



AgEcon SEARCH

RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

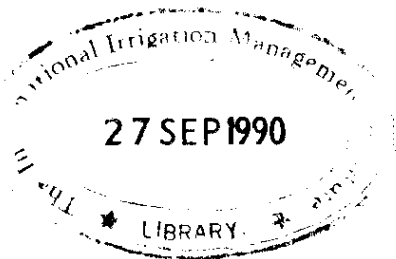
*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

IIMI Country Paper - Sri Lanka - No. 6

Rehabilitation of Small-Scale Irrigation Systems in Sri Lanka

SH.M. NRK.....
.....
..... IIMI
..... CP 63172
..... 5794
..... A. B. E.
AC. NO... H. 6559. 01



H6559
01

Rehabilitation of Small-Scale Irrigation Systems in Sri Lanka

State Policy and Practice in Two Systems

SHYAMALA ABEYRATNE

INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE

Abeyratne, S. 1990. Rehabilitation of small-scale irrigation systems in Sri Lanka: State policy and practice in two systems. Colombo, Sri Lanka: IIMI. xiv + 58pp.

/small-scale systems/ farmer-agency interactions/ social aspects/ farmer participation/ farmers' associations/ rehabilitation/ policy/ Sri Lanka/

DDC: 631.7

ISBN: 92-9090-123-3

Summary: Based on a study of two small irrigation systems in Sri Lanka, this report analyzes the impact of a government program for system rehabilitation and improvement of water management. The study reveals that during the improvement process, there had been insufficient coordination between the implementing agencies, and consultation with farmers was also below the expectations of the managers of the national program. As a result, the existing system of water allocation was disrupted, threatening the long-term impact of the program. The study draws lessons for improving future programs of this nature in Sri Lanka and elsewhere.

Please direct inquiries and comments to:

Information Office
International Irrigation Management Institute
P.O. Box 2075
Colombo
Sri Lanka

© IIMI, 1990

Responsibility for the contents of this publication rests with the author. All rights reserved.

Cover photograph by John L. Colmey

Table of Contents

List of Illustrations	vii
List of Tables	viii
Foreword	ix
Executive Summary	xii
Acknowledgements	xiv
Chapter 1. Overview of Small-Scale Irrigation	1
INTRODUCTION	1
Tanks and Anicuts	2
Management Responsibility	5
Background to the Study	6
Methodology	7
Chapter 2. Background to Primary Research Sites	9
THAMBAGAMUWA	9
Social Organization of Irrigation in Thambagamuwa	11
AMBEWILA	13
Social Organization of Irrigation in Ambewila	18
Chapter 3. State Intervention in Irrigation Development:	
The VIRP	19
REHABILITATION	19
Program Description	20
Implementing Agencies	20
Strategy for Promoting Participation/Organization of Farmers	21
The Tank or Anicut Committee	22

	Some Attempted Remedies during Program Implementation	23
Chapter 4.	VIRP Intervention in the Field	25
	VIRP IN AMBEWILA	25
	The Process	26
	The Agricultural Planning Team and the Tank Committee	28
	VIRP IN THAMBAGAMUWA	34
	Possible Impact of the New Structures	39
Chapter 5.	Implications of the VIRP Intervention Strategy	45
	THE VIRP PROCESS	45
	Selection Stage	45
	Design Stage	46
	Construction Stage	46
	Post-rehabilitation	47
	Impact on Management	53
	CONCLUSION	55
References	57

List of Illustrations

1.	Map of Sri Lanka: location of research sites	8
2.	Thambagamuwa showing two main yayas (rice-field tracts) and individual rice-field plots (pangu)	12
3.	Sketch map of Ambewila Tank	14

List of Tables

1. Magnitude of thattumaru tenancy in Thambagamuwa 11
2. Investment in minor irrigation rehabilitation — incremental index. 19

Foreword

THE RESEARCH FOR this study of two small irrigation systems was done in 1986-87. Shyamala Abeyratne was a Ph.D. candidate at Cornell University, and was supported by the International Irrigation Management Institute (IIMI) as a Research Fellow during this period. The research itself was carried out under the supervision of Ed Martin, then an Agricultural Economist on the staff of IIMI.

Ms. Abeyratne has already had considerable experience as a researcher into Sri Lankan irrigation management topics, primarily through her position as Research and Training Officer at the Agrarian Research and Training Institute. This experience included evaluations of some of the early rehabilitation projects under the Village Irrigation Rehabilitation Project (VIRP). This project, funded primarily by the World Bank and implemented by the Department of Agrarian Services, is intended to strengthen the capacity of the Department of Agrarian Services, and also to rehabilitate 1,200 "minor" systems, i.e., systems under 80 hectares (ha). As part of the rehabilitation project, improved water management practices and organizational innovations are also being introduced.

The present study examines rather critically the implementation of the rehabilitation on two small systems, one a reservoir system, the other a diversion or "anicut" system; and it raises questions about the likely long-term impact on the productivity and sustainability of the system. The observations in this paper are consistent with those of researchers in other systems in Sri Lanka, and in other countries.

But, as noted by one of the reviewers of this paper, two caveats should be kept in mind while reading this paper. First, the district in which the study was done is in no way "typical" of the environment in which most minor irrigation is located in Sri Lanka. Most of the irrigation systems are located in the Dry Zone, whereas these systems are located in a zone that is intermediate

between the Dry and Wet Zones. This simply means that there is more rainfall which is spread more evenly throughout the year.

Second, since this research was completed, the Department of Agrarian Services has recognized that it must make a greater effort to encourage farmer participation in its projects, and has developed a "team approach" to achieve its objectives. This is reported in a recent workshop paper by Mr. J. Medagama, Assistant Commissioner of Agrarian Services for Water Management.¹ It is work like the present paper that has assisted the department to reexamine its approach, and try new ideas. Further research on more recently rehabilitated systems would shed light on the effectiveness of the new approach.

At this point it may be useful to record our debt to the Department of Agrarian Services, and particularly to Mr. J. Medagama, Assistant Commissioner for Water Management, and the overall director of the VIRP. Mr. Medagama provided assistance at several stages of the work, and prepared detailed comments on a draft of the paper, even taking the time to visit one of the systems and observe the situation for himself. Mr. Medagama is himself a frequent contributor at workshops on farmer-managed irrigation systems. The department has always been supportive of researchers, and open to ideas for making improvements in its approach to working with farmers in small systems.

One more observation may be useful. During the period between the end of the research and the publication of this study, there is evidence that there have been further changes in at least one of the two systems studied, changes that the author would not have predicted. For example, based on his recent visit to Ambewila System, Mr. Medagama reports that some of the problems of access to water had been reduced by the farmers' shifting from rice to non-rice crops, which use less water and usually give larger returns. This would seem to support the wisdom of the present effort to promote crop diversification in irrigation systems throughout Sri Lanka.

¹"Adjusting the Process for Participatory Management in Small-Scale Reservoir Systems Through Team Approach — A Case Study in North Central Sri Lanka" by J. Medagama. Paper presented at Workshop on the Role of Social Organizers in Assisting Farmer-Managed Irrigation Systems, Khon Kaen, Thailand, 15-20 May 1989. Unpublished paper.

With all of these observations, we believe that this case study is a valuable contribution to the literature on assistance programs for farmer-managed or at least small-scale irrigation systems, and that the lessons drawn are relevant not only to Sri Lanka, but to other countries as well.

Douglas J. Merrey

Head, Sri Lanka Field Operations

October, 1989.

Executive Summary

THIS MONOGRAPH IS based on some of the preliminary findings from a broader research study conducted by the author for her doctoral dissertation. The monograph focuses on government-/donor-agency intervention for rehabilitation under the VIRP on small-scale irrigation systems in Sri Lanka. The study looks at both a tank (reservoir) and an anicut (weir) in Ratnapura District. Research in the field included participant observation, questionnaire surveys, monitoring of water flows over a *yala* (dry) and *maha* (wet) season, and survey of records at the district and local levels. A review of materials at the National Archives in Colombo provided the historical background to the study.

Government intervention in land development and irrigation system rehabilitation in the tank area was found to be a continuous and increasing activity, culminating with rehabilitation under the VIRP in 1982-83. The impact of these various phases of state intervention was assessed in terms of a number of factors, including the patterns of inter-*yaya* (rice-field tract) and intra-*yaya* water distribution and the degree of local management of the system. It was found that all irrigation-related tasks were undertaken under the auspices of local level government officers and there was little room for farmer management of the system. It was further evident the VIRP rehabilitation-cum-water management program, though committed to the principle of participatory management, had disrupted the existing system of water allocation which had incorporated all the water users in the command through a system of seasonal rotation. Some cultivators were found to be obtaining water at will, resorting to claims of prior appropriation as soon as their system was seen to be handed over to the "Tank Committee," the institutional format introduced under the VIRP. This in turn invited further government administration and intervention for irrigation management.

The anicut system — consistent with the national picture — had little government intervention until rehabilitation was undertaken in 1987 under the VIRP. This intervention disrupted the existing patterns of water distribution, and cultivators were apprehensive about their individual water supplies and the management of the system as a whole. Cultivators clearly felt rehabilitation of the headworks was more beneficial than modifications at the tertiary level where property rights were more entrenched. The rehabilitation process was further hampered by the lack of institutional links between the two implementing agencies, little experience in anicut-specific rehabilitation, a water-management package separated from physical rehabilitation, and an inadequate institutional base for the formation of a tank/anicut committee.

Acknowledgements

I WOULD LIKE first to extend my appreciation to the International Irrigation Management Institute for awarding me a research fellowship enabling me to undertake this work. I greatly appreciate the support of Drs. Thomas Wickham, Roberto Lenton and Senen Miranda in this endeavor.

I also owe special thanks to Dr. Ed Martin for his assistance and encouragement at all times. As the designated "research adviser" he provided valuable academic and logistical support. I also wish to thank Drs. David Groenfeldt and Pamela Stanbury for their friendship during my association with IIMI.

My field assistants, Mr. S.D. Epakanda, Mr. T. Ariyaratne, and Mr. Ranjith Ariyaratne were instrumental in helping me to collect much of the field data and I am grateful to them for their contributions.

I am deeply indebted to Dr. Jayantha Perera (then Deputy Director, the Agrarian Research and Training Institute) for his invaluable support and guidance, and to Mr. Jaliya Medagama (Deputy Commissioner/Water Management, Department of Agrarian Services) for willingly sharing information on the rehabilitation program. Mr. Medagama also went through a draft of this paper and offered very detailed, thoughtful comments, corrections, and suggestions, many of which have been used here. I would also like to thank Dr. Douglas J. Merrey for editing and preparing this monograph for publication, and Ms. Surani Neangoda for cheerfully taking upon herself the task of typing it.

Finally, I must note that even with all this assistance I alone, am responsible for this paper.

Shyamala Abeyratne
Rural Sociologist
1989

CHAPTER 1

Overview of Small-Scale Irrigation

INTRODUCTION

NATIONAL GOVERNMENTS AND international donors have been paying increasing attention to small irrigation systems. In Sri Lanka, one of the major programs aimed at rehabilitating minor or small-scale irrigation is the Village Irrigation Rehabilitation Project (VIRP). The strategy of intervention adopted under this program and its impact were studied in the field, under a broader research study aimed at understanding the impact of public programs on property rights in land and water, and as a result, on local capacity to manage irrigation effectively.

Cross-cultural studies demonstrate the advantages inherent in small-scale irrigation systems for eliciting farmer participation in investment, design, construction, and operation and maintenance activities (Lynch, 1985). Because small-scale irrigation projects are of a manageable size and have more accessible technology, and because the communities surrounding them tend to be relatively homogeneous, it is generally believed that opportunities for local involvement are enhanced. In turn, the success of these projects is thought to depend on eliciting community involvement.

From the government point of view there are several advantages in promoting local involvement from the inception of a rehabilitation exercise. Small-scale irrigation projects tend to be widely scattered and thus costly for the government to fund detailed feasibility and design studies prior to investment. Instead, it can rely on local people to provide information on microvariations in soil, climate, and crop water needs, in addition to valuable socioeconomic information such as legal and customary property rights to land and water, and labor availability on a seasonal or permanent basis. The community can also provide human resources for construction or system repair, thus reducing the costs to government. And of course, if management of the systems after construction remains with the local users, the expense to the government will be substantially less.

However, the ability and willingness of the community to take on project responsibility, especially the kinds of tasks that follow rehabilitation, depend on at least four factors: a high level of local participation, from inception through the different phases of project development; the existence of (or potential for) local organizational capacity for decision making in relation to system management and resource mobilization; economic and social incentives for participation, including agricultural prices to encourage farmers to contribute towards the system; and clear-cut property rights in land, water and the irrigation works that define relationships among the community members.

It is increasingly evident in Sri Lanka, where government intervention in rural life has been extensive since the 1930s and strong links have been forged with the state apparatus and the market, that village communities have a great deal of difficulty sustaining autonomous local organizations. It is only realistic to expect some degree of state involvement in small-scale irrigation systems. For example, state recognition may be a prerequisite to formalizing local organizations so that they may be able to obtain credit for construction, or state financing may be the expedient route to physical rehabilitation of the system. Two questions arise; to what extent is farmer participation warranted and expected, and does the intervention strategy under the VIRP promote sustained participatory management of small-scale irrigation systems?

Tanks and Anicuts

There are two main types of small-scale irrigation systems in Sri Lanka — tanks (reservoirs) and anicuts (weirs). Village or minor¹ tanks tend to be located in the dry zone (65 percent of the island's land area). Anicut systems, which depend on river and stream flows, tend to be located in the more hilly

¹Small-scale irrigation systems in Sri Lanka are also known as minor or village irrigation. The three terms are used interchangeably in this paper.

regions which also correspond to the wet and intermediate zones of the country² (35 percent of land area).

