. Units will include institutional development and training, Operation and Maintenance (O&M), rehabilitation and modernization, and a research management unit. Range Deputy Directors will report to the Director for irrigation management; key positions will be openly filled from a variety of disciplines.

Promotions in the ID should be on the basis of seniority cum performance.

The ID and the IMD should be integrated in two phases. In Phase I, the ID will re-organize and recruit new staff while the IMD will continue its responsibilities in Integrated Management of Major Irrigation Settlement Schemes (INMAS). In Phase 2, the ID will take over the INMAS Program as well. Some IMD staff may opt to join the ID; others will form the nucleus of a unit within the MLI&MD to monitor policy implementation.

Mahaweli Authority of Sri Lanka (MASL)

It is recommended that a high-level committee of the MASL be established to develop a more focussed mission statement, and the Agricultural Planning and Analysis Project in close collaboration with IMPSA should study the reorganization.

Department of Agrarian Services

A separate Deputy Commissioner for Human Resources Development should be appointed.

With regard to farmers organizations, functions should be divided between a Deputy Commissioner and an Assistant Commissioner.

A separate Deputy Commissioner is proposed for ensuring close collaboration among other agencies.

A post of Deputy Commissioner for Institutional Building is to be created.

Provincial Council and Local Government

The setting up of Provincial Agricultural Committees in each province to represent the Central Coordinating Committee for irrigation management is suggested.

Strategy for Implementing Organizational Reforms

Both organizational and individual change must be pursued. Four key principles to govern the overall strategy and five specific methodologies are proposed.

The Private Sector

The government needs to guarantee secure access to land, water and other resources for productive irrigated agricultural enterprises.

Irrigation Management Policy Support Activity, 1991. Sustainable and productive resource management: Macro-policies for land and water resources. IMPSA Policy Paper No. 7. Ministry of Lands, Irrigation, and Mahaweli Development, Colombo, Sri Lanka.

Keywords : resource management / macro-policies / water resources / land use / Sri Lanka

Study Site : Nonspecific.

Study Period : 1990-1991

Introduction

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Objective

To prepare policies on sustainable and productive resource management.

Recommendations/Conclusions

The following measures are recommended in the short term, which could pave the way for more effective long-term policies.

Research

It is proposed that a land tenure and productivity research program be developed.

A much stronger research and development capability is also required.

Watershed Management Policy

An integrated approach to watershed management in specific geographic areas is needed. It is recommended that a Steering Committee on Watershed Management be initiated through MLI&MD. Economic analysis of the costs and benefits of upland watershed conservation for both upstream and

downstream beneficiaries should be an important part of the watershed project planning process. Technical, economic and social research studies are required to assess the severity of watershed degradation.

Farmers with more secure land tenure are more likely to participate in watershed conservation programs which may have only medium- and long-term benefits. Therefore, land tenure needs to be evaluated in the planning phase of watershed conservation programs.

Water Resources Policies

The first priority should be ensuring basic human welfare, in terms of the provision of safe and adequate water for drinking and other domestic uses. The highest economic value of water, which includes social, environmental and other costs and benefits should be the major basis for all decisions on water resources investments. It is recommended that the government establish a National Water Resources Council supported by a strong Secretariat. Sri Lanka needs to examine her own experiences and those of other countries about how to clearly define and enforce water rights and ensure equity and efficiency in the use of water resources. It is important to develop an adequate updated database and water resources management information system. In future there will be significant opportunities for private investment in water resources development. Future water resources policies should include adequate provisions to minimize negative environmental impacts.

Proposed Water Resources Study

In order to develop an effective and comprehensive water resources law and prepare a master plan to guide future investments, a three-phase study has been recommended.

Aluwihare, P.B. and Masao Kikuchi. 1991. Irrigation investment trends in Sri Lanka: New construction and beyond. IIMI, Colombo, Sri Lanka.

Keywords : irrigation investments / construction / independence / management style / irrigation management

Study Site : Nonspecific

Study Period : 1988-1991

As Sri Lanka has come to a state of near self-sufficiency in rice, the irrigation sector of the country is at a turning point. This paper tries to answer the question, " in which direction should the irrigation sector now proceed?"

