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A RAPID-ASSESSMENT SURVEY OF THE IRRIGATION COMPONENT OF THE ANURADHAPURA DRY-ZONE AGRICULTURE PROJECT (ADZAP)

by

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CONTENTS

FOREWORD

This paper reports on a study of the irrigation component of the Anuradhapura Dry Zone Agriculture Project (ADZAP) conducted jointly by staffs of the International Irrigation Management Institute (IIMI) and the Department of Agrarian Services (DAS). The field study was conducted from June to September 1988 by Mr. Ratnasiri Ekanayake (IIMI Research Officer and senior author of this report) and Mr. Somaratne (DAS Technical Assistant). Backstopping was provided by Mr. W.M.U. Navaratne (DAS Regional Engineer) and Dr. David Groenfeldt (IIMI Irrigation Specialist), the other two authors. The authors are very grateful for Mr Somaratne's assistance, the support from DAS personnel, and the cooperation of the farmers. Dr. Douglas J. Merrey, Head of Sri Lanka Field Operations at IIMI, did extensive editing of this paper.

IIMI's research program on minor irrigation systems in Sri Lanka has included studies of the Badulla Integrated Rural Development Project (IRDP) as well as the Village Irrigation Rehabilitation Project (VIRP) in both Ratnapura and Anuradhapura districts. In December 1987, IIMI cosponsored a workshop with the Agrarian Research and Training Institute (ARTI) to discuss research priorities in minor irrigation. Representatives from the various minor-irrigation assistance projects in the country participated. A presentation on ADZAP was given by the DAS engineer in Anuradhapura, Mr. W.M.U. Navaratne. Following the workshop, IIMI staff met with the ARTI Director, Mr. Joe Alwis, and the DAS Deputy Commissioner for Water Management, Mr. Jaliya Medagama, to discuss a possible study on ADZAP.

The result of those discussions was a decision to conduct a small survey of a representative number of ADZAP tanks to focus on the irrigation component of the project, both the implementation and water-management aspects. Since ARTI had recently completed a study of the ADZAP project as a whole, it was felt that a study focusing on the irrigation component could form a useful complement, and would be conducted jointly by IIMI and DAS.

The study reported here was originally intended to form the first phase of a two-part study, the second phase to be an intensive study of three or four tanks during one agricultural season. However, a change of strategy was decided midway into Phase I when it was realized that a rather different approach to minor-irrigation development was being implemented by the Freedom From Hunger Campaign (FFHC) in the midst of the ADZAP area (in Thanthirimalay). The potential for comparing the two approaches seemed too good an opportunity to let pass. The second phase of the study, therefore, to be undertaken in 1989, will be a survey of FFHC tanks in the Thanthirimalay area with the objective of drawing lessons relevant to future irrigation development in Anuradhapura district.

This study is one of several activities funded through a three-year grant to IIMI for research on farmer-managed irrigation systems. The grant has been made available by the International Fund for Agricultural

Development (IFAD) and the West German Federal Ministry of Economic Cooperation (BMZ). Grateful acknowledgement is made to both organizations for this support. This paper was published using IIMI's unrestricted funds.

BACKGROUND

The International Irrigation Management Institute (IIMI) in cooperation with the Department of Agrarian Services (DAS) conducted a study of 31 ADZAP tank schemes, focusing on the irrigation component of the project. The study was conducted during June-September 1988, and forms part of the Institute's ongoing research to document alternative strategies for assisting the minor irrigation sector. This report provides an overview of the study and its findings.

The Project

The focus of the Anuradhapura Dry Zone Agriculture Project (ADZAP) has been to provide a viable farming system through careful development of local resources. The pre-project context of semi-shifting chena (swidden) agriculture was to give way to permanent, intensive cultivation of both irrigated command areas and upland plots. In addition, the project includes components for livestock development, rural roads, agricultural extension and training, and credit.

While the project originated as an area-development project, the early interest of the International Fund for Agricultural Development (IFAD) emphasized the target group concept with a focus on poor, landless chena cultivators. The project would provide permanent land-use rights to promote investment while providing small irrigated plots to supplement the rain-fed production. In its integrated approach and target orientation the project sought to provide a model for the development of other dry-zone areas in the country.

This report deals with the irrigation component of ADZAP which constitutes the greatest component cost and the dominant focus of the project. The original project plan was to rehabilitate 600 small tanks which would then form the basis for new communities comprising the former chena cultivators from the immediate areas. While the number of renovated tanks was later reduced to 138 (of which 83 involved an expansion of the existing command area) the focus of the project has continued to be the irrigation component. At the same time, the reduction in numbers has been accompanied by an increased project attention to the upland areas adjacent to the tank. This slight shift of emphasis is significant to the present study since one of the major conclusions (discussed in the final section of this report) has to do with the productive potential of the upland areas.

It will be suggested that supplementary lift irrigation, that is, tapping the groundwater supplied by the tank itself, could become an important feature of the farming system in the project area.

IIMI's Research Interests

The interest which IIMI finds in the irrigation component of the project is linked to the Institute's mandate, "to strengthen national efforts to improve and sustain the performance of irrigation systems, through the development and dissemination of management innovations." From IIMI's irrigation perspective, the ADZAP project is a national-level effort seeking to enhance the productivity of small-scale tank irrigation systems which have been either abandoned or fallen into a state of disrepair.

The ADZAP project also comprises several innovative management features which have relevance to the challenges facing other regions of Sri Lanka, and other countries, in improving the performance of the small-scale (farmer-managed)[1] irrigation sector. Perhaps the most significant feature of ADZAP is its multi-component nature. The farming system is treated as a whole and the major line agencies having responsibilities for the farming system components are directly involved in the project. Coordination among the line agencies (representating several ministries) is handled through a special project-management office. Approaching small-scale irrigation as part of an integrated farming system is "natural" in the sense that it matches the farmers' multi-component context. Administratively, however, integrated projects pose a variety of problems and potential pitfalls.

A second feature of the ADZAP project is that it involves resettlement of beneficiaries. Moving residence from the existing rain-fed fields (usually located illegally on government land) to new allotments provided under the project is a complex process. Would-be settlers must perceive some advantage to moving before they are willing to uproot their families. The relative attractiveness of an ADZAP project residence depends upon the facilities available in the project (e.g., drinking water, schools, medical facilities) as well as settlers' current situation. Here the target group concept becomes significant; by selecting poor, generally landless families as the settlers, the project tried to tip the balance in favor of moving.

By understanding the implementation process of the project's irrigation component IIMI hopes to gain lessons and insights that can provide benefits at four levels: 1) the implementation of remaining work under the ADZAP project, 2) future projects within the ADZAP region, 3) projects in other dry-zone areas of Sri Lanka, and 4) projects in other countries. At the same time, the ADZAP study provided an opportunity to work collaboratively with staff of DAS, the agency responsible for small-scale irrigation in the country. Research collaboration with DAS, as with the ADZAP project

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[1]Several terms are used synonymously in this report: "small-scale" irrigation systems is a generic size category which in the Sri Lankan context becomes "minor irrigation" to refer to systems with command areas below 80 hectares (ha). The term "farmer-managed" irrigation systems refer to systems where farmers control the water at the intake as well as in the command area. Since farmers have de facto control over minor-tank sluice gates, all minor irrigation systems referred to in this report are considered to be "farmer-managed."

overall, was viewed as a two-way relationship whereby IIMI could learn about the dynamics of the agency/project while contributing to the functions of the agency (DAS) and the project (ADZAP).

RESEARCH METHODOLOGY

A survey of a representative sample of tanks was conducted to provide an overview of the irrigation component of the project. The study sought to complement a recent socioeconomic survey conducted by ARTI (Jayasena, 1988). The IIMI study traced the development of each sample tank from the pre-project situation to headworks construction (by the Irrigation Department) and later downstream development (by DAS) and water management. Particular attention was given to the selection of settlers and the process of resettlement.