About 235,000 ha are irrigated by small-scale irrigation systems. This is about a third of the total irrigated area under rice, and minor irrigation contributes to an estimated 35 percent of rice production. However, yields under minor irrigation average about 1.9 tons per ha (38 bushels per acre [bu per ac]), as compared to average yields of about 2.8 tons per ha (56 bu per ac) in major irrigation schemes. The cropping intensity under minor irrigation systems is also lower than in major systems.

The number of minor anicuts and working (not abandoned) tanks is roughly equal (9,795 and 9,294 respectively); the area under village tanks is much greater and estimated to be 148,589 ha, while only 87,074 ha are irrigated by anicuts (DAS, 1984).

Historically, it appears that village tanks figured more than anicuts as items for government intervention and administration. There were at least two stated reasons for this. First, tanks were considered to have physical structures (especially sluices) which needed a certain degree of sophisticated expertise to be kept in working order, and it was believed that villagers could not handle this without government assistance; and second, tanks were often hydraulically interdependent. Thus the lack of maintenance of one, it was believed, could lead to deleterious results in others. The government was particularly concerned about breaches that could result in loss of life and property under village tanks further downstream. Despite government intervention in rehabilitation and administration of tanks, given the socioecological context, tank villages tended to be relatively cohesive communities ordered around the tank water source. In turn, the village tanks provided an economic livelihood, and social status and identity to the villagers (Leach, 1961).

Until the mid-1960s, anicuts, on the other hand, were usually temporary structures, constructed with large boulders plugged with mud and straw. When floods washed away the weirs, local effort was expended to replace them, and

²The ecological zones are delineated on the basis of annual rainfall as follows: dry zone = 1,270 - 1,900 millimeters (mm), intermediate zone = 1,900 - 2,540mm, and wet zone = over 2,540mm.

the government saw little need to intervene. A further major contributing factor was the land tenure structure in areas where anicuts predominated. From at least the 1500s (i.e., from the beginning of the Kandyan period), much of the land in these areas was owned by monasteries and feudal land-owning families, who had tenants to farm the land. Tenancy conditions were highly exacting³ and gave little motivation to invest extraordinary efforts in system maintenance. Anicut-irrigated agriculture remained, as a result, at low levels of productivity while a major part of the people's livelihood was based on nonirrigated or *chena* (slash-and-burn) cultivation. Thus, given the marginal contribution of irrigated agriculture to peasant welfare in these areas coupled with the fact that private temples and *walauwas* (landholding manors) operationally owned extensive tracts of land, the government saw little reason to invest in improvements in these systems. As a result, the government administrative framework for supervision of village irrigation was more intensive in the tank country than in anicut areas, as was its investment in rehabilitation activities.

From the 1960s, following the enactment of the Paddy Lands Act in 1958 — which greatly relieved the tenancy problem and formally entrusted the Department of Agrarian Services with *all* minor irrigation systems — the government began to look into village anicut refurbishment. Typically, temporary weirs were replaced with concrete ones and sometimes channels were lined. The main purpose of rehabilitation was to obviate the need for seasonal replacement of the washed-away weir; rarely was it aimed at augmenting water supplies. Also, unlike in the case of tank systems, the government seldom became involved in land-alienation programs in the immediate area. These two factors were, in fact, interrelated; more land was available for government-sponsored land-alienation/settlement programs in the dry zone and, as a result, tank rehabilitation also had the goal of extending the command area. Anicut rehabilitation, on the other hand, was aimed primarily at reducing the need for maintenance.

Thus we see another factor that distinguishes tanks from anicuts: though tank villages exhibited socioecological characteristics that contributed to strong

³Fifty percent of the harvest share had to be given to the landowner, and tenants were also seasonally evicted.

community formation, government involvement in them in terms of rehabilitation and land alienation was relatively greater than in anicuts. In anicut systems, in contrast, local effort was needed to maintain the irrigation facilities, but land tenure and the marginality of irrigated agriculture detracted from community formation and, at the same time, precluded government intervention in land and water development.

Management Responsibility

The Irrigation Ordinance No. 32 of 1949 provided one of the first definitive statements on what constitutes minor or village irrigation systems: "a minor irrigation system is one constructed by the farmers without government help, or with the help of masonry works and sluices supplied free of charge by the government and maintained by the farmers." This definition tried to demarcate responsibility for management and maintenance. Government assistance was to be limited to the provision of physical structures while management responsibility was to remain with the farmers.

The Agrarian Services Act No. 58 of 1979, which is currently in force, defines minor irrigation as an "irrigation work which serves up to 200 acres [80 ha] of agricultural land." This change in definition which only attempts to say what is not a major irrigation system reflects a sea change in actual (and perceived) management of minor irrigation systems.

From a historical point of view, it is apparent that since the time of the abolition of *rajakariya*⁴ in 1832, the Government began to play a role in irrigation management. Initially this was limited to construction, but by 1900 it was extended to maintenance, with communal help. By 1932, responsibility for construction, improvement, and maintenance of minor irrigation systems was entrusted to the centralized Irrigation Department, which in 1948 passed on the responsibility to the Ministry of Agriculture. In 1958 the Department of Agrarian Services was established and was specifically entrusted with responsibility for all minor irrigation schemes. With the Agricultural

⁴Compulsory labor which in terms of irrigation, involved annual contribution to system maintenance.

Productivity Laws of the 1970s, construction and maintenance activities were separated and assigned to the Irrigation Department and the Department of Agrarian Services, respectively. Today, overall administration and maintenance responsibility is with the Department of Agrarian Services, and at a local level the Divisional Officer and the Cultivation Officer, under its jurisdiction, play a significant role in day-to-day operational activities.

Background to the Study

The study was conducted in 1986-87 in two primary locations: a village anicut and a village tank supplemented by an anicut, in Ratnapura District, Sri Lanka (see Figure 1). This area is known as the intermediate low country with an average rainfall of 1,270 to 1,900 mm, distributed bimodally. This Ratnapura District is not representative of the dry zone where most of the minor irrigation (particularly tanks) is located. Agriculture is predominantly rice, along with plantation crops of tea and rubber. Recently, fruit crops and high-income cash crops, such as pepper, have been introduced. Ratnapura District is the main gemming area in Sri Lanka and many farmers combine this activity with agriculture. They sometimes convert rice fields into gem pits, temporarily taking them out of production. Fifty-one percent of Ratnapura District is under minor irrigation with 693 anicuts and 32 tanks. The magnitude of anicut systems — which typically allows for cultivation during both agricultural seasons — probably explains why Ratnapura District has the highest cropping intensity in the country, at 165 percent (Department of Census and Statistics, 1987).

The selection of study sites was based on their having: 1) an irrigation history, so that studying them would provide insights into changes in property relations through time, 2) a sizeable farmer population (at least 75 families) and 3) some (but differing) degrees of state intervention in the form of construction/rehabilitation of the irrigation works. As it happened, the first system selected, Thambagamuwa, had a long irrigation history and had been relatively untouched by government programs until mid-1987 when rehabilitation was done under the VIRP. The author was in the field during the course of rehabilitation and thus had the opportunity to obtain a firsthand view of the actual rehabilitation process and ascertain the immediate views of

farmers. Ambewila, the second study site, had been rehabilitated under the VIRP in 1981-82, and, hence provided an appropriate location for studying the impact on land and water rights, as more than five years had elapsed since rehabilitation.

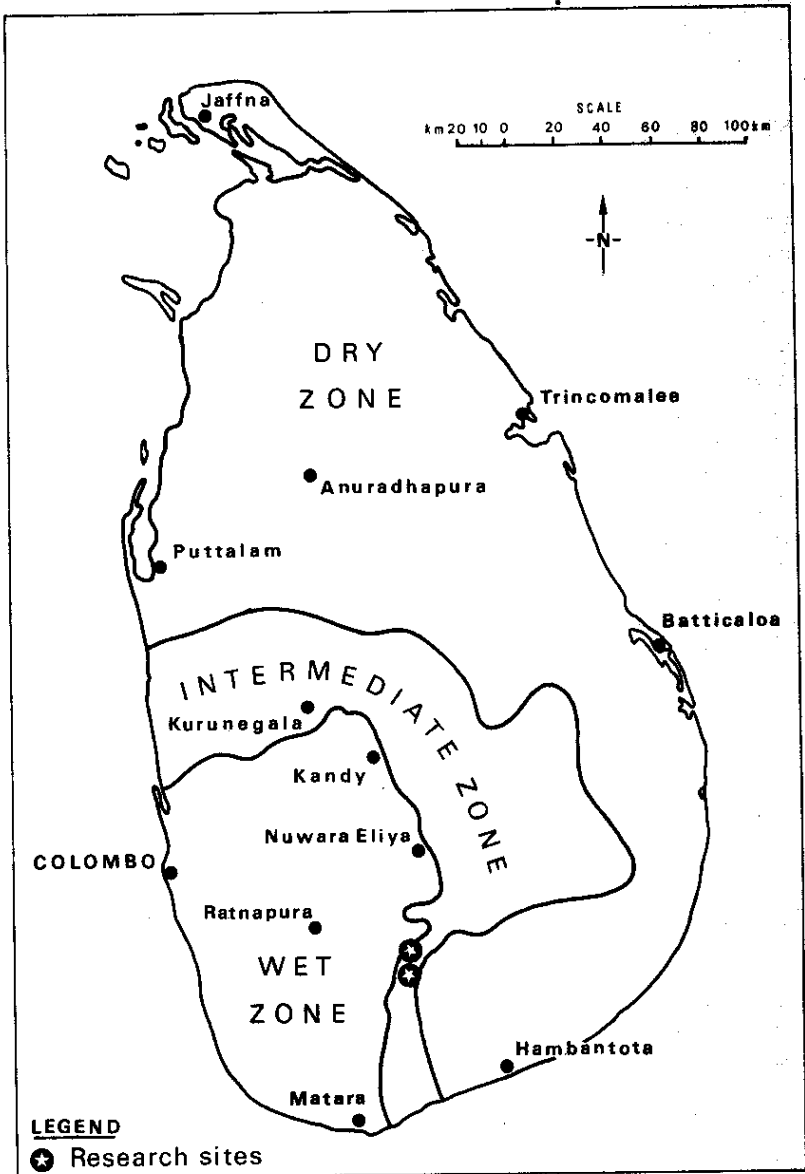
Methodology

Research began in August 1986 and consisted of an archival research, key-informant interviews, a questionnaire survey, a review of secondary sources, and water measurements.

For purposes of studying the intervention strategy, the last four methods were the most relevant though archival research provided a much needed historical backdrop and pinpointed the policy concerns in different eras. The questionnaire survey proper was aimed at obtaining general village-wide socioeconomic data. A separate short questionnaire focusing on the VIRP intervention was administered to households in Thambagamuwa soon after rehabilitation to ascertain views on construction activity and anticipated effects on individual water supplies and water distribution. Research in the field covered a maha and yala season.⁵ The research assistants were housed permanently in the two areas, and the principal researcher also spent considerable time in each of the locations. In all, field work was conducted for a period of 11 months, from September 1986 to August 1987.

⁵Maha from October to January is the season of the northeast monsoon while the yala season from April to August experiences the southwest monsoon. The dry zone of the northern and eastern parts of Sri Lanka receive little rainfall during the yala season.

Figure 1. Map of Sri Lanka: location of research sites.



CHAPTER 2

Background to Primary Research Sites

THAMBAGAMUWA

THAMBAGAMUWA VILLAGE COMES under the Thambagamuwa *Grama Sevaka* (administrative village) division along with eight other villages. There are 203 households dispersed among six residential hamlets. The hamlets reflect the caste divisions in the village, with a distinct overlap between *govigama* (high caste status) and access to rice land.

Thambagamuwa village has seven *yayas* (rice-field tracts) of which the two main tracts — Mahawelyaya and Kanathiriyawelyaya — consist of 14 and 6.5 ha, respectively. These two tracts are irrigated from the same water source (the Kanathiriyawelyaya anicut) and have extensive farming, kinship, and tenurial links with each other (see Figure 2).

One hundred eighty-five village households are dependent on agriculture while 18 households are dependent on nonfarming incomes, mostly gemming and small businesses. There is an average of six persons per household. Rice dominated the village economy for the last 15 years, replacing chena cultivation, but now, fruit crops, primarily banana and spices such as pepper, contribute a substantial portion to village income. Since 1983, yams and vegetables such as gourds and beans have been grown for the market in rice fields under limited irrigation.

Thambagamuwa is 48 kilometers (km) from Ratnapura town, the district capital. The nearest main town, Godakawela, which is 13 km away, has a high school, a hospital, and a bus depot and houses several district government offices. Pallebadda, which is 2 km from Thambagamuwa village has a post office, two primary schools, a rural bank, a *pola* (weekly market), and a hospital. The local Agrarian Services Centre is also located here. It must be mentioned that Thambagamuwa village is located near the main road running south and is, therefore, fairly well-served with amenities. The main bridge and the road going through the village were constructed in 1985. Some of the residential clusters are very much in the interior of the village and because of

the topography, are only accessible by narrow and steep footpaths.

Since rotational tenancy and rotational landownership⁶ are highly prevalent, it is difficult to give precise figures on landowners and tenants. There are 90 rice-field plots in the seven tracts, and in maha 1986/87 there were 40 noncultivating owners, 5 owner-cultivators and 40 tenants.⁷ The fact that the number of owners and tenants changes by season points to the complexities in land and water rights in the system. Most of the owners (69 percent) are not Thambagamuwa villagers but are resident in neighboring towns/villages. Tenants, by contrast, are resident in the immediate village.

On average, a tenant has access to approximately 1.05 ha of rice land, albeit on a rotational tenure system and in scattered parcels. The high rate of tenancy of rice land is the hallmark of the system and colors all aspects of social and economic life of the village. Tenancy also plays the important role of land consolidation in a system that otherwise would have been characterized by highly fragmented, nonviable landholdings.

