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STUDY ON IRRIGATION SYSTEMS REHABILITATION AND IMPROVED OPERATIONS AND MANAGEMENT

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ACTIVITY A: REHABILITATION AND IMPROVEMENT FOR MANAGEMENT

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EXECUTIVE SUMMARY

Improvement in Plain System Management has been identified as a key to better performance of irrigation systems. This aspect of Irrigation Management deserves more professional attention and research.

The objective of the present study is to document with a management-oriented approach the reality of main canal operations with particular reference to the implications of the planning and design of main systems on the management and performance of the systems. Main canal regulation has been analyzed from the point of view of (a) its impact on the distribution of flows from the main canal, (b) its contribution to the manageability and ability to operate the physics1 systems, and (c) its implications for the managerial requirements of the irrigation agencies.

IIMI has conducted a compsrative study of three irrigation systems in Sri Lanka and one in the Philippines, which display different planning and design features in their main systems and canals. These are: (a) the Kalankuttiya Branch Canal of the Galnewa Project in System H of the Mahaweli Economic Agency of the Mahaweli Authority of Sri Lanka; (b) the Right Bank Main Canal (RBMC) of the Kirindi Oya Irrigation and Settlement Project (KOISP) of the Irrieation Department, Sri Lanka; (c) the Rajangana Pilot Distributary Canal of the Rajangana Irrigation Scheme of the Irrigation Department, Sri Lanka; and (d) the Santo Domingo Area (SDA) Plain Canal of the Upper Pampanga River Integrated Irrigation System (UPRIIS) of the National Irrigation Administration (NIA) of the Philippines.

The study analyzes the impact of the physical aspects of the systems, including the structuring of main systems and canals, on (a) the organizational setup of the Irrigation Agencies in charge of their operations, and (b) the manageability of the two interrelated primary functions of a main canal, namely the conveyance of water from a source of supply to remote places of delivery to sub-units of the system.

Field investigations and analyses have been conducted to examine (a) the actual conditions under which canal operators exert control over the physical process. the flow of water, and (b) the actual conditions under which the management process of decision making takes place at the various operational levels of the agency as required for canal regulation.

Most of the information utilized for the study was collected during one irrigation season in 1988. This was performed through (a) intensive automatic recording of canal water levels using electronic data-longer technology, as well as classical stare-recorders (a total of 31 different. sensing points were dispersed at key locations alone the main canals and at some branching points), (b) careful field monitoring of canal operations, and (c) interviews of the operations staff. The study also drew upon previous work conducted by IIMI on the same systems as well as results generated by simulations performed through available mathematical models of some of the canals.

A. The Impact of Planning and Design on the Management of the Conveyance of Water in the Main Canals Studied

The main. canals studied correspond to subsystems of much larger projects. With the exception of the Kirindi Oya Right Bank Main Canal, which takes off directly from a main storage reservoir, the canals studied were dependent for their supply on an upper conveyance system. In the case of the Kalankuttiya Branch Canal, the upper conveyance system consists of a cascade of 3 tanks, namely, Kalankuttiya, Mulannatuwa, and Kalawewa. The last tank is itself supplemented by a diversion from the Mahaweli River. In the case of the Santo Domingo Area Main canal, the upper conveyance system is characterized by a cascade of 5 diversions along the 50 km long water course and diversion canal (DC#1) between the source of supply and the head of the canal studied (SDA Main Canal). In the case of Rajangana the canal studied is a distributary canal taking off the upper reaches of a main canal.

The following design characteristics were identified as important parameters that constitute the foundation for more decentralized operations at the head of subsystems:

A1. Decentralized storage capacities such as in Mahaweli System H can improve the manageability of extended systems. This was evidenced by the higher level of performance achieved in System H, in terms of the quantitative control of the supply at the head of the subsystem, when compared with the Diversion Canal DC#1 at UPRIIS.

At Kalankuttiya, during yala (dry season) 1988 the management of the left bank main canal (conveyance system) succeeded, with limited managerial effort, in refilling the Kalankuttiya Tank in due. time without affecting the program of water issues from the tank. This result, however, has to be weighed against the difficulties experienced previously at a time of water shortage (maha, or wet season, 1986/87). This shortage put exceptional strain on the conveyance system and on its management, which found itself relatively unprepared to face such a situation with its usual managerial practices.

At the UPRIIS, on the contrary, the supply provided at the head of the SDA Main Canal depends largely on the performance of the upper conveyance system (DC#1). In 1988, the supply at the head of the SDA was very irregular despite the considerable managerial efforts deployed by the staff of the Water Central Coordinating Center of the UPRIIS/NIA, assisted by the District Hydrologist and supported by an effective radio communication system. The supply conditions at the head of the system make it almost futile for the Agency to envisage distributing water within the Santo Domingo Area with the objective of quantitative flow control as in the case of Kalankuttiya. Instead, it was observed that the distribution was implemented with a rather high degree of success on the basis of a "degraded" objective, that, is, to share whatever inflow is available in proportion to the planted areas.