The sample of 31 locations was generated by selecting every third scheme from the DAS list of 83 ADZAP tanks where downstream development is completed, underway, or planned. This gave a sample size of 27. Six other tanks were added purposively, on the basis of previous information being available; two of the original 27 ere later dropped. Thus, the sample consists of 25 tanks which were randomly selected, supplemented by 6 additional tanks. A map showing the location of the sample tanks is given in Annex 1. Since the sample of 25 tanks included 4 where downstream development work was still ongoing this report uses a reduced sample of 21 tanks for much of the analysis. Where the status of downstream development is not an issue the full sample of 25 is used.

A questionnaire was designed for the study based partly on rapid-assessment questionnaires used by IIMI in previous studies elsewhere (e.g., in Badulla district) but considerably modified for the ADZAP context. The development of rapid-assessment methodologies is one objective of IIMI's research program on minor irrigation, and great care was taken in designing the data-gathering instruments for the ADZAP study. The questionnaire, reproduced in Annex 2, covered four general topics: 1) tank construction, 2) the settlement process, 3) the agricultural economy, and 4) irrigation operation and management. The team of two researchers (the socioeconomist and the technical assistant) devoted one day to each scheme, covering two or three schemes per week. The questionnaire was filled through field observations and group interviews normally comprising 5-10 farmers. In addition, some information was gathered from the DAS files on the sample tanks. Two narrative reports were prepared for each scheme: a technical report and a socioeconomic summary. These reports provided background material for use in the analysis.

THE STUDY AREA

Small tank-based farming systems in Anuradhapura district provide a classic example of the dry-zone irrigated agriculture that has been portrayed by a number of authors (Farmer, 1957; Abeyratne, 1956; Leach, 1961; Somasiri, 1978; and Abeysinghe, 1982). These and other studies describe a threefold land-use system comprising irrigated rice fields, home gardens, and chena cultivation. While home gardens are a near universal feature of dry-zone homesteads, a significant (and unknown) proportion of farmers exploit only one of the other two land-use systems; some farmers have irrigated land with no chena while many others have chena but no irrigated land.

The primary objective of the Anuradhapura Dry-Zone Agriculture Project (ADZAP) has been to stabilize chena cultivation and to localize it in the vicinity of minor tanks. Rehabilitation of minor tanks was viewed as the "nucleus" of the project (Medagama, 1985) in providing water for domestic use as well as for rice cultivation. The total number of minor tanks (less than 80 ha) in Anuradhapura district is estimated at more than 1400.[2] There are several hundred more that have been abandoned. Most of the tanks now in use are quite old and each is referred to as a purana wewa; other categories of tanks include a few privately owned tanks and recently constructed/ rehabilitated "settlement" tanks. The vast majority of tanks are purana wewas, the operation and maintenance of which follow the general pattern outlined by Leach (1961).

Because of their reliance on localized rainfall irrigation from minor tanks is only as secure as the rainfall in the immediate vicinity. Cultivation of the full extent of command area occurs rarely, perhaps once in ten years. The difficulty of cultivating the full extent is tied to the land expansion of minor tanks since the Land Development Ordinance in 1935. The tank command area is normally divided into three sections consisting of 1) the maha wela (also referred to as purana (old) wela), the traditional command area; 2) the akkara wela, the portion of command area that was expanded under various village-expansion programs based on the 1935 Land Development Ordinance; and 3) the nawa asvadduma, land developed under individual initiative which has stretched the overall command area to the present condition.

Because of the poor rainfall and small size of landholdings (due to fragmentation) farmers in the Anuradhapura dry zone tend to pay more attention to chena cultivation than to irrigated cultivation. Chena refers to unirrigated cultivation which is not permanent although fallow cycles vary greatly from place to place. The so called "true" chena usually refers to cultivation cycles of four to five years after which a new location is

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[2]Cited in the Economic Review of February 1986 (p. 8), based on government surveys conducted by the Ministry of Lands and Land Development and the Department of Agrarian Services.

selected and the shrub jungle is burned to prepare the fields for cultivation. In many cases the cultivation is, for all practical purposes, permanent, in that there is no shifting cycle. However, when the land fertility drops below a certain point a shift will take place. A variation of chena cultivation is seen in permanently settled areas where a three-season fallow rotation is practiced within the vicinity of a permanent homestead. Thus, three continuous seasons of maha, yala, and maha are cultivated in one plot, after which it is left fallow for several years while adjacent fields are cultivated. The yala crop of choice is gingelly (sesame) since it requires very little water and can attain maturity from residual soil moisture.

Whatever the precise pattern, chena cultivation is nearly always done in the immediate vicinity of the homestead and it is usually a group activity. While individual plots are owned separately clusters of families representing villages or hamlets cultivate in the same vicinity or move together to a new area nearby.

Nearly all the land used for chena cultivation is owned by the state and cultivated illegally. However, some farmers do hold temporary permits provided by the government (1970-77), as part of an effort to increase national food production. Permits were given to cultivation societies formed by interested farmers. Some urban people were also induced into farming at this time, and cultivated 5-10 acres (2.03-4.06 ha) each. Following the change in government in 1977, the cultivation societies were disbanded but many of the cultivators stayed on. A few of the better-organized groups also took steps to renovate tanks in the area. As with the chena land around them, most tanks, whether working or abandoned, are also owned by the government. Abandoned tanks have typically been breached so that they do not contain water unless a temporary dam is made to plug the breach. If the tank is located in an otherwise usable area, farmers will often plug the breaches with logs, dirt, and brush to create a small reservoir for cultivating 2-10 acres (0.81-4.06 ha). In other cases, where the reservoir is not usable but the command area is suitable for rice, rain-fed rice is grown. The tank bed itself is often used for rain-fed rice.

Many of the abandoned tanks which are partly functional as reservoirs were reconditioned by local farmers attracted to the area because of the tank. In some cases, farmers have done substantial renovation to these abandoned tanks, filling in the original bund, installing sluices, and digging small canal networks.

Chena cultivators do not necessarily derive from tank-based villages in the area, although many do. Some chena cultivators represent second and third generation overflow from large-scale settlement schemes in the area. Others come from urban areas, with an entrepreneurial orientation, cultivating up to 25 acres (10.12 ha). Some chena cultivators have full-time off-farm jobs and view chena as a lucrative part-time activity.

PRE-PROJECT STATUS OF ADZAP TANKS

Of the 21 tanks included in the survey sample 9 were classified as "working", prior to the project. Most of the land under the "working tanks" was owned by individuals and not by the government. Assistance through ADZAP served to increase the command area of the tanks and to allocate the new lands to farmers. The command area of the 9 "working tanks" was expanded, by raising the bund and providing new sluices and better channel systems, by extending the canal network into a new command area, or by amalgamating two "working tanks" (as in the case of Pahalagama and Kudagama).

Farmers cultivating around these 9 "working tanks" generally reported that they have not been able to cultivate the full extent of the pre-project command area for 5-10 years. Of the nine sample tanks only one was able to provide water to the new project command area. Another three tanks are likely, in the farmers' view, to provide water to the project area after further improvements (including water harvesting in the catchment) are carried out. In the remaining five "working tanks" in the sample the newly developed command areas were being used for chena. Most of the cultivators were local residents who also had irrigated land.

The 13 sample tanks which were not "working tanks" prior to the project were used for various chena activities and for some irrigation. Table 1 gives an indication of the pre-project use of the command areas of the 21 sample tanks based on farmers' recall data.

Table 1. How the pre-project lands were used (n=21).

	Command area %	Upland %
Chena*	33	57
Settled highland (early chena)*	43	29
Part chena/part highland	19	9
Part chena/part irrigated	5	-
Part chena/part left to jungle	-	5
Total	100	100

* The choice between chena and settled highland is determined by both physical factors (land shape, soil-moisture condition, and soil fertility) and socioeconomic factors (land availability and village formation).