The average size of a rice plot (parcel) is 0.4 ha, with a range of 0.1 to 1.1 ha. And 51 percent of all cultivators have access to irrigated land in two or more tracts. This wide dispersion of access to rice land is mostly on the basis of kinship and serves to spread each cultivator's risks. The fact that much of this tenancy is in the form of *thattumaru* or rotational tenancy leads to further complexities in the system.

In this area, highland plots are fully utilized. On average a household was found to have access to 0.93 ha of highland, typically in more than one parcel. Though a detailed survey of costs and returns was not undertaken it was evident that upland crop cultivation provided a significant and regular proportion of household cash income while rice cultivation was mainly for purposes of subsistence. Only five percent of the households sold any rice.

⁶Rotational tenancy (*thattumaru* and *kattimaru* tenure as it is commonly known) is unique to the low- and mid-country wet zone and involves the annual or seasonal rotation between persons of rights to land or of the land itself.

⁷These figures are only for Kanathiriyanwelyaya, Mathalairawelyaya, Pallewelawelyaya, Peelladeniyaya, and Tuntotayaya which are cultivated during the maha season.

Social Organization of Irrigation in Thambagamuwa

The present research study was limited to the two main rice-field tracts — Mahawelyaya and Kanathiriyawelyaya. These two tracts are irrigated from a common, permanent anicut. A close scrutiny of historical evidence suggests that Kanathiriyawelyaya was developed as an extension to the Mahawelyaya in the 1950s in response to population pressure. However, the capacity of the anicut sets limits on the expansion of cultivation, as does topography. As a result, in Thambagamuwa we see an elaborate form of rotational or thattumaru tenure, where people, land, and water are rotated.

Briefly, rotation of owners of rice land is a mechanism to prevent excessive land subdivision through inheritance. In this manner, nominal ownership rights to rice land and, therefore, status are maintained. The rotation of tenants is a result of population growth relative to available rice land plus, since the Paddy Lands Act of 1958, the security of tenant farming. The magnitude of thattumaru tenancy is shown in Table 1.

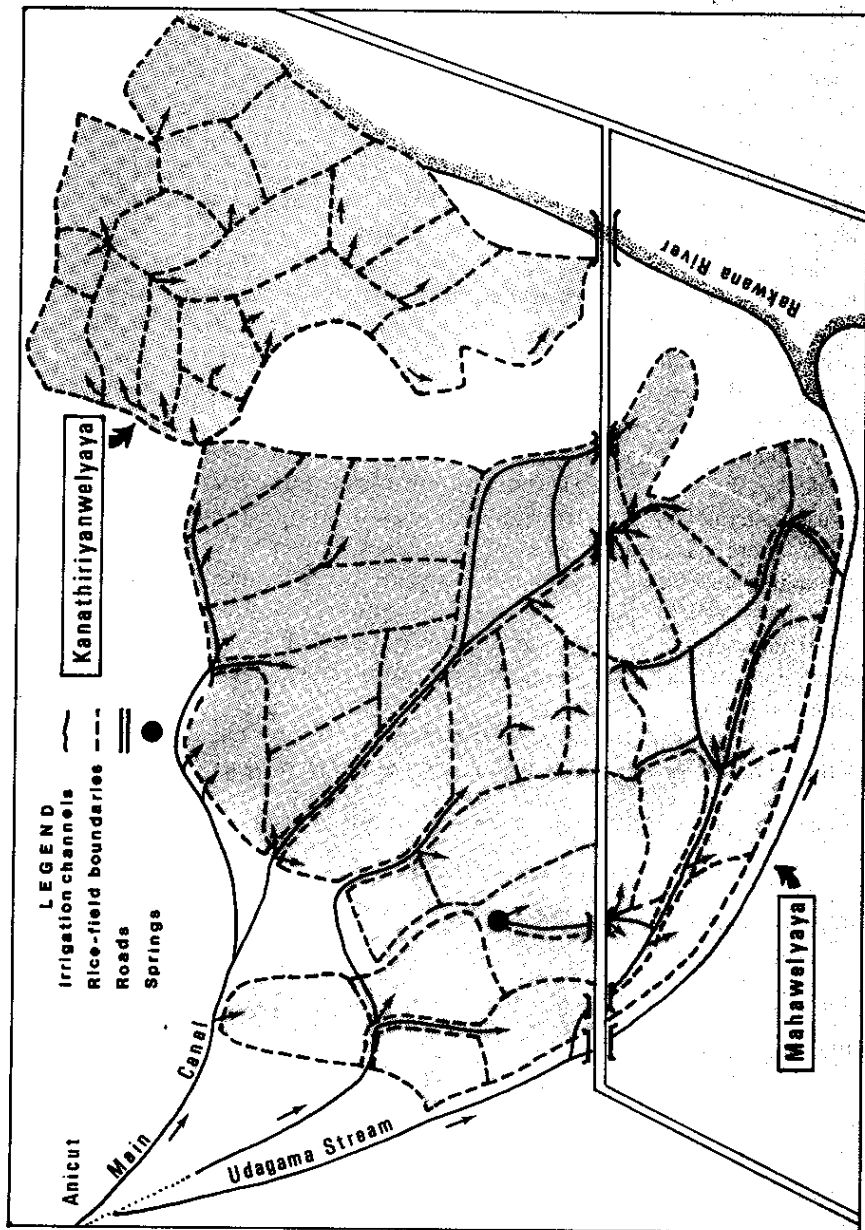
A thattumaru rotation by tract as a response to a scarce water supply is evident in the rotation of water rights so that either the available water supply is used alternatively by each tract each season, or on an annual basis. Since 1985, there has been a rotation by season between Mahawelyaya and Kanathiriyawelyaya. Kanathiriyawelyaya (being further from the anicut) gets maha, and Mahawelyaya gets yala water rights. However, there is a provision imposed by the Agrarian Services Centre: if Mahawelyaya farmers experience two consecutive seasons of water shortage, they will revert to an annual rotation.

A factor that needs explanation is how a system of thattumaru tenancy works within a framework of thattumaru ownership, which operates within a

Table 1. Magnitude of thattumaru tenancy in Thambagamuwa.

	Mahawelyaya	Kanathiriyawelyaya	Other yayas	Total
Total no. of plots under thattumaru	35	15	41	91
Tenancy	20	10	25	55
Percentage-tenancy	57	67	61	60

Figure 2. Thambagamuwa showing two main yayas (rice-field tracts) and individual rice-field plots (pangu).



system of thattumaru cultivation/irrigation by tract. Or expressed in another way, how are irrigation/cultivation rights determined when there is a rotation of people, of access to land, and of water?

In this case the rotation of water takes precedence, and determines ownership and tenancy rights. Thus access to land (namely, tenancy rights) and landownership rights are defined in terms of the season when irrigation water rights are accorded and cultivation is possible. Hence, if irrigation rights are given only in alternate years, a tenant cultivator whose turn comes quarterly would have a cultivation turn once in eight years. However, if irrigation rights are given for both maha and yala seasons, his turn would come every two years. Hence, overall irrigation rights — which incidentally are given on a tract basis — determine the frequency of the “people rotation” and “land rotation.”

To all intents and purposes the water rotation works smoothly, and every effort is made to stick to the cultivation schedule and not to spillover into the alternate tract’s “season.” Similarly, though highly elaborate, the different forms of rotational tenure bind the community together and spread each cultivator’s risks and interests widely. Most importantly, it serves to equalize access to the critical resource of water.

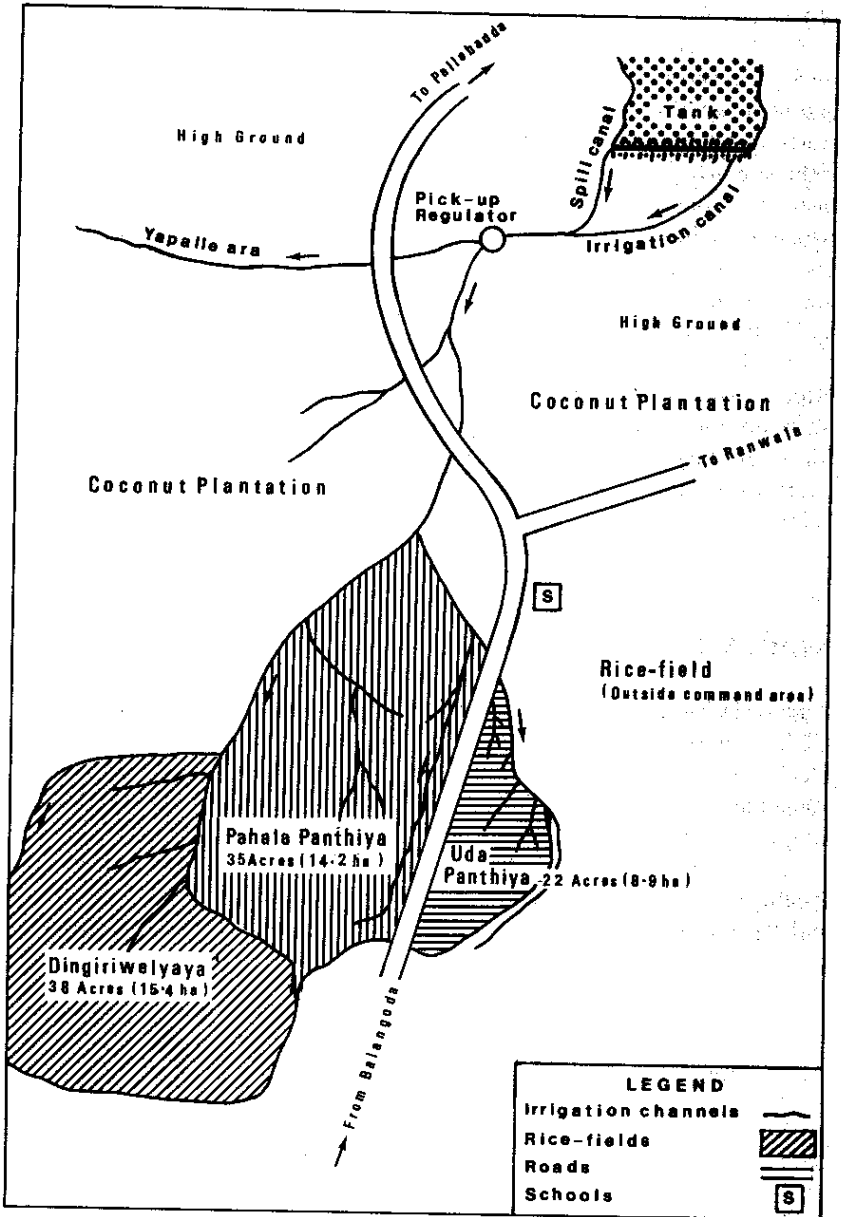
AMBEWILA

Ambewila, which is within the Baddulegama Grama Sevaka and Cultivation Officer Division, consists of the Ethgala tank, three rice-field tracts, large blocks of coconut land, a strip of residential area, and a small town center containing two tea kiosks, a barber salon, a bakery, a primary school and a secondary school, and about three shops selling a range of sundries.

Today, the irrigated area of Ambewila consists of the three tracts of Uda Panthiya, Pahala Panthiya, and Dingiriwelyaya (see Figure 3). Uda Panthiya and Pahala Panthiya were the areas to be asweddumised⁸ first and contain

⁸Leveled and bunded for flood irrigation of rice.

Figure 3. Sketch map of Ambewila Tank.



*pangu*⁹ land belonging to different sources, including the Muttetupola Walauwa, the Thambagamuwa Walauwa, and different temples. Pockets of *sinnakkara* (freehold) land also exist within these two tracts.

In Uda Panthiya there are 12 *pangu* or irrigated landholdings. The average size of a *panguwa* in Uda Panthiya is 1.01 ha with a range from 0.2 to 1.3 ha. In Pahala Panthiya, the *pangu* are smaller (0.53 ha average) because it is the older tract and, hence, fragmentation has been greater. Each of these *pangu* in both tracts has a distinctive name, reflecting ownership and/or topographical location, in relation to the water supply. Uda and Pahala Panthiya together have 46 cultivators (tenants and owner cultivators), while 9 persons are noncultivating owners. Dingiriwelyaya land plots were given out as 0.4-ha blocks and have tended to retain their original size. There are 36 owner-cultivators farming this tract.

From a survey of materials in the archives and from the villagers' accounts, it appears that the Ethgala tank was built sometime in the late 17th Century. Its curious name supposedly derives from the fact that once when a king (of the Kandyan period) was visiting the area, an *Etha* (elephant) appeared before him at the site of the present tank and firmly planted its tusks in the ground. In the early period, this tank supplemented the various natural springs in the vicinity and allowed for a reasonable level of rice cultivation on about 12 ha in the area which is now Ambewila.

Archival evidence show that the tank was later breached and was not in use for about a century. Cultivators had to rely exclusively on the water derived from the anicut across the Yapalle river, and their cultivation was limited to a few acres of land in the maha season. This, coupled with the exacting demands of the tenurial system, militated against the formation of a community, based on irrigated rice cultivation.

The tank was finally rehabilitated only in 1952 when the stream flow at the anicut dried up, and the cultivators sent petitions to the government to refurbish the old tank. The government met all the expenditure, though old villagers recall they were summoned to do some of the earthwork. The refurbishment of the tank and distribution system had the following main

⁹Land shares under the traditional land-service feudal structure; the singular of *Pangu* is *Panguwa*.

effects: 1) the water supply became more reliable for maha cultivation; 2) more physical structures allowed for better water management; 3) the irrigated area was expanded to the periphery; 4) *kanna* (seasonal cultivation) meetings were started, mainly as a mechanism to link the State with the farming community for administrative purposes; and 5) the irrigated rice-cultivating community became more consolidated.