Objective

To analyze irrigation investment trends in Sri Lanka during the post-independence period and make recommendations for future investments.

Research Findings

Major government efforts aimed at economic development in general and agricultural development in particular have been directed towards the development of irrigation infrastructure. Such efforts, coupled with the diffusion of seed fertilizer technology, have brought Sri Lanka to a state of near self-sufficiency in rice.

Until the early 1980s, new irrigation construction investments had been accounting for more than 90 percent of the total irrigation investment, and 20 to 40 percent of the total public investment in the country.

As development proceeded, new construction shifted from small projects to major water resources development, resulting in a sharply increasing trend of cost. The cost increase and the decreasing trend in the price of rice, makes new irrigation construction no longer an economically viable investment opportunity.

Since the mid-1970s, a new investment trend has emerged in the irrigation sector. Irrigation rehabilitation/modernization projects have appeared and their share of the total irrigation investment has been rapidly increasing since then.

A major rehabilitation project completed in the mid-1980s showed an internal rate of return of 24 percent as compared to the rate of return on new construction of less than 10 percent in the 1980s. In the case of successful water management improvement projects, the internal rate of return is as high as 70 to 80 percent.

Recommendations/Conclusions

The investment portfolio of the irrigation sector has completely changed. Now that the irrigated land base has been well established; the only economically feasible and viable option left for the irrigation sector in Sri Lanka is to go into the management phase.

Gunadasa, A.M.S.S. 1989. The Kimbulwana Oya Irrigation Scheme: An approach to improved system management. IIMI, Colombo, Sri Lanka.

Keywords : water issue board / farmers organizations / communal irrigation system / seasonal planning / irrigation management / Kimbulwana / Sri Lanka

Study Site : Kimbulwana Oya Irrigation System, North Western Province

Study Period : 1986-1987

Introduction

The author, a Technical Assistant of the Irrigation Department was in charge of the Kimbulwana Oya Irrigation System. With innovative approaches, he built up his credibility and gained the confidence of the farmers by providing a simplified form of technical guidance to them.

Objective

The documentation of the author's experience in irrigation management under IIMI's Special Award Scheme.

Research Findings

1. Large amounts of water can be saved during the wet season by advancing the cultivation season, and using whatever water is left at the end of the season to overcome deficits in the dry season.

2. The confidence of farmers can be built up gradually by analyzing the available data on the irrigation scheme's rainfall, inflow, water deliveries and tank storage with a view to deciding on seasonal planning of cropping patterns, and water deliveries during critical crop growth stages.

Recommendations/Conclusions

Technical personnel can, with innovative approaches, build up their credibility and gain the confidence of farmers by providing a simplified form of technical guidance to the farmers.

Considering the importance of farmer participation in the planning, implementation and construction of systems, a controlling body with elected farmer leaders representing the entire farmer community and

government officers was formed. The farmer leaders were the medium of communication between the farmers and government officers. Conflicts and disputes were settled by a controlling body called the Water Issue Board, which met regularly every Tuesday.

The confidence instilled in the farmers made it possible for a government-maintained system to be converted into a major communal irrigation system where organized farmers undertook the maintenance of the system.

Dayaratne, M.H.S. and Gamini Wickremasinghe. 1990. Role of nongovernmental organizations in the improvement of minor irrigation systems in Sri Lanka. Proceedings of a Workshop held at Digana Village, Kandy, Sri Lanka, 17-18 March 1989.

Keywords : blueprint approach / participatory management / sustainability / nongovernmental organizations

Study Site : Nonspecific

Study Period : 1990

There has been a remarkable increase in the number of nongovernmental organizations (NGOs) in the recent past. Most of the NGOs include the improvement of minor irrigation systems as a component of their development strategies.

Objective

To document the experiences of nongovernmental organizations in the improvement of minor irrigation systems in Sri Lanka.

Research Findings

The papers and follow-up discussions of the workshop reviewed and assessed the approaches, strategies, experience and performance of NGOs relating to the minor irrigation sector.