Pre-project land tenure arrangements in the sample tank area were dominated by encroachments; very few farmers held legal title to the land they cultivated. Some other farmers (probably less than 25 percent) held official permits dating to the pre-1977 period, which they still regard as giving them a certain right to cultivate. According to farmers' recall data, more than half of the land comprising the present command areas and upland

areas of project tanks had been cultivated (generally on 2-3 year cycles) prior to the project.

The cropping pattern prior to the project reflects the soil characteristics of the command areas and the upland areas (Table 2). In general, the heavy soil of the command areas were best suited for rain-fed rice (as well as for some irrigated rice), and for crops such as chili and soya which require less water than "traditional" chena crops of kurakkan (finger millet), meneri (bullrush millet), and gingelly. While the recall information from farmers and the constraints of a rapid survey could show a definite correlation it would appear that cultivation practices and cropping patterns in the pre-project command areas offer a good predictor of a prospective tank's productivity.

Table 2. Pre-project cropping pattern; upland versus lowland (n=21).

Crops	Upland area %	Command area %
Rice (irrigated)	-	9.0
Rice (rain-fed)	.0	29.0
Rice (mix of irrigated and rain-fed)	-	10.0
Irrigated rice with some plots of traditional chena crops	-	5.0
Rain-fed rice mixed with traditional chena crops	-	29.0
Traditional chena crops	48.0	9.0
New chena crops	48.0	9.0
Total	100.0	100.0

THE PLANNING AND SELECTION PROCESS

Two types of selection processes took place under the ADZAP scheme: 1) the selection of abandoned tanks, meeting specified criteria; and 2) the selection of settlers to cultivate the new allotments associated with those tanks.

Tank Selection

Tanks selected for renovation were expected to have significant potential to support irrigated agriculture. The minimum command area under each tank was to be greater than 20 acres (8.1 ha) with a storage capacity of at least 3700 cubic meters (m^3) (3 acre-feet) for each acre (0.4047 ha) of command. A second criterion was the existence of nearby settlements to provide services and labor. Economic considerations in tank selection included a maximum investment cost of Rs 15,000[3] per acre (Rs 37,000 per ha) for upstream works (catchment, tank bed, bund, sluice, and spill) and Rs 6,070 per acre (Rs 15,000 per ha) for downstream development (land clearing, channel construction, and channel outlets). The overall investment thus appears to be about Rs 21,052 per acre (Rs 52,018 per ha). The internal rate of return for each tank was to be at least 15 percent per year.

Selection of tanks was done in some places by government officials and in other cases at the request of the beneficiaries. In the early stages of the project the project manager's office asked the Agrarian Services Officers to report on the abandoned tanks suitable for development. Most of the information was provided by cultivation officers, sometimes with the knowledge of farmers in the area. A second scenario was that a group of chena cultivators in the vicinity of an abandoned tank sent a request through a political leader, Rural Development Society, or political party branch to be forwarded to the proper authorities. The Irrigation Department compiled the preliminary "interest list" which was forwarded to the ADZAP project office. In one case, an irrigation officer was himself responsible for tank selection. In the case of the nine "working tanks" in the sample the farmers lobbied for rehabilitation of their tank rather than the development of an abandoned tank.

On the basis of interviews conducted with farmers in the 21 sample tanks, the initial request for tank selection often came from a Rural Development Society (Grama Sangwardhana Samithi). Table 3 gives farmers' responses to the question, "who first requested ADZAP assistance?"

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[3] The exchange rate in 1988 was US$1 = about Rs 30.

Table 3. Farmers' responses to the question "who requested ADZAP assistance?"

	Tanks (n=21) %
Field-level officer	5
Local farmers	14
Rural Development Society	76
Irrigation officer	5
Total	100

Settler Selection

Settler selection took place after upstream construction (tank bund, sluice, spillway, and catchment development) was completed by the Irrigation Department. People in the area were notified of a "land kachcheri" to be held for each tank separately, or in some cases for several tanks together. Officials from the Land Commissioner's Department and from the Project Manager's office participated in the selection interviews. Criteria considered in settler selection included landlessness, family size, proximity to the tank of the applicant's current residence, and cultivation history in the area. An additional implicit criterion, according to many respondents, was political affiliation.

Those selected in the land kachcheri were not guaranteed an allotment. The list could change through the influence of local political leaders. In some cases, the number of settlers selected for a given tank exceeded the number originally planned for and also exceeded the irrigable capacity of the tank.

While some qualified settlers were excluded from selection when the demand exceeded the supply, and when their political influence was weak, in other cases the number of qualified applicants was insufficient, and political selectees were given allotments for which they would not normally qualify. Table 4 presents data on how the settlers were selected, based on interview data in 21 tanks.

Table 4. How the settlers were selected.

	Tanks (n=21) %
Land kachcheri	29
Land kachcheri partly replaced by political selections	14
Land kachcheri supplemented by other selectees	19
Land kachcheri partly replaced by prior cultivators	29
All residents of the tank bed	9
Total	100

Preference for those who were already cultivating in the area prior to the project was underscored through the process of publicizing by the land kachcheri. Notices were posted at prominent places near the project site to attract those in the area. Short-listing applications was in the hands of the Member of Parliament. The protracted process of selection provided many opportunities for deleting names and substituting others, for various reasons. Once selected, the allotments (one acre [0.4047 ha] of irrigated land and 3 acres [1.22 ha] of upland) were distributed by lot. While the number of settlers depended on the area of land available for cultivation under each scheme, in a few cases additional allotments were made through political pressure. In one case, a planned command area of 40 acres (16.19 ha) was extended by 17 acres (6.88 ha) to accommodate additional settlers.

Local cultivators were given preference in the selection. In 64 percent of the sample tanks a majority of settlers comprised pre-project cultivators. However, the farmers' claim to prior cultivation of the land was difficult to substantiate in the interviews, since there were various shades of meaning, depending upon the type and intensity of cultivation in the pre-project context. Settler selection based on prior residence in the project area was more clear-cut. In a few cases, there were more prior residents than could be accommodated in the new scheme. In such cases, some selectees were allotted only upland areas. In two cases, the size of upland allotments was reduced from 3 acres to 2 acres (1.22 ha to 0.81 ha) in order to accommodate all those with a prior claim to having cultivated the area.

An interesting case was that of Kunchikulama where 40 settlers were given normal-sized allotments (1 acre [0.4047 ha] irrigated and 3 acres [1.22 ha] upland) and 37 other settlers were given 2-acre (0.81-ha) upland allotments only. However, the total number of settlers who actually cultivated their allotments, either lowland or upland, was 18. This number includes those who constructed houses in their upland allotments as well as those who cultivated from a distance. One such farmer was the farmer representative who lived 4 miles (6.44 km) away. Another farmer in the same situation was the president of the Rural Development Society in the area who lived 3 miles (4.83 km) away. Rather than uproot his own family he asked another family to reside in his allotment on his behalf.

The large number of settlers who were allotted only upland areas with no irrigated land points to problems in the selection process. Those without allotments in the command area are not officially recognized as "project people" although they are project beneficiaries (since they have been allotted upland plots). Without official project status they are not entitled to credit and other benefits available to full-fledged selectees.

The low rate of actual settlement in the allotted lands following selection, also points to problems which, as will be discussed in a later section, have consistently plagued the project. While the root cause of many of the problems in the rate of settlement may be traced to undue political influence that issue was not addressed directly in this study. Rather, this study attempted to document the status of settlement and to characterize features of both the settlers and the irrigation systems, which can explain the current status of the project.

The distance between the settlers' original village and the new settlement was anticipated to be a major factor in the rate of settlement. However, the number of selectees who actually settled is not explained solely on the basis of distance. Table 5 gives aggregate data for all 41 of the villages which provided settlers to the 21 sample tanks. While it is clear that very short distances (less than 1 mile [1.61 km]) have a higher rate of settlement, quite distant villages (greater than 4 miles [6.44 km]) show a higher rate of settlement than those in the 2-3 mile (3.22-4.83 km) range.