Apart from refurbishment of the tank, the entrance of the state was felt in three main phases. First, with the Waste Lands Ordinance of 1840 followed by cadastral surveys in the 1870s, surveyors came into the area and demarcated private land from crown (i.e., government) land. Not only did this have an impact on access to jungle lands for chena cultivation but the issuing of *pimbura* (village plans) clearly systematized landownership. This was an opportunity seized by the local *Appos* (a Kandyan label for the gentry) to formalize their land base and in the process exploit the peasants' ignorance. The *Appos* reportedly did this by telling the peasant cultivators that the government would take over their lands unless they said the land belonged to the *Appos*; alternatively, the *Appos* declared these lands to be waste land and later managed to buy it from the crown. Hence, the *Appos* disclaimed the existence of "communal land" belonging to the villagers as a group and managed to privatize it to their benefit. The government, wishing to promote capitalist farming, in turn connived with the *Appos* to bring this about.

The second main phase of state penetration was in the 1930s and involved the selling of relatively large blocks of highland (nonirrigated land) for the promotion of capitalist farming. Initially, investors from outside the area bought the land for papaya cultivation, but they were soon replaced by local capitalists who started coconut plantations. The villagers term this phase "the settlement period" as this brought in a new influx of population that actually settled in the area and also tried to buy rice land. Thus, local coconut-estate capitalists began to own land in the Ambewila rice-field tract, side by side with the original *nindagam*¹⁰ and *viharagam*¹¹ landowners.

¹⁰A *nindagam* land is a village which is granted by the king as the entire property of the grantee or temporary chief.

¹¹A *viharagam* land is a village which is granted to the temple.

The third phase of state intervention, which can be termed the welfarism phase, spanned the 1940s and 1950s when the main road that passes through the Ambewila tract was made, a road that is commonly termed the “malaria road” as it was constructed by the Destitute Relief Commission using the food-for-work concept for malaria victims. Also in this phase, land was provided to landless peasants under a special LDO¹² scheme. In Ambewila this consisted of the provision of 15.4 ha of highland to landless persons, in the form of 0.4 ha blocks on a leasehold basis. Using drainage water from Pahala Panthiya, this land was gradually asweddumised and now constitutes the third tract in Ambewila, known as Dingiriwelyaya.

Though this land came under the Land Development Ordinance, it was not in the strict sense, land given out under Village Expansion Schemes as a direct response to population pressure, so that landless kin of the original villagers could be provided land in the village periphery. Here, complete outsiders — having no kinship or other links with those cultivating in the existing tracts — were allocated land for highland (nonirrigated) cultivation purposes. Many old residents said they could remember government officers literally stopping people on the road and offering to settle them on this land but that people were extremely reluctant to accept the offer as it was thick scrub jungle, except for about 2.4 ha of *purana* (traditional) land where *otu ande*¹³ was being practiced. Those who did settle there, on their own initiative, but according to them, with the full consent of the Divisional Revenue Officer,¹⁴ gradually converted their lands to irrigated rice land starting in 1956. They then officially registered their lands in the mid-1960s and started paying the acreage tax to the government.

¹²Land was given out on leasehold basis by the government under terms of the Land Development Ordinance of 1935.

¹³Usually practiced on less fertile land and involves the tenant giving one-tenth of produce to the owners.

¹⁴Divisional Revenue Officer who in 1938 replaced the hereditary *Ratamahattaya*, was a Civil Service Officer and was responsible for law and order within his area of jurisdiction.

Social Organization of Irrigation in Ambewila

As mentioned earlier, Uda and Pahala Panthiya rice-field tracts were the first to be asweddumized with irrigation from the Yapalle river, using a small temporary anicut. This water supply was able to irrigate 27 ha of Uda and Pahala Panthiya in *alternate years*, (i.e., during the maha season only). After the refurbishment of the Ethgala tank, which was followed soon after by the enactment of the Paddy Lands Act of 1958, it was possible to cultivate Uda and Pahala Panthiya in *alternate seasons*. At this point 2.4 ha in Dingiriwelyaya were also being cultivated with drainage water. Gradually, the rest of Dingiriwelyaya also came to be asweddumized and irrigated with the increase in drainage after the tank refurbishment efforts; but this whole process took another five years. In the meantime, Uda and Pahala Panthiya continued to do alternate season cultivation based, according to farmers, on a strict time schedule.

After all of Dingiriwelyaya was asweddumized in the 1960s and registered as rice lands for purposes of the acreage tax, a rotation was instituted by the farmers, under the supervision of the Department of Agrarian Services, that included all three tracts. For 20 years subsequently — that is up to the VIRP refurbishment in 1981 — the rotation worked to the satisfaction of all, with Uda Panthiya and Dingiriwelyaya cultivating yala and Pahala Panthiya cultivating the maha season. This decision to irrigate Uda Panthiya and Dingiriwelyaya together was based on the areas involved; it would have been impossible to cultivate Pahala Panthiya and Dingiriwelyaya together in any one season as the combined area was too large.

CHAPTER 3

State Intervention in Irrigation Development: The VIRP

REHABILITATION

IN RECENT YEARS, the government of Sri Lanka has turned to a strategy based on the intensification of agricultural production on existing irrigated lands, especially those coming under minor irrigation tanks and anicuts. Within this larger effort, the Village Irrigation Rehabilitation Project (VIRP) was the first comprehensive program to look into all aspects of improved water management under small-scale systems. This program proposed to rehabilitate over 1,200 village tanks and anicuts in 14 districts of the island. Rehabilitation of these small-scale tanks and anicuts, it was believed, would offer certain advantages: 1) short gestation periods compared to rehabilitation of large-scale irrigation works; 2) dispersion of government funds to neglected rural areas for the upliftment of the welfare of the poorest sections; and 3) creation of conditions for efficient use and control of water, and as a consequence, expansion of the cropped area as well as of cropping intensity. State investment in minor irrigation rehabilitation increased substantially with this program as can be seen in Table 2.

Table 2. Investment in minor irrigation rehabilitation — incremental index.

Year	Investment (Rs million)	Incremental index
1982	20.0	100
1983	84.4	422
1984	95.0	475

Source: Adapted from Economic Review, February 1986.

There are several other government- and nongovernment-sponsored rehabilitation programs for minor irrigation underway — the Anuradhapura Dry Zone Agricultural Project (ADZAP), the Integrated Rural Development

Program (IRDP), to name two. This discussion, however, will be limited to the intervention strategy under the VIRP, in the two research sites in Ratnapura District. Where appropriate, information from the author's own experience of VIRP intervention in six small-scale systems in Moneragala District¹⁵ will be utilized as well.

Program Description

The VIRP has two main objectives: physical rehabilitation of deteriorated minor irrigation schemes to increase agricultural production and farm incomes,¹⁶ and the introduction of a systematic water-management program to ensure efficient use of water once rehabilitation work is completed.

Implementing Agencies

The Irrigation Department is responsible for the civil works component of the project. Once rehabilitated, the Irrigation Department hands over the irrigation system to the Department of Agrarian Services which is then responsible for planning and implementing a water-management program to ensure optimum utilization of the available water. Specific water-management programs are to be drawn up for individual tanks and anicuts in consultation with farmers. Operation and maintenance functions become the responsibility of the farmers with the support of the Department of Agrarian Services. However, the Irrigation Department is responsible for ensuring satisfactory functioning of the headworks and structures rehabilitated under the project, for a period of two years thereafter.

¹⁵This was a study undertaken in 1984-85 by the Agrarian Research and Training Institute in two systems prior to rehabilitation, two systems under rehabilitation, and two systems after rehabilitation. See Abeyratne and Perera (1986).

¹⁶This includes schemes currently in use at low levels of efficiency, those abandoned some years previously, and those where no cultivation is done.

Strategy for Promoting Participation/Organization of Farmers

Agricultural Planning Team. Subsequent to rehabilitation, operation and maintenance activities are to be the responsibility of the farmers, with the support and sponsorship of the Department of Agrarian Services. It is supposed to provide institutional support mainly through the Agricultural Planning Team constituted for each district.¹⁷ This team is an appendage of the Department of Agrarian Services and consists of three Government officers: a Technical Assistant, an Agricultural Instructor and a Divisional Officer.¹⁸ While the Agricultural Instructor is on secondment from the Department of Agriculture, the Technical Assistant and Divisional Officer are employees of the Department of Agrarian Services.

The principal function of the Agricultural Planning Team is to formulate and thereafter implement a water-management program for each rehabilitated tank or anicut, in consultation with the farmers. The Agricultural Planning Team is supposed to visit each refurbished system in its district at regular intervals. When the project started, a tank supervisor, a salaried official, was appointed to supervise 10-15 tanks and was meant to assist the Technical Assistant of the Agricultural Planning Team. The tank supervisor position has since been abolished.

The Agricultural Planning Team is supposed to spend approximately two weeks in each locality, and become acquainted with the specific requirements of each tank or anicut before formulating a water-management package. Local feedback is to be provided by the Cultivation Officer, the local Agricultural Extension Officer, and the Farmer Representatives. The Agricultural Planning Team members are instructed that the water-management programs should be developed on the basis of rainfall, soil type, and hydrological data and a proper understanding of existing agricultural practices for each area; and that

¹⁷Realizing that a single District Agricultural Planning team has too much work, the number has been recently increased.

¹⁸The Divisional Officer was added to the Agricultural Planning Team upon recognition of the importance of paying attention to the social and community aspects of village irrigation.

consideration should be given to production constraints and risks under which the cultivators operate.¹⁹

After the Agricultural Planning Team has finalized the water-management plan and it has been approved by the Deputy Commissioner (Water Management) in Colombo, the Team has been instructed to divide the command area into groups of 6-10 farmers along field canal demarcations. Each of these groups in turn has to select a farmer leader who will represent the group on the Tank or Anicut Committee.

The Tank or Anicut Committee

The Tank or Anicut Committee is regarded as the primary vehicle to enlist farmer participation in operation and maintenance activities. The Committee is without legal status and is meant to be a relatively informal association that is formed with the impetus provided by the Agricultural Planning Team.²⁰ The Committee consists of the Farmer Representative as Chairman,²¹ the farmer leaders, and the relevant government officers, including the Cultivation Officer and the Agricultural Extension Officer. Responsibility for organizing agricultural inputs and for providing extension advice rests with the officers in the Committee while distribution of water and resolution of conflicts are the responsibilities of the Farmer Representative and the other farmer leaders. Hence, there is a clear division of responsibility; those irrigation-cum-agricultural tasks that require extra-community activity and by definition warrant a certain amount of governmental intervention are to be performed by the government administration while matters strictly internal to the community are left to the farmers with the assistance at the farmer representative level. However, in the early period, the tank supervisor remained

¹⁹The Agricultural Planning Team members are given a two-week intensive training course, followed annually by a two-week refresher course.

²⁰This conforms to the amendments to the Agrarian Services Act of 1979.

²¹Elected under the Agrarian Services Act No. 58 of 1979.

in overall charge of the water-management program while today that responsibility has devolved to the Cultivation Officer.

Some Attempted Remedies During Program Implementation

Within a year or two of project inception, certain defects in approach were recognized and remedial action taken to improve them. One of the most important changes was to bring in the Agricultural Planning Team at the time an irrigation system was identified for rehabilitation. It was considered important to integrate the post-rehabilitation water-management package with actual reconstruction, rather than have them separated so markedly. Also as mentioned earlier, the constitution of the Agricultural Planning Team was changed to include a Divisional Officer who it was hoped would give due weight to the social and community aspects of village irrigation.

It was decided that the tank supervisor in many ways performed activities that could be done by the Cultivation Officer and the Farmer Representative. Hence, this position was abolished so that once the Agricultural Planning Team moves out, the Cultivation Officer, along with the Farmer Representative, remains in a supervisory position over the water-management package.

Another significant innovation was the introduction of "ratification meetings" which are to be held after the plans and estimates for rehabilitation are ready. These are intended primarily as mechanisms to explain proposals for rehabilitation to the farmers and to obtain their approval.

The problems inherent in the handing over exercise were to be ameliorated by the introduction of a method of joint inspection by the Irrigation Department and the Department of Agrarian Services. This would allow the two departments to come to an agreement on whether rehabilitation was properly completed or, in the event that some feature was not satisfactory, for provision to be made for the Department of Agrarian Services to complete it. An important feature was that a time limit of one month was set before which the Department of Agrarian Services had to inform the Irrigation Department of any defects in design or construction, thus holding both departments accountable to have the job completed speedily.

Another important innovation was the Subcommittee on Village Irrigation, which under the chairmanship of the Government Agent, is to provide

coordination of the rehabilitation process at the district level. It was hoped that the Sub-Steering Committee, having only 4-5 key members under the chairmanship of the Government Agent, could make quick decisions, unlike the existing District Agricultural Committee with its 15-20 members which meets relatively infrequently.²²

²²Much of this analysis is presented in Abeyratne, (1986).

CHAPTER 4

VIRP Intervention in the Field

HAVING PRESENTED AN overall description of the VIRP we now move on to a discussion of the program as it was actually implemented in the two field locations, Ambewila and Thambagamuwa. The Ambewila intervention occurred six to seven years ago, and details about the process were obtained from memoranda and correspondence available at the local Agrarian Services Centre and the Department of Agrarian Services district office. In addition, in the field we interviewed farmers in all three tracts and asked them to recall details about the implementation process and impact immediately after rehabilitation. Current patterns of water allocation and distribution and the incidence of irrigation-related conflicts were also studied to assess the long-term impact of the intervention.