The NGO approaches vary from the rigid blueprint type to the flexible problem-oriented participatory type. This reflected the difference of interest of NGOs, which in turn indicated the preference of the different donor agencies supporting the individual NGOs. However, a striking observation was that each type of approach demonstrated its emphasis towards the motivation of farmers in groups. Nevertheless, the same concern did not appear to exist in the task of evolving a mechanism for sustainability. It was also revealed that most of the NGOs have created a certain degree of dependency for system management like the government agencies. From the proceedings, two aspects of sustainability were highlighted:

1. Community-centered sustainability.

2. Agency-centered sustainability.

Recommendations/Conclusions

The NGOs too have acted as officers creating a considerable degree of dependency for system management. The major reason for NGOs to behave like bureaucrats could be the fact that most of the NGO workers have originally worked in government or semi-government agencies.

NGOs are not perceived socially as alternatives to government organizations and as such, it is necessary that the government regulates NGO activities so that optimum use of resources and sustainability could be achieved.

System sustainability cannot be attained during a short period of time, but hitherto experimented strategies of both government organizations and NGOs could be systematically applied. However, different environmental conditions have to be taken into account, since a "rigid model" cannot be replicated in the context of sustainability.

Dantanarayana, D. and U.D.S. Udawattage. 1987. Design of the distribution network towards effective water management in micro-scale irrigation schemes in Sri Lanka. Irrigation Design for Management, Asian Regional Symposium, Kandy, Sri Lanka, 16-18 February 1987.

Keywords : water management / distribution network / Puttalam District / village tanks

Study Site : Puttalam District

Study Period : 1980s

Introduction

This paper analyzes changes to the configuration of the canal system for better water management in micro-scale irrigation schemes. The design alternative considered is appropriate to the World Bank-financed Integrated Rural Development (IRD) 11 Project. Guidelines are given for replication of the preferred design scheme. A scheme from the Puttalam District is presented as an example.

Objectives

To achieve better water management in micro-scale irrigation schemes:

1. By improving and changing the canal configuration.
2. By providing regulated outlets.

Research Findings

The present network of canals and utilization thereof:

1. Water issues are made on an ad hoc basis and there is no schedule for sluice operation.
2. There are no measuring devices to guide the sluice operator.
3. Some schemes do not have controllable sluices.
4. The practice of taking water through numerous "bunt-cuts" (illegal outlets) in the canal in the absence of irrigation structures was also observed.

5. Drainage canals are used as supply canals.

6. Inadequate conveyance capacity and short canal embankments result in overflows.

Conclusions

1. Basic improvements and configuration changes.

   a. Improvements to the existing canals.

      The canals need to be desisted, regraded (including introduction of drop structures wherever needed), and canal embankments raised and formed so as to promote a stable bed and to preclude embankment overflows.

   b. Configuration changes in the canal system.

      In the Adipola Paddy Tract, the supply canal and drainage canal are one and the same, running centrally along the paddy tract. Effective water management is not possible by this method. Introduction of new supply canals along the opposite boundaries of the tract enables the water management schedule.

2. Regulated outlets for water management.

To ensure equitable distribution of water to the entire tract, canals must be regulated and control outlets provided. Four alternatives are provided. The option of grouping several bunds together to one outlet—the entire canal regulated which is cost effective and agrees with IRD 11 Project (i.e., to provide farm outlets to permit rotational issues so as to solve tail-end problems)—is recommended for the project.

Recommendations

Selection of the location of farm turnouts and the identification of sub-divisions in the tract to prevent disputes are also discussed.

Application of the suggestions to the Adipola Scheme in Puttalam District is described based on an illustrative system configuration.

Sivagurunathan, S. 1985. Rehabilitation of irrigation projects for improved water management. *In* Institute of Engineers, Sri Lanka. Transactions for 1985.