Table 5. Rate of settlement by distance between original residence and settlement location (aggregate data from the 21 sample tanks).

Distance (miles)[a]	No. of villages	Total no. selected	Total no. selected	% Selectees who have settled
< 0.5	16	482	272	58
0.5 - 1.0	5	115	64	58
1.0 - 1.5	4	31	14	45
1.5 - 2.0	3	120	78	65
2.0 - 2.5	2	27	2	7
2.5 - 3.0	7	99	32	32
3.0 - 3.5	1	20	0	0
> 4.0	3	180	89	98
Total/average	41	1074	551	51 (Average)

[a] 1 mile = 1.609 km

PROJECT IMPLEMENTATION

Rehabilitation of minor tanks under ADZAP involved 3 components: 1) upstream development carried out by the Irrigation Department which included surveying, engineering design, and repair and construction of tank bunds, spills, and sluices; 2) downstream development work undertaken by DAS including land clearing and construction of channel networks; and 3) implementation of 20 "pilot schemes" for water management, also undertaken by DAS. Downstream development consisted of two phases, jungle clearing and initial land leveling (Phase I) and construction of field channels and outlets (Phase II).

Although construction of the main canal leading from the sluice was the responsibility of the Irrigation Department, in some cases it was left for DAS to perform the task. In other cases, the Irrigation Department constructed field channels in addition to the main canal, thus going beyond their mandate.

While downstream development was the responsibility of DAS the intent was that certain tasks would be undertaken by the farmers themselves under the overall guidance of the cultivation officer. During the first years of the project farmers were given the option of clearing their own lands and receiving a payment or asking the project's contractor for that scheme to do the land clearing. In more recent years (since 1986) farmers have not been consulted about this and all work was given to contractors. The justification for this practice was that farmers took too much time to complete the work and were unable to level some of the more difficult lands without machinery.

Upstream development works were constructed by the Irrigation Department prior to selection of settlers. As a result, using settler labor was not a policy although residents of the area were often hired as laborers and the same people became beneficiaries later on. However, at this time most of them were not certain that they would be selected. The downstream development work carried out by DAS tended to use beneficiary labor to a great extent but even here it was not a requirement that the contractors hire beneficiaries.

Private contractors undertook all the actual work of construction both in upstream development and in downstream development. The role of the Irrigation Department and DAS was to design and supervise the work. Contractors included private individuals, Rural Development Societies, or combinations of these (e.g., when a Rural Development Society sub-contracted to a private individual).

Upstream development in working tanks was a relatively easy undertaking. Generally the bund and spill were raised slightly and strengthened. Abandoned tanks required considerably more effort, that is, to repair the breach, install a spill and sluice, and rebuild the bund. In most of the

sample tanks, the tank bund was raised by more than 50 percent. Extensions to the length were less dramatic and in about one-third of the cases there was no change in the length. The nine "working tanks" in the sample had existing sluices but none of the abandoned tanks had sluices in place prior to renovation. With two exceptions the sluices in the "working tanks" were of the tower type, installed within the last twenty years by the Irrigation Department. The two exceptions to this were "junction block" type sluices. These were replaced with new sluices and three of the tower sluices were also replaced. The major work done in the sample tanks is given in Table 6.

Table 6. Major features of upstream development in sample tanks (n=26).

	% of tanks
Bund, sluice and spill	27
Bund, sluice, and part of main canal	8
Bund, sluice, spill, and entire main canal	38
Bund, sluice, spill, main canal and field-channel outlet structures	27
Total	100

Contractors

Nearly all irrigation development work was carried out by private contractors. In 81 percent of the 21 sample tanks the contract work was actually done by the Irrigation Department technical assistant who made use of a non-departmental individual's name to disguise his own involvement as contractor. In the remaining 19 percent of the tanks private contractors did the work without the technical assistant's involvement.

As mentioned above, farmers' involvement in the upstream construction was minimal since settlers were not even selected at the time the construction work was carried out. However, many of the eventual beneficiaries who were living in the vicinity were employed during the construction but they had little or no input into the design or placement of structures.

One of the critical steps in both tank selection and later development is the calculation of the catchment area so that the water harvest can be estimated. The procedure followed by the Irrigation Department is outlined in Ponrajah (1984) and is based on the topographical maps (1:63,000 scale) available from the survey office. The catchment boundary is traced on the map according to the contour lines. However, since the contour interval for these maps is 100 feet (30.48 m) and the terrain within the project area is relatively flat, there are many cases where the entire catchment area has less than 100 feet (30.48 m) of vertical variation. Estimates based solely on the map without field investigation are highly inaccurate, yet they were

accepted in practice in project planning.[4] Problems arising from overly optimistic assumptions about the catchment area are discussed in later sections of this report.

Role of the Department of Agrarian Services

The Department of Agrarian Services (DAS) was responsible for downstream development work including land leveling, bunding, construction of field channels, and some irrigation structures. The work was carried out by the DAS staff themselves, by contractors, or by farmers. As mentioned earlier, the initial plan for farmers to undertake the work of the land leveling and command area development work did not prove effective. After 1986, DAS hired private contractors to take on the more difficult aspects of land development work which involved special equipment (e.g., tractors and bulldozers) and deducted a per acre charge from the payments to farmers. According to ADZAP policies, farmers receive Rs 2000 for land development in their two-acre irrigated plots to cover the full cost of land development. A portion of this was paid to farmers according to the work which they themselves carried out.

Construction of field channels and pipe-outlets comprised the primary role of DAS in downstream development. However, only on 24 percent of the tanks (n=21) were field channels and outlets installed. In the remaining 76 percent, the major DAS involvement was to reconstruct work done one or two years earlier by contractors under the Irrigation Department's supervision. Thus, much of the DAS work was tied up in reconstruction work which should have been already completed by the Irrigation Department.

Time delays between the Irrigation Department's work and the DAS work were a factor in the need for repairs to Irrigation Department structures. The average time gap between the completion of Irrigation Department work and the start of the DAS work was roughly three years.[5] During the intervening years both erosion and vandalism took their toll. Apart from the time delays there were other reasons for the Irrigation Department's structures to be improved by DAS. Poor quality construction by some contractors or miscalculations in design, or both, as well as misplaced turnout structures within the command area, all served to divert the resources of DAS from the

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[4] This procedure is not approved in the Irrigation Department's manual, but is accepted in practice. The relevant excerpt from the manual (Ponrajah 1984:9) is: "Where contours are not available in the map, the boundary is drawn by taking into account the direction of facing of tanks within the catchment, the direction of flow of drainage lines, the lay out of paddy fields and other such features (sic). In difficult cases field inspection will be required to establish the boundary with any degree of accuracy."

[5] Based on farmer interviews and corroborated by DAS officials but not checked against written records.

downstream work which was their intended responsibility. As with the work overseen by the Irrigation Department, DAS used contractors to implement downstream development. Preference was given to Rural Development Societies as per project guidelines, but in practice, the Rural Development Societies often subcontracted to private contractors. Table 7 gives the breakdown for DAS contracts based on farmer interviews.

Table 7. Contractual arrangements for downstream development work in ADZAP sample tanks (n=21).

	% of tanks
Rural Development Society (alone)	5
Rural Development Society, sub-contracted to a private contractor	24
Rural Development Society, sub-contracted to an officer	14
Private contractors	57
Total	100

In contrast to the construction of headworks, which was done before beneficiaries were selected, the downstream-development phase of the project attempted to involve farmers in the construction work. However, as noted earlier, this practice changed during the later stages of the ADZAP project, and a relatively greater portion of the downstream development work was tendered to private contractors. Part of the reason for this shift in practice appears to be the farmers' inability to carry out the intended land leveling without mechanized equipment; a second reason was the delay in waiting for farmers to clear the land. In many cases, farmers were reluctant to settle in the allotted lands in the project (indeed this is a major problem with the project which will be discussed in a later section).