A2. The rational use of hydraulic "controls" (e.g., long-crested weirs) across canals, if permitted by the topography, as an alternative option to manual water level control through gated cross-regulators, was found to have

a significant impact on the staffing and manageability of the systems. Reasons for this include: (a) simple hydraulics and simple operations; (b) reduced room for decision making at the level of the operators while nevertheless improving the quality of the water level control in the main canal, which in turn conditions the decision making and operations at the offtakes aimed at flow control; (c) opportunity for decentralized operations of the delivery function, relatively uninfluenced by the operations related to the conveyance of water in the main canal.

It was observed, in Kirindi Oya, that the excessive operational flexibility available at the diversion point from a main canal (gated cross-regulator plus lateral offtake) was abused to the detriment of conditions for effective management of the conveyance of water throughout the main canal. A likely explanation is that the present concern of gate operators is limited to the distribution of water; they have little or no concern for the conveyance of water along the main canal.

It was also observed that although "controls" are seldom used as level control devices, they are more readily **used** as measuring devices, but sometimes with limited success.

"Controls" in the form of duckbill weirs existing at the Kalankuttiya Branch Canal, (and on the Rajangana Pilot canal) were found to be effective in creating hydraulic conditions (control of level) suitable for the control of water issues at the offtakes while eliminating the burden of gate operations on the main canal and all its 'negative consequences. Under such a conditioning environment in the main canal, further gain of performance in the control of flow could be envisaged through technological innovations such as baffle distributors, provided of course that the process of technology transfer has been adequately effected.

B. Performance of the Conveyance System: A Conditioning Factor for the Control of Water Delivery

The planning and design features referred to above were found to have an impact on the performance of the conveyance of water along canals, a factor that conditions the control of the water delivery. Other managerial conditions required for the control of water issues that were examined were: (a) the availability of explicit delivery targets, (b) the possibility of obtaining feedback on the actual flows delivered, and (c) the availability of physical means for operations.

B1. At the head of the canals studied, these conditions were generally found to be adequate, with the exception of the SDA. The poor performance of the SDA bin canal in that respect was essentially conditioned by the inadequately regulated sources of its supply: (a) the local flow from a creek, and (b) the irregular supply from the upper conveyance system. As a result, the delivery objective within the Santo Domingo Area during the 1988 wet season (which in fact turned out to be relatively water short) was found to be limited to the equitable sharing of available water and apparently not the provision of controlled water issues like in the other systems.

02. The general observation in the systems studied was that the managerial conditions required for the control of delivery at the offtakes were deficient. This deficiency can be attributed in part to the design features of the canals that often include ineffective devices to assess the flow diverted. Of more importance, however, are the deficiencies of the present regulating mechanisms for the conveyance of water along the canals and the difficulties in achieving this with the current practices of operation of the gated cross-regulators, This gap was of particular significance at Kirindi Oya Right Bank Main Canal, as the hydraulics and the length of the canal make it difficult to perform efficiently the downstream mode of regulation attempted by the Agency. But even in the Rajangana Pilot Distributary Canal where this function could have been performed more easily, the Agency did not seem to have taken advantage of the technology to manage the conveyance function better, and in particular to monitor the inflow-outflow water balance along the canal.

C. General Findings and Conclusions

As a result of the investigations carried out in the four systems, some general conclusions were arrived at as follows:

C1. The territorial magnitude of extensive irrigation projects is reflected in the dimensions of the organizational setup of their management agencies.

C2. The potential complexity of the management is not only determined by the size and structure of the organizations but also to a large extent by the layout of the main system and the hydraulics of the canals. It may also happen, however, that even in a system of limited size with an organization of corresponding magnitude, such as the Kirindi Oya Right Bank Main Canal, the canal hydraulics might still be highly complex. Appropriate managerial practices are therefore needed to cope with this complexity. The operation of systems in a dynamic manner while maintaining the objective of an acceptable level of performance generally results in a higher degree of complexity of the management.

C3. There are both a parallel and a link between the physical infrastructure of the irrigation main system and the superimposed organizational arrangements of the agency to manage tie water from the source to the various points of delivery.

C4. The parallel refers to the relative degrees of centralization versus decentralization available in both the agency and the physical system to control the complex process of decision making and the actions to be performed at various hierarchical levels with a view to the effective conveyance and distribution of water. The conveyance system of the Mahaweli System H, including a cascade of intermediate storage tanks, is an example of a main system with opportunities for decentralized operations of subsystems. In contrast, the conveyance system that provides the supply to the Santo Domingo Area Main Canal is directly dependent on the operations of a central reservoir.

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