We were exceptionally fortunate to be in the field when refurbishment under the VIRP for Thambagamuwa was underway. Indeed, the fact that we had been in the field for about eight months prior to rehabilitation meant that we had an understanding of the pre-existing socioeconomic and technical organization of irrigation in Thambagamuwa and thereby could more fully appreciate the possible consequences of the proposed rehabilitation. The only drawback was that we were unable to monitor a season *subsequent* to rehabilitation and thereby actually measure water flows and other impacts. Nonetheless, the Ambewila example along with that of Thambagamuwa, provided excellent material for a case study of the government's main rehabilitation program for small-scale irrigation systems.

VIRP IN AMBEWILA

Ambewila was one of the first irrigation systems to be chosen for rehabilitation in Ratnapura District. The details of the actual procedure are presented below so as to highlight the many steps involved and how they differed on the

ground from the program proposal. Thereafter, a summary of the impact, based mainly on reports by farmers on the current nature of water distribution, is presented.

The Process

In 1980, in response to a request by the Assistant Commissioner of Agrarian Services to forward priority lists of items requiring rehabilitation in the district, the Cultivation Officer forwarded a list of five irrigation systems. The Ambewila (Ethgala) tank was given first priority on the list. The problems initially cited for requesting rehabilitation included a sluice that was leaking so that there was no alternative but to allow for continuous irrigation, lack of a proper irrigation schedule, and the absence of a tank gauge. A case was made to repair the sluice, fix the tank water gauge, and construct a weir box and a bifurcation with measuring devices. The command area to be benefited from the proposed rehabilitation was stated to be 48.6 ha.²⁴

Over a year later (7 December 1981) a memo was sent by the Assistant Commissioner, Department of Agrarian Services to the Divisional Officer Ambewila telling him that the Ethgala tank — which was now called Ambewila tank²⁵ — had been selected for the VIRP rehabilitation and that therefore the Assistant Commissioner, Department of Agrarian Services for Ratnapura would be visiting the system along with the Assistant Commissioner for Water Management, for a preliminary inquiry and discussion. In February 1981, a circular was sent to the Cultivation Officer from the Assistant Commissioner, Department of Agrarian Services instructing him to make arrangements to hold a meeting to explain rehabilitation activities to farmers. The farmers, according to this directive, were to be told: 1) the name of the contractor; 2) the estimate of the contract; 3) the volume of work involved; and 4) the benefits that would accrue from the project. This preliminary farmers' meeting was to be attended — apart from farmers — by: 1) the Member of Parliament

²⁴This means the area in Uda Panthiya, Pahala Panthiya, and Dingiriwelyaya.

²⁵It seems more than coincidental that the old name for the tank was dropped and the name "Ambewila" which is the name for the tracts of the Uda and Pahala Panthiya only, was adopted instead.

or his representative; 2) the District Development Council Chairman; 3) the Assistant Government Agent; 4) the Manager, Agricultural Development Authority; 5) the Cultivation Officer; 6) the Divisional Officer; 7) the Technical Officer; 8) the Farmer Representative; 9) the contractors; and 10) the Assistant Commissioner, Department of Agrarian Services. The report of the meeting was to be sent to the Additional Secretary, Ministry of Agricultural Development and Research.

With rehabilitation, the capacity of the tank was increased from 55,555 cubic meters (m^3) to 122,222 m^3 to irrigate 26.7 ha of rice at 0.46 hectaremeters per ha (1.5 acre-feet per acre). Once rehabilitation activities were over in 1982 the Technical Assistant in charge had to follow the procedures for handing over as specified by a previous official circular. The language of this directive is worth noting: it specified how the Technical Assistant should "hand over" the refurbished project to the Cultivation Officer for "safekeeping." The Technical Assistant was instructed to prepare an inventory (on a prescribed form) with four copies, indicating the items used for refurbishment, for example, locks and anicut planks. The four copies were then to be distributed among himself, the Agrarian Services Centre/Department of Agrarian Services, the Cultivation Officer, and the Divisional Officer; the latter was to keep it in the Agrarian Services Centre file.

After the Department of Agrarian Services had "taken over" the irrigation system, it had to implement a Water Management Program. But to do this it was found that the Department of Agrarian Services had to install additional structures. Thus, a measuring device, a bifurcation with retaining walls, three controlling pipe outlets on the right bank of the channel, and three controlling pipe outlets for Dingirivewyaya were constructed, at a cost of Rs 58,916.80.²⁶ These were completed at the end of 1983.

In April 1982, the Assistant Commissioner, Department of Agrarian Services wrote to the Divisional Officer, Ambewila instructing him to call a meeting of all farmers to explain water management activities under this tank. He was also requested to invite all field-level officers and the Buddhist monk of the area to attend this meeting. However, it transpired that the yala 1983 kanna meeting was used as the forum to explain the Water Management

²⁶The exchange rate at the end of 1983 was US\$1.00 = Rs 25.00.

Program, and intriguingly, only Uda and Pahala Panthiya farmers were invited to attend this. A training program on water-management was held in October 1983 — again only Uda and Pahala Panthiya farmers were allowed to come and register for it — and included an introduction to water-management concepts and objectives and lectures on the cultivation calendar, the water-management program for the 1983/84 maha season, and the importance of farmer participation in water management activities.

The Agricultural Planning Team was then instructed to set up the *Wew Sabha* (Tank Committee). The three tracts (this time, including Dingiriwelyaya) were divided into sections based on field channels, and the farmers in each section had to select a group leader to represent them on the Tank Committee. The Farmer Representative (appointed under the Agrarian Services Act of 1979) was to be chairman of the Committee. The Tank Committee was to be responsible for implementing “the Water Management Program” which included implementing a rotational water schedule, utilizing the new structures constructed under VIRP, and cultivating vegetables under irrigated conditions.

The report, submitted by the Agricultural Planning Team, on irrigation practices in the area before VIRP and before its own intervention is worth noting. “Though there was a Cultivation Officer and a Farmer Representative for the entire Cultivation Officer area, there was no proper organization in paddy (sic) cultivation in this tract. The operation of this sluice has been done haphazardly and much water was wasted. Prior to the downstream development works done by the Agrarian Services Department, each and every farm lot was fed with individual turnouts which led to a waste of water.”

According to the Agricultural Planning Team report, with the Water Management Program, timely cultivation was ensured and high-yielding, short-term unhusked rice seed and agrochemicals were introduced. The Agricultural Planning Team proposed to raise the average yield in the area from 3.1 tons/ha to 4 tons/ha, by introducing an agricultural loan system to increase fertilizer use, and by organizing field-training classes for farmers.

The Agricultural Planning Team and the Tank Committee

As mentioned earlier, field work for the present study was undertaken nearly six to seven years after the VIRP intervention, and the condition of the

system suggested that the effects of rehabilitation could hardly be felt. The drop structures and sluice were in working condition but all the remaining control structures had either rusted so badly that they could not be used or they had been damaged so that they were jammed in an open position.

The Tank Committee existed in name only; but the Farmer Representative found it useful to have one or several of the members accompany him to open or close the sluice and thereby support him in implementing what were sometimes unpopular management decisions. The selected group leaders were known by all farmers and were undoubtedly the most vocal members of the tract. However, they did not feel they had a significant role to play in irrigation management. For example, decisions regarding a water rotation were not made by them or on their instigation. Rather, the Farmer Representative along with the relevant officers tended to make the decisions, bypassing the Tank Committee members. Farmers in Dingiriwelyaya, when asked why they did not voice their grievances via the Tank Committee, said that the Committee was totally ineffectual and that what they needed were "sticks and stones to fight with other farmers and not a Tank Committee." The Tank Committee did not implement a water-management program *per se*. The Agricultural Instructor, an energetic young woman, was single-handedly introducing new agricultural practices,²⁷ based on an administrative directive from the Department of Agrarian Services.

Though the Tank Committee existed in the sense that representatives were selected, it did not play any role as a committee, either in irrigation management activities or as a body that would negotiate on behalf of the farmers. Routine operation and maintenance — or for that matter any extraordinary task or decision making — were handled by the normal administrative framework of the Department of Agrarian Services and other related government officers. The Cultivation and Divisional Officers were found to play an especially significant role and were viewed as responsible for management of the system.

²⁷When we were in the field she was showing farmers how to raise unhusked rice seedlings under the *Da Pok* method. (This is a method where unhusked rice seeds are germinated in an artificial atmosphere, for instance in polythene covers, for an optimum of 14 days.)

This was dramatized by a claim of some farmers that a case of vandalism — damaging the sluice by two villagers — resulted in the Divisional Officer being transferred. The two villagers, incidentally, were not prosecuted.

The activities of the Agricultural Planning Team were also fraught with problems. To begin with, the single Agricultural Planning Team in the district had to cover 52 systems (the number was to increase to 75 by the end of 1987), which was a singularly difficult task. This meant that they could not spend the stipulated amount of time in a system, either during or after rehabilitation. We interviewed the three Agricultural Planning Team members for Ratnapura District and found them to be enthusiastic and informed, but with a very real problem of having too much work. They also voiced another significant problem, the total lack of communication (preferably an institutionalized link) with the Irrigation Department. As all three Agricultural Planning Team members come under the Department of Agrarian Services, they had no contact with the Irrigation Department and had no mechanism to be informed of rehabilitation activities. As a result, despite project stipulations to the contrary, they were invited to visit an irrigation system only after physical rehabilitation was completed.

Farmers from all three tracts were interviewed and asked their views on rehabilitation and its impact. Based on information provided by them, the impact of the intervention can be summarized as follows:

1. Expectations of all farmers were raised that the water supply would be increased, enabling double-cropping of the entire command area with rice, including Dingiriwelyaya. Dingiriwelyaya farmers, in particular, had high hopes of achieving this goal as they knew that the VIRP costs had been justified by taking the area of their tract into consideration. In addition, three new control structures were put into their part of the system, under VIRP. These control structures carried with them the implication that Dingiriwelyaya would be obtaining water as part of the system and was not to be irrigated with drainage water only.

2. Raised expectations led to the abandonment of the established tract thattumaru or water rotation. As a result, both Uda and Pahala Panthiya started cultivating both seasons. In fact, Uda Panthiya managed even a third season in the initial years after refurbishment.

3. Cultivation of both these tracts, in both seasons, made cultivation in Dingiriwelyaya increasingly difficult, especially as time went on and the tank became silted. However, since the original tract thattumaruru had been abandoned, Dingiriwelyaya had no "claims" to water in a specified season. As a result, from 1984 until 1987 yala, Dingiriwelyaya farmers did not get in a single season's cultivation whereas hitherto they had a guarantee of at least the yala season each year.

4. Dingiriwelyaya's abandonment was given support by the local Member of Parliament, and, as a result, tacit support by the government officers on the basis that the VIRP rehabilitation was done for the benefit of only Uda and Pahala Panthiya farmers. Dingiriwelyaya farmers were told that they could cultivate only with drainage water or if excess water was available in the tank. Thus VIRP intervention was used to legitimize senior-junior rights to the water supply.

5. An increased water supply in the early years after VIRP encouraged the extension of the command area into the fringes of the head-end areas of Uda and Pahala Panthiya. These "encroachments"²⁸ were irrigated by extending the water supply of the adjoining field under continuous irrigation. However in one case, an extra channel plus a concrete structure were built under VIRP auspices to irrigate an encroachment of 0.4 ha on the periphery of Uda Panthiya.²⁹ Since all of the encroachments are in the head-end areas and are cultivated by politically influential people, they easily get water before Dingiriwelyaya farmers. Dingiriwelyaya farmers see this as one more effort to deny them rights to water in the system.

6. Enhanced water supplies and the possibility of double-cropping (and even-triple cropping in the early years) coupled with the insecurity of access to water for Dingiriwelyaya, have increased the incidence of irrigation-related conflicts. Farmers and officers attested to this, as did the field observers.

²⁸These lands are still not registered officially as rice fields.

²⁹That this is a recently aswedumized piece of land is evidenced by the fact that coconut trees still grow in the middle of the rice field.

7. Vegetable cultivation under irrigated conditions was only moderately welcomed, both because of a traditional preference for rice (not the least because of tenancy conditions) and because the highlands were already being cultivated with vegetables. Farmers also said that soil conditions were not suitable for vegetables as they were poorly drained soils, a view that is not entirely correct. They talked about 3.5 meters of mud in the fields as this was originally the bed of a major tank.

8. The traditional tract thattumaru (rotation by rice-field tract) which left at least one tract fallow each season had taken care of the requirements of grazing buffaloes and cattle. Double-cropping caused a problem for the draft-power owner and the draft-power supply available to the cultivators.

In summary then, we see a situation where a rotation had been instituted since the mid-1960s that allowed each tract at least one cultivation season a year. VIRP refurbishment in 1982-83 resulted in raised expectations to double (and even triple) cropping which were matched by the actual ability of two tracts in the first few seasons to do so. However, as the tank became increasingly silted, and as encroachments in the upper reaches made additional demands on the available water supply, it became obvious that all three tracts could not cultivate both seasons.³⁰ With time it also became evident that Uda and Pahala Panthiya could cultivate both seasons *if* Dingiriwelyaya were abandoned. The only justification for this was to claim superior rights to the tank water supply by arguing that the tank belonged to the pangu lands of Uda and Pahala Panthiya, and that VIRP was only for the latter's benefit. This contention was publicly supported by the local Member of Parliament who gave it the needed "official" sanction.

The reality of the situation is that most of the land in Uda and Pahala Panthiya is owned by politically and economically influential persons,³¹

³⁰As pointed out by Mr. J. Medagama in his comments on this paper, at that time everyone assumed rice to be the sole crop. Since the study was completed, Mr. Medagama reports that other crops are now cultivated making double-cropping in all tracts possible.