In several of the more recent ADZAP tanks, farmers were not consulted, and did not know whether their command area would be leveled and cleared by a contractor or whether they were expected to do it. As the project completion date drew near, project management was concerned the funds would not be utilized in time, and so resorted to contracts as the fastest way to finish the work. Table 8 summarizes farmers' participation in construction work, both for "upstream" development and "downstream" development.

Of the 21 sample tanks, land development in 16 was done entirely by the settlers under the original policies of the project, i.e., that settlers were responsible for land development. In four other tanks, the major work of land development was done by private contractors, with some farmer consultation. These four cases represented a change in project policy, as discussed above. In one other case work was undertaken by contractors, but farmers were not consulted.

Table 8. Farmer participation in ADZAP tank development in sample tanks (n=21).

	%
Irrigation Department	
No participation	24
Channel construction only	28
Bund and channel construction	28
Total	100
Department of Agrarian Services	
Land clearing	19
Land clearing and channel construction	81
Total	100

Farmer representatives were selected at meetings organized by DAS while downstream work was still in progress. Thus, settlers had a spokesman through whom they could make their suggestions known regarding downstream-development work.

STATUS OF IRRIGATED AGRICULTURE IN THE SAMPLE TANKS

The 21 sample tanks varied considerably in the number of seasons they had been in operation. Since the sample was chosen systematically the ages of the irrigation systems should be representative of the project as a whole. In four other tanks downstream development was still being undertaken (Table 9).

During the 1988 yala (dry season) irrigated cultivation took place in only 4 of the 21 tanks (19 percent). With the exception of one tank in which 37 percent of the command area was irrigated the cultivation in the irrigated portions of the command areas was limited to a few hectares (2.03, 0.81 and 1.02 ha [0.5, 2.0, and 2.5 acres]). In five other tanks gingelly was cultivated in the command area as well as in upland areas (during the 1988 yala).

Table 9. Number of seasons since completion of downstream development in ADZAP sample tanks (n=21).

No. of seasons	No. of tanks	% of tanks
0	4	19
1	1	5
2	2	10
3	5	24
4	7	33
5	1	5
6	1	5
2.8 (Average)	21 (Total)	100 (Total)

During the 1987/88 maha (wet season) cultivation took place in the command areas of 7 of the 21 tanks (33 percent). However, in many instances, the command area cultivation was rain-fed rather than irrigated. While poor water availability was the main factor in not irrigating there were also cases where water availability was sufficient but farmers did not irrigate. For example, in Thimbalawa water was available in both maha 1987/88 and yala 1988. During maha, only 37 percent of the area was cultivated by 75 percent of the farmers. If the remaining farmers had cultivated an additional 35 percent of the areas could have been cropped. Here the problem was not lack of water; it was a problem of settlement.

In a number of other tanks the primary constraint to cultivation was a technical, rather than a settlement issue. An example is Katugampoligama tank where the catchment is adequate but the tank bund is so permeable that the water drains out before it can be utilized. A similar problem is met in Rambawewa where the bund was constructed very quickly by a private

contractor without adequate attention to the consistency of the earth in the bund (according to settler interviews). In spite of repairs attempted by the Department of Agrarian Services, seepage of water slowly drains the tank.

An additional problem in Rambawewa is the level of the main canal which is too low to irrigate the extreme head-end portions of the intended command area while the capacity of the canal is too small to send water reliably to the tail end. The Rambewewa farmers did not irrigate any of the command area during the 1987/88 maha or in the 1988 yala. Farmers claimed they could have cultivated 40 percent of the command area during yala with the existing tank water if the tank bund and channels had been constructed properly.

Lack of water in the tank catchment was the most common problem encountered in the sample tanks. While rainfall was somewhat less than normal in the area a more critical constraint than this lack of rainfall was the insufficient catchment area. Most of the farmers interviewed in the sample tanks expressed little hope that they would ever see the full extent of the "true" cultivable areas under their tanks, as a percentage of the official command area.

Table 10. Farmers' estimates of the potential irrigable area.

% of official irrigable area	No. of tanks	% of tanks
Less than 50	4	19
About 50	9	43
Between 50-75	6	28
100	2	10
Total	21	100

Farmers' estimates of the potential irrigable area (Table 10) is supported by the estimate of a DAS Technical Assistant that 60 percent of the sample tanks have catchments insufficient to support the planned command area. Poor rains during the two seasons for which data were collected (maha 1987/88 and yala 1988) constituted a factor in the unusually low extent of cultivation (Table 11). In some tanks, cultivation had been carried out successfully prior to the 1987/88 maha but not since then. One such case is the tank of Nelunkanniya-Halmillawa where farmers' cultivated 100 percent of the command area during the 1984/85 maha but nothing since then. The explanation given for the 1984/85 success was the guidance of the DAS officials who used the tank as a pilot project. Farmers took only 3 water issues from the tank and used the rains for land preparation. Following this experimental season the rains were inadequate and farmers claimed that the interest of the DAS officials also lagged.

Rainfall within the project area varied substantially in different areas of the district. In general, rainfall was higher towards the southern parts and in the northern parts where there is relatively more dense vegetation in the catchment areas, the water situation was better than in the central parts (near Anuradhapura city) where the combination of low rainfall and deforested catchment resulted in particularly scarce water supplies.

Many of the sample tanks, even some with relatively good catchments, showed little cultivation because of problems in the settlement process (discussed below). In the case of Kumbuwewa tank (northeast region of the district), there is a good water source but project development had been delayed due to problems with tendering the contracts. In the case of Rambawewa tank, in the southern part of the district, the water availability is good but the water retention capacity of the tank is poor (as noted above).

Irrigated Cultivation Outside the Project Area

While figures on outside cultivation are somewhat unreliable due to farmers' reticence on this topic, it appears that many farmers do have irrigated land outside the project area. A rough estimate is that 30 percent of ADZAP allottees have irrigated lands outside the project although the proportion varies considerably in different areas. In some of the working tanks renovated under ADZAP (e.g., Pimburellegama) farmers have lands in both the pre-existent command area as well as in the new project area. In other cases, the ADZAP tank is located near an existing village (and tank) and settlers have some land in both locations.

STATUS OF UPLAND DEVELOPMENT

Upland development was carried out by the project and included "jungle clearing", demarcating boundaries, disking the soil, making ridges to protect against soil erosion, and road construction. Although in the early stages of the project farmers were reimbursed for their labor in carrying out some of these tasks the practice at the time of this survey (June-September 1988) was that all work was tendered to contractors. Tables 11a and 11b illustrate the cultivated command area in ADZAP sample tanks based on farmer interviews.

Table 11 a. Cultivated command area in ADZAP sample tanks (n=21), during yala 1988.

	Irrigated acres cultivated	Unirrigated acres cultivated	Total	Percent of command area	Crops grown
1. Elapathgama	-	-	-	-	-
2. Anduketiyawa	-	-	-	-	-
3. Bogodawewa	-	-	-	-	-
4. Godogahawewa	-	-	-	-	-
5. Ittawa	-	-	-	-	-
6. Maradankalla	-	-	-	-	-
7. Munasinghe Wewa	-	-	-	-	-
8. Nelunkanniya-Halmillawa	-	-	-	-	-
9. Kabaragoaya Wewa	-	-	-	-	-
10. Kimbulwewa	2.2	-	2.2	2	chili
11. Kiralapetiyawa	-	-	-	-	-
12. Madangaswewa	2.0	-	2.0	4	rice
13. Mahathammannawa	-	15.0	15.0	22	gingelly
14. Pahalagama-Kudagama	-	36.0	36.0	87	gingelly
15. Pahalamawatha Wewa	0.5	-	0.5	18	rice
16. Pimburellegama	-	-	-	-	-
17. Randoowa	-	12.0	12.0	46	gingelly
18. Rambawewa	-	-	-	-	-
19. Sivalpitiya	-	-	-	-	-
20. Talgaswewa	-	50.0	50.0	96	gingelly
21. Thimbalawa	20.0	-	20.0	37	rice
Total/average	24.7	113.0	137.7	14.8	

Table 11 b. Cultivated command areas in ADZAP sample tanks (n=21), during maha 1987/88.