Keywords : Iranamadu / rehabilitation / irrigation / water management

Study Site : Iranamadu

Study Period : Nonspecific

The paper discusses the design criteria and methodology adopted in the Iranamadu Rehabilitation Project. The strategy adopted in the evolution of design criteria and methodology was to obtain the views of farmers organizations and the possible remedial measures and to have them evaluated by a team of Irrigation Engineers and Technical Assistants of the Irrigation Department. The project was supported by the World Bank.

Objective

To achieve improved water management in the rehabilitation project by ensuring:

1. System safety.
2. Adequate capacities to deliver available water in an efficient manner.
3. Positive control and regulation of water deliveries in the distribution system.
4. Measurement of flow at turnout structures and other critical locations in the distribution system.
5. Ease of operation, maintenance and management.

Research Findings

The low efficiency of the system is mainly due to the inadequate regulation and control structures, the nonavailability of water measuring devices, and the deterioration of irrigation system due to loss of life span. The non-existence or non-functioning of farmer organizations in the project management is also a problem in water management.

Recommendations

Rehabilitation of Iranamadu

1. ***Headworks.*** Protective measures are needed to control erosion of upstream and downstream slopes, and repairs are required on the stilling basins. The spill level is also to be raised by one foot to augment the tank capacity by 7,500 acre-feet (ac.ft.).

2. ***Project Area.*** On the right bank, improvements to field canals and construction of measuring devices at the turnouts are needed. On the left bank, provision of necessary measuring devices, control and regulation structures and farm turnouts are required.

3. ***Phase of Implementation.*** The construction program is phased out in such a way that the cultivation would not be suspended. It is planned for implementation over a six-year period.

Dharmawardhana, M.W.W. 1968. Quality control of concrete at Uda Walawe Headworks. ***In*** **Institute of Engineers, Ceylon. Transactions for 1968. Vol. 1. p.97-130.**

Keywords : quality control / concrete / Uda Walawe

Study Site : Uda Walawe

Study Period : 1965-1967

Introduction

This paper is based on the author's experience in the construction of the Uda Walawe Headwork. The paper describes laboratory procedures and quality control methods involved in the concrete mix designs and concrete testing, including specifications for concrete, mix proportions, cement and aggregates, and batching procedure.

Since the recommended American and British practices of concrete mix design were not relevant to the Uda Walawe Headwork which is subjected to water pressure, the United States Bureau of Reclamation (USBR) practice was adopted.

Objectives

1. To ensure quality control of concrete at the Uda Walawe Headwork.
2. To determine the factors which affect the compressive strength of concrete.
3. To determine the effect of sugar on the setting time of concrete.

Research Findings

Variation in Strength

Assuming a Gaussian distribution for the strength, factors which contribute to the variation of strength were found to be the quality of cement, quality of aggregate, moisture content of aggregate, batching errors, temperature of placement, curing, preparation and handling of test specimens and testing errors.

The largest contribution for the standard deviation was by the moisture content of the aggregates. Standard deviation due to inaccurate batching is relatively small.

Concrete

It was seen that the mixes at Uda Walawe are leaner than mixes used for normal volume batching, and also that the average compressive strength is higher.

Permeability Test

Permeability tests revealed that the concrete was satisfactory.

Tests on the Use of Sugar

It enabled the concreting of structures to be carried out without the risk of developing cold joints by prolonging the setting time. A sugar cement ratio of 0.05 percent prolonged the setting time by approximately 4 hours and increased the compressive strength by approximately 10 percent.

Segregation of Mix

It was found that the concrete did not segregate so long as the grading pattern and size of aggregates remained according to the mix design.

It was also observed that an increase in the fines over the allowed amount caused the sticking of concrete inside the buckets. Also, mixes with large size aggregate tended to segregate more than an identical mix without (3") aggregate.

Conclusions

The quality control of concrete at Uda Walawe could be described as fair by USBR standards. The disparity between the coefficient of variation assumed for mix designs and the coefficient of variation obtained, may be attributed to the following:

1. Variation in the quality of the cement.

2. Variation in the moisture content of the aggregate.

3. Variation in the batching of water and cement.

4. Changes in the requirement of water arising due to varying atmospheric temperature.

The use of sugar as a retarder on setting time was satisfactory.