³¹The Member of Parliament himself owns 5 percent of the land in Pahala Panthiya and 20 percent in Uda Panthiya.

whereas the Dingiriwelyaya farmers come from relatively impoverished backgrounds. As a result, even the government officers were swayed into supporting the Uda and Pahala Panthiya claims at the kanna meetings. The Dingiriwelyaya farmers, therefore, have had no basis for their claims on the water supply other than to claim registration of their land as rice land and to attest to payment of the acreage tax, meaning a *de jure* claim on irrigation rights. This was corroborated by the questionnaire survey where more Dingiriwelyaya farmers emphasized the importance of having the land registered and justified the paying of the acreage levy, since this was the only claim they could make to rights in the system.

It seems ironic that while, in the first place, claims to water are administratively determined, state-sponsored programs of rehabilitation are responsible for disrupting these claims and for throwing the system out of gear. When field work was started in the maha season of 1986/87, the system was undoubtedly in disarray. Uda Panthiya farmers were cultivating both seasons, and Pahala Panthiya farmers were attempting to do the same. This delayed cultivation operations and thereby ensured that Dingiriwelyaya farmers could not cultivate, either with a separate water issue or with drainage water. As a result, Dingiriwelyaya had not been able to have a successful cultivation season for several seasons. Dingiriwelyaya farmers were angry, but not being sufficiently organized and not having recourse to redress their grievances via the kanna meeting, were engaged in *ad hoc*, individual attempts to disrupt the water supply to the other two tracts. Their hostility was focused especially on Pahala Panthiya whose farmers they considered to be the villains of the piece. Tension in the system was high, and we were accosted at each turn and told a different version of the story though the reasons used to justify each tract's claim to the tank water supply were consistent.

Ultimately the right to cultivate in yala 1987 was assigned to both Uda Panthiya and Dingiriwelyaya (i.e., reverting to the old thattumaru system) at the kanna meeting held in February 1987 on the grounds that "all cultivators must be ensured even a minimum subsistence."³² Coincidentally, the Member of Parliament also died, convincing Dingiriwelyaya farmers that their "right"

³²The officers voiced it this way. Their *volte-face* had much to do with the extent of agitation by different farmers in Dingiriwelyaya.

would not be retracted mid-season. But as bad luck would have it, very unusual drought conditions prevailed over the whole country and both Uda Panthiya and Dingiriwelyaya rice crops were totally destroyed.

We interviewed Dingiriwelyaya farmers as to their future plans after this unfortunate turn of events. The drought in that season plus the continuing uncertainty in water rights had convinced them of the need to go in for crops with less intensive water regimes. Specifically they hoped to grow yams under rain-fed conditions in the following maha season.³³ They also realized the need to enhance the tank water supply and the advantage of initiating this process. Hence, along with the Farmer Representative's support, the unofficial leader in Dingiriwelyaya drew up a petition to the new Member of Parliament requesting assistance to desilt the tank, pleading the plight of the farmers in all three tracts. The petition stated that farmers were agreeable to defray a percentage of the costs. All farmers in Dingiriwelyaya signed the petition while only a third of the farmers in Uda and Pahala Panthiya signed it, no doubt showing the Dingiriwelyaya farmers' greater need for this refurbishment. At the time field work was completed there had been no response to the petition.

VIRP IN THAMBAGAMUWA

Thambagamuwa was selected for rehabilitation in early 1987, a fact brought to the notice of the villagers only when piles of quarry stones were unloaded in different parts of the village. There was speculation as to what kind of construction might ensue but not even the Farmer Representative knew at this stage what was going to be done.

³³In his detailed comments on this paper, Mr. J. Medagama reports that the shift to cultivating other food crops, alternating with rice, has now become a well-established pattern on all three tracts, and has greatly ameliorated the conflicts and problems observed during the study period.

In early May, the Technical Assistant of the Irrigation Department, along with the contractor,³⁴ met with the Farmer Representative, and the three of them walked up to the anicut and took some measurements. A few days later the stipulated farmers' meeting was called for by the Farmer Representative (on the instructions of the Technical Assistant), and Farmers gathered as requested in the Mahawelyaya. But the Irrigation Department personnel and the Agricultural Planning Team members did not turn up. This was repeated a few days later when again the farmers gathered for the meeting, but the officials did not come.

On 29 May, construction began with no warning. By now the cultivation season was in full swing in Mahawelyaya for the yala season.³⁵ The Technical Assistant discussed the matter with the Farmer Representative, and they came to an agreement that there would be three days of water issue followed by four days with no issue so that construction work could be done. But two cultivators towards the tail end of the tract who were facing water stress broke the structures and started taking water to their fields. As a result, the contractor had to abandon construction work midway. Then the Technical Assistant attempted to obtain the signatures of farmers in Kanathiriyawelyaya on a petition agreeing that they would delay their cultivation season by three months — which was tantamount to giving up one season — so that construction work could be completed.

The farmers had no idea of the type of construction that was going to take place until the structures were literally in place, often leading directly to their own rice fields. The contractor, when asked, said that the locations of the new controlling pipe structures were in "the plan;" likewise when farmers suggested modifications, or more frequently a change in the angle of a controlling pipe outlet, the contractor said he could not deviate from "the plan."

The fact that all 28 pipe outlets had a uniform diameter of 10 centimeters (cm) irrespective of the area they were to irrigate caused even more acrimony. When some farmers protested that areas less than their own received the

³⁴The contractor who was a clerk in the Irrigation Department, had allegedly obtained the contract on behalf of the Technical Assistant.

³⁵Fields had been plowed and the rice sown approximately two weeks earlier, hence demand for irrigation water was high.

same amount of water as their own fields, they were told that the Irrigation Department had only 10-cm outlet pipes in stock. Ultimately, in frustration, the tenant-cultivator of Nindakumbura rice field (tail end of Mahawelyaya), whose land suffered the most because of the positioning of the new concrete controlling pipe outlet to his plot,³⁶ originated a petition arguing against the controlling pipe outlets and requesting instead a *kattakande* (proportional weir). Twelve farmers in Mahawelyaya signed the petition and gave it to the Cultivation Officer. When we checked the Agrarian Services Centre files a few weeks later, there was no such petition on record, suggesting that it had been "lost" en route.

The petition also mirrored the farmers' displeasure with the Farmer Representative who, having had the first and sole contact with the contractor and Technical Assistant, not only had obtained a separate and strategically placed pipe outlet to his field but had also managed to obtain the sub-contract to provide labor for the earthwork component of the project. For the latter, different members of his family, including his daughters, each earned Rs 30 a day. As for the special structure leading to his field, he managed to have it placed right at the head of his channel, thus ensuring a larger and more assured water supply to his own field in Mahawelyaya. As mentioned above the other farmers' petition came to naught, and other than some of the blatantly misplaced controlling pipe outlets (one, for example, was placed so low that water was flowing out of the rice plot *back* into the channel) being altered, using even more concrete, farmers had to accept the designs and structures foisted upon them. Before the season was over, farmers had on their own "modified" several of the 28 controlling pipe outlets. In fact, many of the pipe outlet structures were not used; farmers made cuts in the canal bund to direct water into their fields as they had before the rehabilitation.

The Technical Assistant who had done the preliminary investigations was interviewed.³⁷ He insisted that the farmer meetings had been held and that

³⁶It has been alleged by some that since the cultivator and the Farmer Representative do not get on, the latter influenced the Technical Assistant and the contractor in determining the location of this controlling pipe outlet.

³⁷This particular Technical Assistant was now on "compulsory leave" but was still occasionally on the scene because he had obtained the contract using the clerk's name.

"procedures" had been followed according to established rules.³⁸ He even insisted that the district Irrigation Engineer had visited the project every two weeks to supervise the work when in reality no one other than he himself had ever come there. He was also emphatic in maintaining that the designs had been modified to suit farmers' wishes and needs though several times he stressed that the Irrigation Department was a "technical department" and therefore "must construct mechanically."

When questioned repeatedly on what were the anticipated project benefits, the Technical Assistant talked of better water management that would lead to increased cropping intensity, meaning cultivating both maha and yala seasons in both Mahawelyaya and Kanathiriyawelyaya but that to ensure this "we have to forcibly control water." To achieve this, he emphasized the need for "a strong Farmer Representative" and "disciplined farmers," but was quick to add that this would be the task of the Department of Agrarian Services. He also made an interesting observation: that with technical advice provided by the Irrigation Department and earthwork done by the farmers the need for all the concrete work could be obviated. However, according to him, because it would be hard to organize local labor, however much cheaper, it was much easier to construct concrete structures.

The Technical Assistant who succeeded him knew even less about the system *per se* because he had not, according to him, done the preliminary investigations. He was, however, more conscious of the limitations of a technical solution and said he could not anticipate more benefits from the rehabilitation work than a small reduction in seepage and wastage in the conveyance system. He did not believe this would be significant enough to allow for simultaneous cultivation of both tracts in maha or yala seasons. He was also ready to admit that the concrete controlling pipe outlets may in fact require extra management on the part of the farmers and that to elicit this may prove to be difficult. He even went on to say that there really was "no point for the expense but for the fact that an external donor agency was paying"!

³⁸That he still did not know of our 10 months' presence in the field and that we knew that the farmers' meetings had actually not been held, was another indication of how much he really knew of the irrigation system or the village, or both.

The fact that a blueprint approach is taken by the Irrigation Department with subsequent problems of compatibility and effective use was voiced by this particular Technical Assistant who saw anicut systems being perceptibly different from tank systems. For example, he noted that one should not put measuring devices into anicut systems — only regulators should be put in — since water cannot be controlled but only regulated in anicut systems.

The course that the program of rehabilitation took in Thambaganuwa confirms the notion that small-scale irrigation systems fall within the sphere of the State's responsibility. The system was selected on criteria determined by national policy and recommended by the Member of Parliament of the area. Despite the rhetoric of a "pre-construction phase" that would elicit farmers' input, if not at least inform farmers of what was to take place, construction work was started without the farmers' knowledge. The Irrigation Department personnel talked of the irrigation system belonging to the Department of Agrarian Services, but "handed over" to the Irrigation Department for the duration of the rehabilitation since the latter had the technical skills. It was clear in their minds, and even in the minds of the farmers that it was a "taking over" and "handing over" exercise between two government departments.

Existing patterns of water management and water distribution were simply overlooked and structures determined and placed to match the estimated value of the contract. The farmers were not sufficiently organized nor motivated as a group to attempt to counter this. If at all, they sought to maximize their individual advantage at the expense of others. In addition, they lent support to the Irrigation Department's arguments that water was not being effectively managed by the community, by asking for gates and padlocks in place of removable planks on the basis that this would prevent water thefts. Moreover, some farmers stated that the concrete structures would not only minimize damage but that being now the "government's structures" would make farmers fearful of the police being brought in, if tampered with. Hence, a preference was being articulated for extra-community authority to resolve internal conflicts.

In fact, from the farmers' perspective it was the government's responsibility to finance and undertake rehabilitation work. Farmers had no idea that they should or could obtain the contract as a group and undertake rehabilitation work themselves. Similarly they had no expectations about a say in the quality

of the construction. This is not because they were afraid to confront the Irrigation Department personnel; it was simply because they believed that it was not within their purview. The irrigation system, according to them, belongs to the Department of Agrarian Services, and it is up to the Department of Agrarian Services to obtain the technical services of the Irrigation Department and have the system rehabilitated.

Nor did they have a clear idea of what this rehabilitation should constitute. The Farmer Representative had routinely applied to the Member of Parliament to have some funds from the district budget allocated for the "development" of the village. And what was eventually allocated through VIRP for the rehabilitation of the irrigation system was not necessarily what they anticipated. Yet, many farmers were satisfied in feeling that their village had not been overlooked when allocating funds within the electorate.

Possible Impact of the New Structures

What has been the effect of the new structures introduced in Thambagamuwa under VIRP? Certainly, at least, one complete season of cultivation would have had to be monitored to understand the full impact of the new structures. Nevertheless, from preliminary observations and from the choice of structures introduced, one could observe or predict the following overall outcomes:

1. The concrete controlling pipe outlets introduced inequities and made them permanent by their very positioning in the system;
2. The permanent width of controlling pipe outlets can introduce rigidity into a rotational water schedule as the width sets a limit on the flow discharge and cannot be adjusted;
3. For controlling pipe outlets to work ideally, they require a sufficient head of water. In the context of a continuous flow, they tend to favor head enders and can result in existing inequities being heightened. Regulators similarly depend on a sufficient head of water being maintained and can be made to favor head enders;

4. The controlling pipe outlets introduce other inflexibilities into the system. For example, fragmentation — a very real problem under village irrigation systems — cannot be catered for;
5. Traditional patterns of water allocation and distribution can be disrupted as uniform controlling pipe outlets were introduced irrespective of area to be irrigated. This may, for example, increase the incidence of conflict;
6. Regulators require increased and sometimes more sophisticated management. This may either necessitate skills beyond those of the Farmer Representative (requiring government assistance) or concentrate in him discretionary powers in managing water flows that he could abuse to the detriment of some farmers;
7. The retaining walls in most locations were useful in preventing submersion of the rice plots below; some, however, were put in merely to spend budgeted funds;
8. The new structures are "management intensive" and will require more time (and skills) in management than farmers are willing to contribute in a farming system that is not solely dependent on irrigated rice.

Some factors mentioned above are already evident but others can be anticipated because of the intrinsic nature of the structures introduced.³⁹ Already, the Farmer Representative has managed to make permanent his advantage by having a controlling pipe outlet installed at the head of the main channel to Mahawelyaya to irrigate his field. Likewise, this representative has allowed his personal animosity towards the cultivator of Hunukotuwa plot to result in the latter having a controlling pipe outlet positioned in such a way that he does not get even the water he used to get. Where, no doubt, position in the tract had already resulted in relative inequality in water availability, the controlling pipe outlets have both aggravated and made this permanent.

³⁹Of course, the impact of the controlling pipe outlets may not be so great if most of them are bypassed.