	Irrigated acres cultivated	Unirrigated acres cultivated	Total	Percent of command area	Crops grown
1. Elapathgama	-	-	-	-	-
2. Anduketiyawa	23.0	-	23.0	53.0	rice
3. Bogodawewa	-	-	-	-	-
4. Godagahawewa	-	-	-	-	-
5. Ittawa	10.0	-	10.0	17.0	rice
6. Maradankadalla	-	-	-	-	-
7. Munasinghe Wewa	-	-	-	-	-
8. Nelunkanniya-Halmillawa	-	-	-	-	-
9. Kabaragoya Wewa	-	-	-	-	-
10. Kimbulwewa	4.0	-	4.0	4.0	rice
11. Kiralapetiyawa	2.0	-	2.0	2.0	rice
12. Madangaswewa	-	-	-	-	-
13. Mahathammannawa	-	-	-	-	-
14. Pahalagama-Kudagama	-	-	-	-	-
15. Pahalamawatha Wewa	-	-	-	-	-
17. Randoowa	-	26.0	26.0	100.0	rice
18. Rambawewa	-	-	-	-	-
19. Sivalapitiya	-	-	-	-	-
20. Talgaswewa	-	10.0	10.0	19.0	rice
21. Thimbalawa	40.0	-	40.0	74.0	rice
Total/average	79.0	36.0	115.0	12.8	

The study found remarkable progress in upland cultivation even where the rate of settlement was relatively low. In general, the status of upland cultivation was far better than that of irrigated cultivation. Table 12 summarizes cultivation in the sample during maha 1987/88 and yala 1988.

Table 12. Cultivation extent in upland areas of ADZAP sample tanks (n=21) during maha 1987/88 and yala 1988.

Name of tank	maha 1987/88 Total acres	maha 1987/88 Cultivated acres	yala 1988 Cultivated acres
1. Elapathgama	249	0*	-
2. Anduketiyawa	123	80	70
3. Bogodawewa	84	84	58
4. Godagahawewa	219	0*	-
5. Ittawa	162	137	135
6. Maradankalla	96	75	60
7. Munasinghe Wewa	177	0*	120
8. Nelunkanniya-Halmillawa	78	78	80
9. Kabaragoya Wewa	141	40	-
10. Kimbulwewa	318	288	288
11. Kiralapetiyawa	288	156	288
12. Madangaswewa	153	50	50
13. Mahathammannawa	240	234	150
14. Pahalagama-Kudagama	123	50	-
15. Pahalamawathawewa	129	50	-
16. Pimburellegama	171	0*	30
17. Randoowa	78	78	-
18. Rambawewa	213	191	78
19. Sivalapitiya	99	0*	-
20. Talgaswewa	177	177	-
21. Thimbalawa	162	128	150
Total	3480	1896 (54%)	1557 (46%)
(Total excluding land under development)	2565	(74%)	(51%)

* Land recently developed or under development.

The dominant crop grown during yala in all tanks was gingelly. In Kabaragoyawewa, a small extent of chili was also grown. During maha, maize was the major crop; other crops included soya, mung, cowpea and chili. Upland cultivation practices were similar to chena cultivation; fertilizer was used only in a few cases but some high-yielding varieties were used, particularly maize.

The consensus among farmers in 8 tanks of the 17 sample tanks where there had been cultivation was that their upland cultivation is more productive than their former chena cultivation. Farmers in seven other tanks felt that their current upland cultivation was not as good as chena since the soil is no longer fertile in project lands (due to continuous chena cultivation before the project). Some farmers pointed out that the three-acre (1.22 ha) project allotments were smaller than their old chena plots.

Farmers in two tanks claimed there was no difference in the productivity of their old practices and the current upland agriculture. In general, the settled farmers managed to survive within the project area depending mostly on upland cultivation rather than on irrigated rice.

STATUS OF SETTLEMENT IN THE SAMPLE TANKS

Settlement of the people allotted lands in the project is the single most critical condition for successful implementation of the project. In the original planning for the project, settlement was presumed to be an automatic process; beneficiaries would move once they had been allotted land. In practice, however, the intended beneficiaries have demonstrated a marked reluctance to leave their current residences and establish a new home within their allotted tank area.

The process of settlement may take days or years depending upon the circumstances of the settler family. Thus, it is difficult to measure the rate of settlement or to calculate precisely the number of true settlers. Many of the houses in the upland residential areas are no more than storage sheds for temporary cultivation by farmers who still reside in their pre-project homes. Many of these farmers will settle permanently after a period of time; others will never move and their allotments may lie idle until a new family is selected to replace them.

The study identified three general categories of settlers (Table 13). The first category comprises those who are permanently settled, and consider the project area as their new village. The second, and by far the largest category, consists of allottees who have taken up residence in the project but cultivate their upland allotments, attending their fields from their current residence. Typically, they have constructed temporary huts and visit their fields regularly during the cultivation season. The third category consists of allottees who have neither moved their residence nor cultivated their project lands. In some cases, this third category blends into the second with bits of cultivation carried out in the project area but with no more care taken than in a traditional chena plot.

The categories are not permanent and individuals who are in category 3 one year, may decide to move into the project (category 1); similarly, a person in category 2 may decide to shift his attention elsewhere and fall back to the third category. These decisions are based upon a complex of factors, including the quality of the project land itself (e.g., soil fertility) or the particular locality (e.g., availability of drinking water, health services, problems with elephants), or opportunities available elsewhere that may attract the allottee away from the project (e.g., off-farm employment, other land).

Table 13. Status of settlement, by tank (n=21).

Tank name	No. allotted	No. settled permanently	No. partly settled	No. not moved
1. Elapathgama	83	34	30	19
2. Anduketiyawa	41	30	-	11
3. Bogodawewa	38	38	-	-
4. Godagahawewa	73	38*	-	-
5. Ittawa	58	23	35	-
6. Maradankalla	33	26	4	3
7. Munasinghe wewa	59	4	-	55
8. Nelunkanniya-Halmillawa	29	15	10	4
9. Kabaragoya wewa	47	30	-	14
10. Kimbulwewa	106	56*	50	-
11. Kiralapetiyawa	96	70	-	2
12. Madangaswewa	51	33	26	20
13. Mahathammannawa	80	54	-	2
14. Pahalagama-Kudagama	41	10	-	31
15. Pahalamawathawewa	43	11	-	12
16. Pimburellegama	41	-	-	41
17. Randoowa	26	10	-	-
18. Rambawewa	71	36	-	12
19. Sivalapitiya	33	14	-	1
20. Talgaswewa	50	-	-	50
21. Thimbalawa	54	36	-	2
Total	1153	566	284	303
Percent	(100)	(49)	(25)	(26)

* Distinction between permanently and partly settled is not clear; figures given represent a best guess, based on visual inspection of the homestead area and group interviews with settlers.

Of the 1153 allottees in the 21 sample tanks just over quarter had not moved at all; a quarter were only partly settled in their respective project areas (Table 13). Two reasons can be given for not taking up residence in the project area. First, many allottees have other options which are preferable to taking up residence in the project and leading a wholly agricultural life. This category can be viewed as a function of settler selection; simply put, the wrong people were selected. The second reason allottees have not settled has more to do with the facilities in the project than with the allottees themselves. If there is no water in the tank, no wells for drinking water, or no school or medical facilities prospective settlers become reluctant to take up residence. Other factors have to do with technical problems such as underestimating the catchment or poor construction of the tank bund. And some factors have to do with planning and implementation of the various project components or with overall project management. Thus, wells may be lacking through oversight rather than by design and projects may have been selected without checking the availability

of services in the area. These two sets of reasons are described under the following headings: Settler Selection and Project Facilities.

Settler Selection

Selection criteria for project allottees included landlessness, a history of farming as the only means of livehood, and previous (pre-project) use of the project land for agriculture. In practice, however, the selection process allotted lands to many people who did not fit this ideal picture, such as people with permanent houses and land in other villages, with full-time nonagricultural jobs, or who lived in Anuradhapura township and sought employment there. To some extent the selection criteria themselves were inconsistent. Preference for previous residents of the project area implied that those engaged in chena activities would be given first priority. However, chena was often a subsidiary activity in a complicated household economy which included off-farm jobs and those so employed were reluctant to lead a life of full-time agriculture.

Many of the people allotted lands in Kunchikulama, for example, had earlier used the land for chena cultivation but their more important income came from other sources. Their original village is near the Anuradhapura-Mihintale road and many commute to work in Anuradhapura. Others are engaged in cattle rearing and milk production for the Anuradhapura market. As discussed earlier, even the designated farmer representative of the new project continues to reside in his house near the road where he has relatively easy access to his job in Anuradhapura. Many allottees regard the project as a regularization of their informal chena lands where they can continue to pursue part-time cultivation but have no immediate intention of moving there. Some of these absentee allottees noted that their children would settle in the project lands after their marriage.

Political favoritism is one of the underlying causes, although certainly not the only one, of inappropriate settler selection. The normal procedure was that the final list of allottees had to be approved by the respective Member of Parliament. In this process, the list prepared from the land kachcheri (when prospective allottees were interviewed by the GA or his representative) was often revised on the basis of recommendations made by local political supporters. As noted above, this process sometimes resulted in too many names for a particular project, and in some cases, a category of "nonproject" people was created which consisted of previous chena cultivators in the area who were given upland plots, but no command area allotment, and none of the rights accruing to the "project" people. This situation creates economic disparities at the outset and jeopardizes the later formation of a true sense of community among the settlers.

Project Facilities

Provision of tank water is fundamental to the logic of the ADZAP settlement process. It was assumed that the allottees would not settle on their new lands unless the tank was completed so that water would be available both for irrigated agriculture and for domestic uses. Farmer statements supported this assumption although the presence of many settlers in tanks which had never been used for irrigation suggests that the domestic uses are at least as important in attracting settlement as is irrigation. To some extent, adequate provision of other facilities can compensate for lack of tank water in rendering the project area an attractive place to live. Tube wells for drinking water, access roads, and housing loans were some of the project's incentives.

The most commonly cited deficiency in the facilities provided was domestic water; this was the dominant reason given for the relatively low rate of settlement in 19 percent of the sample tanks (Table 14). Provision of other facilities was not viewed as critical but certainly contributed to the settlement rate. Even when facilities were provided, however, they were often poorly planned or were situated so that the politically powerful could benefit most; for example in Rambawewa, one of the two tube wells provided for 71 allottees is located on the allotment of the farmer representative.

Table 14. Dominant reason why allottees have not settled in ADZAP sample tanks (n=21).

	No. of tanks	%
Adequately employed in original village	10	48
Original village is near the project	3	14
Lack of facilities in project area	1	5
Lack of domestic water in project area	4	19
Total	21	100

Opportunities for off-farm employment were also a consideration in the attractiveness of the project area. Although there were some urban-oriented employed allottees the majority were farmers from dry-zone communities in the area. Most had longstanding contacts or friends and relatives in the neighboring communities, through chena and other activities. These people had always pursued a diversified set of activities including gathering fire wood, construction labor, and fishing. They depend upon their network of contacts or their home communities to support these subsidiary livelihoods. Moving into a new project area, even if quite close, has an effect on these longstanding relationships. Those who are particularly dependent upon off-farm employment are reluctant to move into the project area and take up farming as a full-time activity.

The dynamics of the settlement process can also be investigated by considering cases that have been highly successful in attracting alottees.

A case in point is the tank of Bogodawewa where the rate of settlement was 100 percent. All the settlers were selected from a village near the tank and comprised relatives of those villagers. In a real sense, the project was viewed as an expansion of the pre-existing village which would accommodate some of the population overflow. Social and economic relationships were easily maintained while the project gave the new settlers access to facilities (e.g., a tube well) which they had not enjoyed in their original village.

Field officers attached to the project often complained that settlers were more interested in the short-run benefits of the project such as loan facilities and the food rations. There is certainly some truth to this perception; not only the food rations but the downstream development work (for which they received payment) provided settlers with employment and assurance of food for a certain period. But not all settlers run after short-term benefits and depend on the state for services and provisions. The status of upland development and cultivation appears remarkable in contrast to the low rate of settlement and the limited irrigated agriculture. With little else to support them, these farmers need the upland and have devised strategies for irrigation (from wells) and careful dry-land cultivation to grow crops for cash as well as for subsistence.

However, it is clear that unless the allottees believe that their project situation will be a substantial improvement over their existing situation, they will be understandably reluctant to leave their villages and move to the new area. In the case of those who have access to permanent houses and lands it is obvious that they would not move. But even those who live on a plot of 0.25 acre (0.11 ha) with no access to a house other than a thatched hut may still prefer to stay where they are rather than lose the working relationships they have established over the years. Others who have permanent houses and a source of income hope that once their children are married and want a separate place they would come and settle. Until then the project land will be used as an additional asset to the family.

SUMMARY AND CONCLUSIONS

The most striking observation gleaned from the survey is the importance of upland cultivation. In the 21 sample schemes, the average cropping intensity was 51 percent during yala 1988, and 74 percent during maha 1987/88.[6] The corresponding figures of irrigated cultivation intensity in the command areas are 15 percent (yala) and 13 percent (maha). There appears to be several reasons for the low proportion of command area actually utilized. Part of the explanation is that new upland is easier to put into cultivation whereas land shaping in the command area requires more labor. A return visit after one or two years would probably show a more favorable picture. However, in most tanks the problem is not a temporary lack of labor but a permanent lack of water. Catchment areas appear to have been overestimated in many cases; the planned command areas are generally too large, often by more than 50 percent. Other technical problems include porous tank beds and errors in the levels or placement of sluice gates, canals, or outlets.

Chena cultivation continues to play an important role in the agricultural strategies of the settlers. It is not clear whether this represents a "settling-in" process that will stop when the fertility of the current chena fields is depleted (i.e., within the next 1-2 years) or whether chena will persist as a permanent feature in the farming system of the settlers.

The proportion of allottees who have actually settled is a surprisingly low 20 percent in completed schemes. This figure needs to be disaggregated according to the age of the scheme to show the extent to which settlement rates improve with time. The reasons given for not settling varied by scheme, and allottees questioned on this were those who had settled, rather than those who had not. Nonetheless some patterns can be discerned. Selection of allottees who have other means of support was one problem but also important was the location of their present home. People who live near a road are unlikely to give up their access to markets and services, at least while services are problematic in the new settlement. Lack of infrastructure (e.g., drinking water, schools, and hospitals) and problems with elephants or wild pigs were also commonly cited.

The study asked a number of questions about how the project was initiated in a particular situation, how allottees were selected, and how the construction was carried out. In two-thirds of the schemes, a rural development society or political party requested the project, rather than the (chena) farmers in the area. Farmers typically (in 83 percent of the cases) learned about the project only after construction work began, although

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[6] These figures exclude two tanks during yala, and five tanks during maha, where upland development was still underway and cropping intensity was nil for this reason.

many of these same people became beneficiaries at the time of allottee selection.

Some Policy Implications

Two sets of policy implications can be gleaned from this study: 1) greater emphasis should be given to upland cultivation, particularly in the early stages of project development; and 2) farmers should be involved from the very outset of the project in planning, designing, and constructing their irrigation facilities.