Other problems arising from the new structures include their bad location, confusion of existing land boundaries and disruption of the traditional *diya maru* or water-rotation system. Furthermore, many of the controlling pipe outlets are not located where the original inlets were. Rather, the new controlling pipe outlets tend to be located at the shortest point from the channel to the plot, irrespective of land boundaries and topography. For example, the controlling pipe outlet leading to "Ninda Kumbura" is located within the boundaries of the adjoining plot called "Palle Depela." This is causing tension between the landowners of these two plots. Another problem is that the area between the new inlet and the old inlet cannot be irrigated. In some plots, for example Waragahakumbura and Walakumbura, unusually long pipes have been used and the area beneath them cannot be cultivated.

Consequences of the old water-distribution system are most evident in Kanathriyanwelyaya where the earthen proportioning weir made seasonally by farmers has been replaced by complicated concrete structures that do not match the old division of water. The new structures have in fact benefited one particular farmer (Walakumbura-Darande) at the expense of others. The fact that this farmer has access directly to the main channel is affecting the proportion of water available to others. The main problem is that with the new structure, water that had originally been utilized by eight other plots is now irrigating Walakumbura-Darande plot and then flowing relatively unutilized back into the river. The eight farmers are already complaining in anticipation of water shortages.

Most farmers feel that a simpler proportioning weir to correspond to places where they already were seasonally constructing a *darande* (proportioning weir) would have been more suitable and less conflict-prone than the types of structures that have been now introduced. In the questionnaire survey of farmers in Mahawelyaya, conducted specifically to assess farmers' views on VIRP, 17 percent said that the controlling pipe outlets make no difference to the existing operation of the system while 75 percent said that the controlling pipe outlets adversely affected water distribution. In fact, most farmers were explicit in stating that the old outlets were much better and the traditional system of water distribution much more equitable than the VIRP innovations.

In terms of individual water supply, 33 percent of the farmers stated that the new structures made their own supply much worse. The only components

of refurbishment they talked about favorably were the reinforcing walls on the main canal. Farmers felt that they played a useful role in protecting the channel bunds and preventing seepage. However, farmers also feared that the reinforcing walls may prevent the Dewaka channel from obtaining water from the upper Kanathiryanwelyaya channel through seepage, as it did previously. Construction was not yet complete, so the actual effect could not be observed. However, one location had already been sealed off, preventing water from flowing into the lower channel.

Farmers were also worried about the extra labor time involved for managing the system because of the new structures. Seventy-five percent of the farmers interviewed felt that labor time for management would in fact increase.

The overall management of the system seems to pose an even more serious problem, and many farmers had already thought this through and voiced their apprehensions. The most basic fear was the supposed enhancement of the Farmer Representative's position as a result of the new structures. Earlier, the Farmer Representative played an informal leadership role, but most of the actual water distribution was done by the farmers — albeit more or less individually. Now, however, decision making plus actual water distribution have become the responsibility of one individual. Farmers were concerned that management was now elevated to a level beyond that of the individual farmer or, for that matter, a group of farmers, and left instead to the discretion of one individual, the Farmer Representative.⁴⁰ That he could abuse it was already evident in the construction phase. Certainly there were no checks, physical or organizational, on his future actions.

This more authoritarian mode of leadership had been, in fact, a conscious aim on the part of the Technical Assistant supervising the construction. He emphatically told us that what the system needed was a "strong Farmer Representative" and "disciplined farmers." He envisaged that the new structures would provide an impetus in this direction and that the system would, as a result, be "managed better."

⁴⁰While elected by the people and therefore their supposed "representative" the point is that he functioned well in his role from their perspective when there were automatic restraints to his behavior.

The farmers' apprehensions, however, were very real and must be viewed in the broader context of what the role of a Farmer Representative is meant to be under the Agrarian Services Act of 1979. According to the Act, the Farmer Representative is only meant to be a conveyor of field-level information to the Cultivation Officer and is not meant to have any discretionary powers at his disposal. Our field observations confirmed the view that the particular Farmer Representative in Thambagamuwa was chosen precisely because he had no socioeconomic or political power base in the village. In fact, his general demeanor, attire, and home showed that he was more impoverished than other villagers. Hence, a process of rehabilitation that was based only on information provided by him and new structures that gave him unwarranted discretionary powers were bound to cause many fears in the minds of the villagers.

From the farmers' responses plus our own observations in the field, it appears that much of this kind of rehabilitation work is undertaken in a "blue-print" mode, with little understanding of the existing patterns of water distribution or leadership in the local community. The "merits" of a system like Thambagamuwa were precisely those the new structures hoped to change. Thambagamuwa, because of the nature of its land history, its tenurial interactions, and its social and kinship bonds, had a relatively well-defined pattern of water allocation and distribution. In a sense, no formal irrigation organization or association was needed as the system functioned to all intents and purposes as a consensual one. The "water-thattumaru" by tract was accepted and adhered to, as was a switch to a rotational schedule when water was perceived to be inadequate. During other times when there was a continuous flow the system functioned more or less "automatically." The Farmer Representative in this context functioned mostly as an "ombudsman." More weighty decisions were left to the government officers at the kanna meeting or, especially in terms of conflict resolution, to the Cultivation or Divisional Officer.

Consequently, VIRP rehabilitation should not have taken place within the realm of intra-tract water distribution as this was the "strength" of the system. The investment may have had better returns if it had been made higher up in the system — for example, at the level of the headworks or the conveyance system. A clear place for intervention, for example, would have been the *gal amuna* (temporary anicut) irrigating parts of the Mahawelyaya. Farmers

themselves cited this as more important as they have to invest labor in maintaining it each time it washes out. When we asked the Technical Assistant why money was not put into making this anicut a permanent structure, we found he was not aware there were temporary anicuts in the system. That he was not aware of this fact reflected negatively on both the Technical Assistant and the farmers, as the latter had apparently not informed him of this via the Farmer Representative. Nonetheless, it does point out some of the problems that exist when we expect farmers to act as a "community" in relation to officers.

The result of the VIRP intervention then can be summarized as follows. New physical structures have been introduced, supposedly to prevent wastage in the system and, therefore, to increase cropping intensity (i.e., cultivation of both tracts in both seasons). Their technical advantages are in providing more control and more predictability; but both of these advantages are contingent on a relatively abundant water supply. As soon as there is water stress, the controlling pipe outlets introduce inflexibilities into the system. This, it is anticipated, will be evident when a rotational-water schedule is introduced.

The new structures introduced are also "management-increasing" structures, that require a different mode of organization than the one currently in operation. Whether a suitable adaptation will be made is yet to be seen. But for the moment the new structures run counter to the existing organizational fabric, have heightened inequalities in the system, and have made it more open to individual abuse. Even worse, the imposition of structures that appear to be incompatible with existing traditions and practices may in time destroy the strengths in local organizational and leadership resources that exist.

CHAPTER 5

Implications of the VIRP Intervention Strategy

THE VIRP PROCESS

THE DISCUSSION SO far has centered on the VIRP itself and its actual implementation and impact in two field locations. In this section, the implications of the intervention strategy for the long-term management of land and water resources in small-scale systems is examined, taking into consideration each stage of the VIRP process. The stages have been delineated as selection, design, construction, and post-rehabilitation.

Selection Stage

A large number of tanks and anicuts are earmarked for investigation in each district and selected works are chosen for rehabilitation each year. Initial investigation is the Irrigation Department's responsibility while final selection is based primary on the availability of funds per district and on political exigencies. Although the official policy of the Department of Agrarian Services emphasizes farmer involvement in rehabilitation the evidence suggests that only rarely is selection made on the basis of village-community articulation of the need or desire for rehabilitation of the particular system. However, it must also be stated that this does fit into the broader perception of people, that it is the government's responsibility, and that it should provide such "services" to the rural people as part of the national policy to grow more food. Despite a congruence between actual procedure and peoples's perceptions, the stage is already set for the rehabilitation process to be external to the villagers. As such, the dictionary definition of intervention as "coming in as something extraneous," is extremely appropriate when applied to the process of rehabilitation of small-scale irrigation systems.

Design Stage

As with most national programs that have vast coverage, designs are relatively uniform and predetermined to cover most situations. At least four factors were clear from field observations:

1. There are few, if any, design criteria to distinguish between management requirements of tanks as opposed to anicut systems. In addition, the Irrigation Department personnel were found to be trained primarily in terms of tank and not anicut construction and rehabilitation and could perceive systems only in terms of water control for the former. It is also evident that most of the project recommendations are also phrased in terms of tanks, not of anicuts;

2. What gets built appears to be determined primarily by the value of the contract. If the contract specifies a certain amount of concrete work, then chances are that designs will cater to this, even if existing farmer-constructed structures — such as earthen weirs — are functioning admirably;

3. Design criteria are decided independently of proposed improved water-management specifications. Thus, the tendency is for the system to be redesigned in a blueprint mode, and thereafter the staff of the Department of Agrarian Services is left to formulate a water-management package within these confines;

4. Design criteria pay little heed to existing property rights in land and water. One pipe outlet to two pangu (land shares) or a pipe outlet direct from the main canal to a panguwa, for example, can cause disruptions to existing patterns of water distribution and rifts among farmers.

Construction Stage

According to the VIRP guidelines, construction is to be preceded by ratification meetings where farmers are to be consulted on different aspects of the rehabilitation activity. According to the former VIRP Project Director (Irrigation Department), these farmer meetings are held in approximately 80

percent of the cases. The Irrigation Department personnel, when interviewed, said that these meetings eased their work considerably because farmers, when preinformed of rehabilitation, cooperated more willingly.

While the idea of ratification meetings with farmers was a significant advance, it nonetheless appears to be a step to inform farmers rather than to elicit their participation in deciding on key factors in design, etc. Also it appears — as was evident in Thambagamuwa — relatively easy to camouflage the fact that the meetings were not actually held. As a result, there was no opportunity to incorporate any modifications requested by farmers, and they had to accept the designs as given.

Construction activity is also confined to the Irrigation Department (Technical Assistant) and the outside contractor. The latter tends to import labor from outside. As a result, supervision of the quality of construction is external to the village community, and the farmers can exert no control or checks, even on blatant misuse of money or materials. There is a further drawback associated with this. Often the contractor takes on several jobs simultaneously and has no compulsion to complete any one job speedily. As a result, farmers often have to forgo more than one cultivation season as construction activity is delayed.

Post-rehabilitation

Handing over. After physical rehabilitation, the refurbished irrigation system is supposed to be “handed over” to the Department of Agrarian Services. The term “handing over,” even if only symbolic, implies several things to both officers and farmers. The first factor implied in the term “handing over” is that it is a process involving a give-and-take exercise confined to two government departments. This reflects what appears to be the generalized perception that these rehabilitated schemes belong to the state and not to the local users, and that by definition those living and cultivating under these systems are merely recipients of government services.

Second, the fact that one department is responsible for rehabilitation and another for operation and maintenance creates problems, primarily ambiguity in responsibility for the refurbished systems. However, this situation has since been somewhat improved by introducing the method of joint inspection.

The third implication of this "handing over" exercise is that the technical agency, the Irrigation Department, can undertake the rehabilitation exercise without supporting a participatory approach and simply leave it to the Department of Agrarian Services to be committed to the latter after "taking over." As a result, attempts to mobilize farmers after "handing over" have been undermined.

The Water Management Program. All irrigation schemes that are rehabilitated should, in principle, have a water-management program. The water-management programs are to be adapted to the requirements of each system but are to share the twin goals of making efficient use of rainfall and irrigation by improvements in the dependability of the water supply and a more equitable sharing of water among farmers in the command area.

The responsibility for implementing the water-management program lies with the Water Management Division of the Department of Agrarian Services, which delegates to its district-level appendage, the Agricultural Planning Team, responsibility to visit each tank and anicut proposed for rehabilitation, to prepare an appropriate water-management program, and to supervise its implementation. The water-management package is a generally standard one that makes provisions for a rotational-water schedule in times of water stress, and for growing vegetables in rice fields. While the rotational distribution is usually welcomed growing of vegetables in what was the fallow season has often raised a host of problems ranging from tenure to cattle grazing. Thus, it is important to understand the wider implications of not growing rice in a climate of legislation, market prices etc., tailored mainly for rice cultivation.

The Agricultural Planning Team. The idea of a relatively mobile, multidisciplinary team that would attempt to cater to the institutional-cum-management needs of each rehabilitated system is indeed an innovative approach. However, there are certain factors inherent to the Agricultural Planning Team and other factors inherent to village-irrigation systems which make the desired outcome — participatory management by the local community — hard to achieve.

The first problem is a basic one of coverage. As the Project has expanded, the Agricultural Planning Team has had to take on responsibility for supervising water-management programs in more and more systems. For example, the Ratnapura Agricultural Planning Team has responsibility to oversee 52 systems and was adding a further 23 systems to that number in 1987. It was obvious

that though the Team consisted of three extremely dynamic and knowledgeable officers it could not spend the stipulated two weeks in each project site nor take any follow-up action, as was evident in the Ambewila case.

The second drawback is in the constitution of the Agricultural Planning Team. Despite its overly official flavor (it has no farmer representation), the Irrigation Department is not represented in the Team. The result then is that the Agricultural Planning Team (along with the Department of Agrarian Services) is external to the physical rehabilitation exercise which remains strictly the Irrigation Department's business. This is a very real problem for the current Agricultural Planning Team officers who are supposed to keep abreast of the Irrigation Department's rehabilitation schedule but have no institutional link with the Irrigation Department to facilitate this.

Apart from the ambiguities surrounding the orientation of the Agricultural Planning Team there is another problem concerning its constitution. As the project progressed and it was felt important to cater to the social nuances in the community a Divisional Officer was included in the Agricultural Planning Team in the hope that he or she would provide the requisite local feedback. But the Divisional Officer covers a large area and despite training, is unable to provide sufficiently detailed information on a particular community dependent on a water source. This is not an easy factor to overcome; nonetheless, it is advisable to recognize the limitations rather than to depend wholly on the Divisional Officer's knowledge of a particular socioeconomic milieu when formulating rehabilitation plans.

A third problem relates to the approach adopted. The problem is that the Agricultural Planning Team members play primarily an extension-type role, promoting certain agronomic and water-management practices, and yet they are also expected to play a significant organizational role and ensure farmer participation in managing the systems. What is argued here is that if the Agricultural Planning Team plays primarily an extension role (for which incidentally it is trained), it cannot also be expected to play a successful catalytic role, for which it is not trained.

The Tank or Anicut Committee. The Tank or Anicut Committee is the local organization promoted under the VIRP. Its activities are confined to irrigation-cum-agricultural matters but even in these realms it has no authority, either from an administrative view point or from an interest-group constituency (i.e., those dependent on the irrigation water).

The Committee's membership consists of the lowest level of the government-administrative structure, as it relates to irrigation and crop production matters, and group leaders who are responsible to the members in the rice-field tract.⁴¹ Strictly speaking, the government officials are accountable "upwards" to the state while the group leaders are responsible "downwards" to those who own irrigable rice land under the particular water source. Likewise the government officers are responsible for activities that are dependent on interaction with the wider society (e.g., ensuring timely delivery of inputs) while the group leaders are responsible for matters that concern the community and can mediate within it. However in reality, many of these latter decisions are also made by the officers because only they have the necessary legal backing for remedial action (i.e., for prosecution at the Magistrate's court).

Hence the Tank/Anicut Committee is, strictly speaking, not a farmer organization; rather it provides a convenient meeting place or nexus between the state and the community, through its representatives, as it reaches down to provide benefits such as extension advice or production inputs, or as it reaches up to receive them.

The Tank/Anicut Committee, moreover, is a standardized blueprint introduced as a vehicle for resource management and mobilization purposes under the VIRP. It is the recommended arrangement for all refurbished systems. The only provision is the number of farmers: if an irrigation system has more than 15 farmers, farmer grouping is recommended (Department of Agrarian Services, 1984).

The Tank/Anicut Committees together are not federated up to a higher level. This, plus the pronounced government officer presence in its composition, shows that the purpose for organization is not to empower farmers to be the key figures in irrigation management nor to enable them to bargain collectively for their rights as a hydraulic community. Rather, farmers are encouraged to come together primarily for purposes of undertaking agricultural and irrigation-related tasks as set out in the water-management program which in turn is primarily an artifact of the Agricultural Planning Team. Thus the Tank/Anicut Committee is constituted so as to have a mix of local-level participation and

⁴¹Though it is considered preferable that those elected own land in the command area there are no means to ensure this.

government involvement. However, ultimate responsibility for the implementation of the water-management program rests with a government officer — formerly the tank supervisor and now the Cultivation Officer.

Field observations in Ambewila showed that from both the officers' and the farmers' points of view, the Tank/Anicut Committee translates into being a kanna or seasonal cultivation meeting and nothing more. Because, basically the same officers are involved in both, they prefer to have a once-a-season meeting and come to an agreement on the cultivation schedule, type of unhusked rice seed to be used etc., and see no need for a separate Tank/Anicut Committee meeting. Thus, the farmer leaders elected for the Committee are only there in name. If called upon, they are to ensure a rotational-water schedule in their separate tracts or to accompany the Farmer Representative to open or close the sluice. The latter is not an unimportant task; the Farmer Representative under the Act has no real authority — either traditional or administrative — and therefore, prefers to have his actions "legitimated" by the presence of others.

In the course of the Agrarian Research and Training Institute study (Abeyratne and Perera, 1986) and later under the present study, at least four sets of problems were found to confront the concept of a Tank/Anicut Committee. The first is the "community" that the Tank/Anicut Committee represents. The latter's focus on the water supply is one that harks back to the past where the village tank was the epicenter of community life, both economically and socially. Historically, "the one-tank, one-village" concept may have been in fact all-pervasive (at least in the dry zone), and elaborate rules and regulations were established to keep this hydraulic community intact (Leach, 1961). However, a process of state penetration of the rural areas and of village communities has today made the notion of a community organized around a water source extremely fuzzy. A market in land has brought outsiders into what were relatively socially homogeneous communities, and these outsiders have managed to buy land even in the traditional *purana wela*⁴² sections. This makes it harder for the original cultivators to maintain exclusive rights to land and water on the basis of prior appropriation. Population pressure and resultant land fragmentation have resulted in irrigated rice land decreasing

⁴²Rice-field tract with ancestral rights.

in importance for the community: village boundaries have been extended to cover areas beyond those watered by the tank. These rice lands are rain-fed and are not dependent on the irrigation water source.

While, at least in the past, there might have been cohesive communities around tanks, under anicuts — as mentioned at the beginning — there was little community formation, mainly because of the land-tenure structure in these areas. Hence, what we find today is that the village tank does not enjoy the primacy it had in the past, and landholdings under village tanks are extremely fragmented and do not meet subsistence requirements,⁴³ while anicuts are spatially and functionally separate from the “social” village. Also many villagers depend on other crops and activities to bring in a larger portion of their income. This is especially valid for areas in which anicuts predominate where mixed cropping on the uplands brings in a significant proportion of farm income.

Where the village tank or anicut is not the main contributor of income nor of social identity for the community, the irrigation system is found to be of consequence only to those cultivating a limited area immediately adjacent to it. In such a situation it becomes difficult to elicit even the limited farmer participation envisaged for the Tank/Anicut Committees.

The second problem for some localities is that the community of water users is not continuous with those represented on the Tank/Anicut Committee. This Committee is defined only with reference to irrigation water users, but there are cases where other populations were drawing water from the same source. For example, in Kehellanda, one of the Agrarian Research and Training Institute study (Abeyratne and Perera, 1986) locations and a “showpiece” for water management in Moneragala, there was a sizeable community immediately next to the tank whose subsistence depended on fishing in the tank. Similarly in Ambewila, there are many villagers who dredge sand near the pickup anicut and sell it as their main means of livelihood. These groups are not represented on the Tank Committees. As a result, there was a series of conflicts over water levels and the rights each group had over the Tank/Anicut and its water. From this it is evident that if farmer participation is to be encouraged, it is important to delineate irrigation and water-user

⁴³The study by Abeyratne and Perera (1986), for example, found that 70 percent of all holdings are less than 0.4 ha each.

community boundaries more realistically, and not to expect commitment to a Tank/Anicut Committee simply because one owns land under its command while similarly excluding others because they do not use the Tank/Anicut water for irrigation purposes.

The third aspect that emerged with respect to participation in the Tank/Anicut Committee was the critical question of who owned the irrigation water source. In earlier times, the water source (at least in terms of village tanks) contributed to the definition of community and consequently spelled out a clear set of privileges and obligations for those whose cultivation and livelihood relied on it. Today, on the contrary, there seems to be some ambiguity as to who owns the irrigation works. In both Ambewila and Thambagamuwa, the majority of farmers said that the state had ownership and, therefore, the state had responsibility for operation and maintenance activities. In Thambagamuwa, attribution of ownership to the state was clearly a result of the replacement of the temporary weir with a concrete one by the Irrigation Department. Similarly, the introduction of concrete pipe outlets convinced them that these were "the Irrigation Department's structures." However, in those anicut systems that had not undergone rehabilitation, it was found that villagers felt they themselves owned the irrigation system (Abeyratne and Perera, 1986).

Impact on Management

The pervasive belief that, subsequent to rehabilitation, the local people no longer own the irrigation water source has several implications for farmer participation. In the least, it cannot be assumed that the local group will have the incentive to participate in system management or maintenance.

The question of who should do maintenance and who actually does maintenance work was addressed. In the Agrarian Research and Training Institute study, while farmers in the prerehabilitation tanks and anicuts felt that it was the community's responsibility those in systems which had had state involvement in rehabilitation stated that it was clearly the government's responsibility (Abeyratne and Perera, 1986). However, because they were compelled to do maintenance work under the Water Management Program, they did in fact undertake it. The farmers were emphatic in pointing out that

though this was called *shramadana* (voluntary labor) by the project authorities, it was actually done only under compulsion fiat. It was found in the present study that farmers subscribed to the view that maintenance was the government's responsibility, since income from irrigated agriculture was not substantial. Thus, the pertinent question that remains is, what will be the incentive or compulsion for farmers to undertake maintenance work in the future?

This brings up an important point with respect to the VIRP and its impact on management. The Farmer Representative, as envisaged under the Agrarian Services Act of 1979, is to be an assistant to the Cultivation Officer at the field level. As such, he has no discretionary powers and no recourse to punitive action; he can act merely as an "informer" to the Cultivation Officer, a conduit for field-level information. The government administration, therefore, relies on him for information but it really cannot be said that farmers depend on him to further their interests since he carries neither a mantle of traditional authority nor authority linked to the state.

This subtle difference does not seem to have been appreciated by the VIRP strategy which assumes that the Farmer Representative actually represents the farmers and their interests. The project, as a result, places heavy emphasis on information provided by him regarding the community. In Thambagamuwa as discussed, this meant that important information was withheld (e.g., the existence of temporary proportioning weirs in the systems) while other self-serving information was provided which enhanced the position of the Farmer Representative and his relative.

A related factor is the type of physical structures introduced under the VIRP. Generally, it appears that refurbishment of the headworks and features of the main distributary system has resulted in positive impacts and farmers themselves are quick to point this out. It also appears that extension type water-management innovations (e.g., a rotational-water schedule for times of water stress) have met with kudos.⁴⁴ Where VIRP rehabilitation has met with

⁴⁴In the Agrarian Research and Training Institute study for example, 75 percent of the farmers commented positively on water distribution under the rotational schedule drawn up under the program (Abeyratne and Perera, 1986).

censure is when it has altered existing property rights in land and water by introducing physical structures or improvements at the distributary-system level. The Thambagamuwa case is very clear; the problem lies not with concrete reinforcing walls or lined channels, but with controlling pipe outlets which interfere with established property rights, as inconspicuous as the latter may seem to be.

The consequences are far-reaching. Land and irrigation policy in Sri Lanka, from at least the middle of the 19th Century, has shown that the government thought it fit and proper to intervene in small-scale irrigation systems. However, until recently it has been at the level of the headworks or main irrigation facilities. As these facilities were thought to belong to the government, from the people's point of view also this was correct. However, people expressed their right to the use of irrigation water through their access to land, and this was evident in the intricate patterns of water distribution that were developed, underscored by norms of equality. This in Sri Lankan village-irrigation systems was the only realm that could be said to have been somewhat "farmer-managed." However, with VIRP intervention in this sphere, even this realm is being taken over by the government.

CONCLUSION

All the concerns voiced above underscore three major points about rehabilitation exercises in village-irrigation systems. First, the need to understand and appreciate the existing patterns of water allocation and distribution and the organizational basis that surround them. Often the strength of these systems lies in an established pattern of water distribution, with strong norms and rules dictating the behavior of the water users. An initial look may suggest that there is no organizational basis for water distribution, that the system is wasteful of water, and that individual cultivators are appropriating water at will. If the diagnosis is the latter, the prescription is often to introduce permanent structures so as to impose "discipline." This it seems was the perspective motivating the VIRP intervention in Thambagamuwa.

Second, is the need to pay attention to the relationship between system structures and organizational resources. On the ground, this means much more coordinated activity between the "technical department" (Irrigation Department) and the "institutional department" (the Department of Agrarian Services) so that it is not seen that the Irrigation Department "takes over" and independently constructs, and thereafter "hands over" to the Department of Agrarian Services "to do water management." It also means a deeper appreciation of the major differences that exist in water source — tanks and anicuts — and the realization that the engineering "solutions," quite apart from the organizational "solutions," to both, cannot be identical.

Third, in order to integrate the technical and organizational aspects in irrigation rehabilitation, there is a need to involve farmers more effectively than at present in all phases of the rehabilitation process. This is not merely to uphold the rhetoric on farmer participation. It seems logical and advisable, in the long-term, to attempt to integrate the requirements or specifications of the farming community in the design of system structures. Planners are beginning to realize this and encourage the suggestions of farmer groups. As David Korten (1979:61) suggests, such knowledge is valuable, "not as an inventory of quaint practices, but as an inventory of the ingenious methods that intelligent people have devised for living under difficult conditions." Of course, this is not without problems, and one of the largest pitfalls is to view farmers as having relatively uniform interests that will be conveyed to the officers. Yet, there seems to be no alternative but to involve as many people as possible in the rehabilitation process, especially if one wants to maintain long-term perceptions of equity among members in the system. And unless the latter are maintained, there will be irrevocable consequences for system maintenance in the long-run.

References

Abeyratne, S.D. 1986. State intervention in irrigation development: The village irrigation rehabilitation program. Participatory Management in Sri Lanka's Irrigation Schemes. Digana Village, Sri Lanka. IIMI.

Abeyratne, S.D. and Perera, J. 1986. Change and continuity in village irrigation systems: A case study in the Moneragala District. (Agrarian Research and Training Institute Research Study Series). Colombo: Agrarian Research and Training Institute.

Department of Agrarian Services. 1984. Manual on village irrigation. Colombo: Ministry of Agricultural Development and Research.

Department of Census and Statistics. 1987. Sri Lanka census of agriculture 1982: General report. Colombo: Department of Census and Statistics.

Korten, D.C. 1979. Community social organization in rural development. Resource paper presented at the Ford Foundation. Jogjakarta, Indonesia.

Leach, E.R. 1961. Pul Eliya: A Village in Ceylon: A study of land tenure and kinship. London: Cambridge University Press.

Lynch, B.D. 1985. Community participation and local organization for small-scale irrigation. (WMS Report 34). New York, Cornell University.