Upland development. One of the surprising findings of the survey was the intensity of upland cultivation, and particularly irrigated upland, using diesel pumps from open wells. In some of the sample schemes the irrigated upland area exceeded that of the irrigated command area. Some farmers were able to irrigate one-half to one-third of an acre of high value vegetables and fruit trees providing both food and cash. While the study did not document upland irrigation systematically (since its importance was not anticipated) it is clear that at least in some locations the use of groundwater to irrigate upland areas is economically feasible. The extent which can be supported and the possible drawdown effect on the tank supplies are important issues to investigate. It is quite possible that under certain soil and groundwater conditions the most productive use of the tank will not be surface irrigation but groundwater recharge to support upland wells. The tank command area might be used for maha rice that would be irrigated minimally from the tank, preserving the major portion of groundwater recharge for yala.

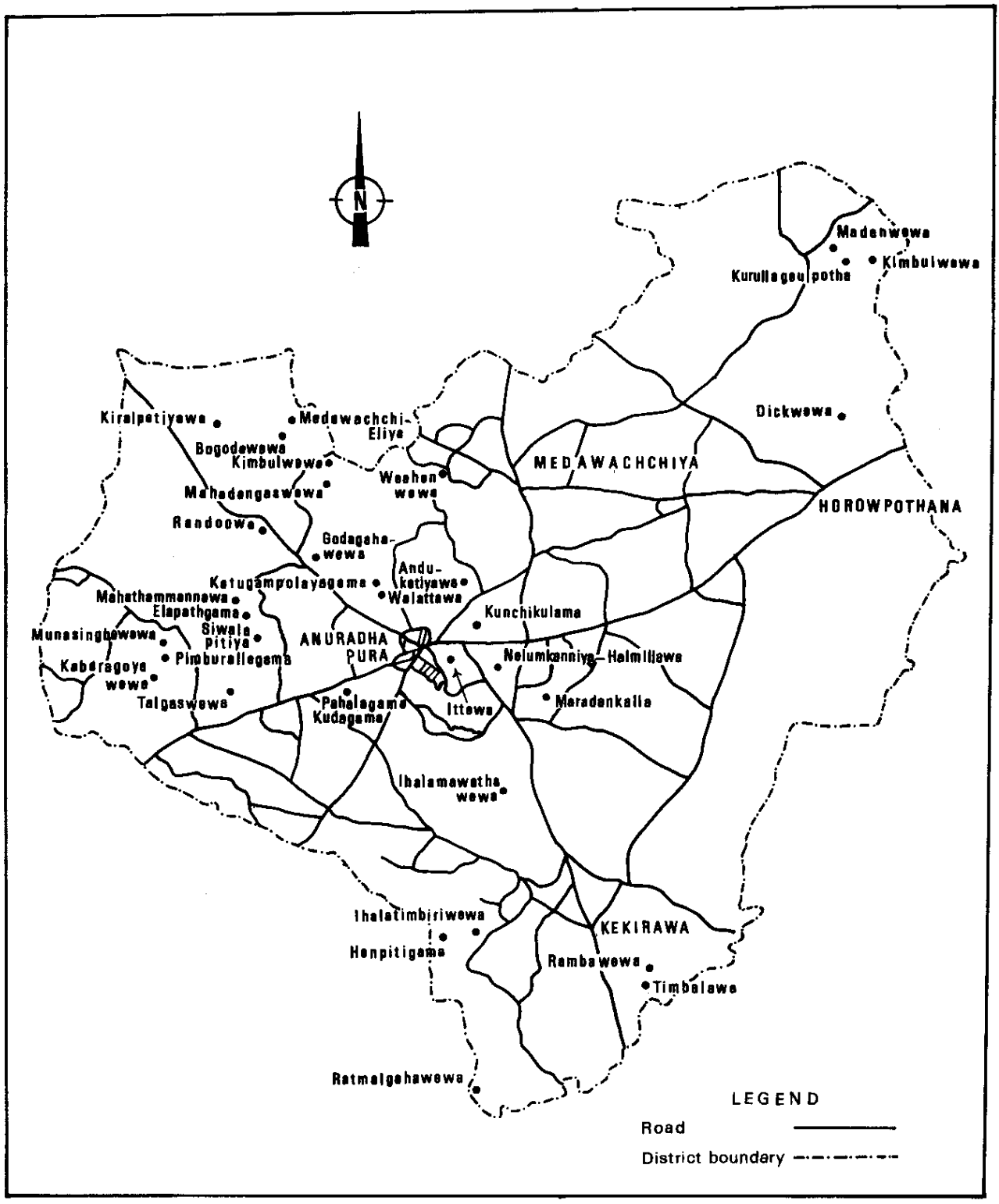
Farmer participation. One of the lessons of this study is that new settlements involve a very complex process even in the case of resettlement distances of only a few kilometers. Providing the services which allottees expect and require if they are to become true settlers is a strain on the agencies providing the services. At the same time, the existence of abandoned tanks in the midst of chena areas suggests the logic of resettlement around refurbished tanks. One policy implication for developing the agricultural economy in this context is to seek ways to involve the beneficiaries in more tasks over a longer period of time, allowing some of the natural "settling-in" process to occur while investments are still being made.

An underlying assumption of the ADZAP project has been that the intended beneficiaries would not settle until they see water in the tank. In fact, many of the sample tanks had little or no water for several seasons, but had productive upland development. Emphasizing upland development first and irrigated development afterwards, might help reduce the total costs of tank refurbishment by using settlers' labor. Guaranteed employment in tank construction might be a greater incentive to would-be settlers than tank water per se.

An approach that begins with the organization of the beneficiary farmers, rather than with the construction of the tank bund would have significant implications for the work of the implementation agencies. The use of social organizers would probably have to precede any other type of agency intervention, to identify the beneficiaries, so that the farmers would be in a position to take advantage of the labor opportunities of the project. Interaction between farmers and representatives of the agricultural line agencies (Irrigation and Agrarian Services) would result, after a long process, in an agreed plan for a tank -- its location, construction, contractors, and labor. Initially, such an approach might be slower than if construction is carried out prior to selection of beneficiaries but over the medium and long term, a participatory approach may outpace and outproduce a construction-oriented approach.

Whether a participatory approach is feasible in the Anuradhapura conditions is an open question and one which IIMI's future research will seek to address. The National Freedom From Hunger Campaign (FFHC) has been working in the vicinity of Thanthirimaly for the past several years where several ADZAP tanks are also located. The participatory, manual-labor approach has not been directly assessed in relation to government approaches. The next phase of IIMI's involvement with the ADZAP project will therefore focus on the case of FFHC to seek lessons that could be applied to future developments in Anuradhapura district.

ANNEX 1. Map of ADZAP area showing sample tank.



ANNEX 2

RAPID-ASSESSMENT SURVEY OF ADZAP
MINOR-IRRIGATION SYSTEMS

Date _____

Team Members:
1.
2.
3.
4.

Name of system _____

Location: Thulana _____

A.S. Division _____

Electorate _____

Command area _____ acres Year completed _____

No. of families allotted _____ No. of families settled _____

Sketch Map of System (Includes: tank, bund, sluice, channels, command area, upland fields, and hamlet area; also indicates preexisting structures)

PART I. TANK CONSTRUCTION AND HISTORY

A. TECHNICAL DATA

Source: files/officers

When was a tank first constructed here?
When was it abandoned?
Reason?

Before Project Situation:

Bund

Sluice

Catchment area

Structures (if any)

Size of command area

After the Project (present situation)

Bund — Length _____ meters (m) B.T.L. _____
Condition

Sluice

	(Left)	(Right)
Location	_____	_____
Type/size	_____	_____
Sill level	_____	_____
Condition	_____	_____

Spill
Location _____
Type _____
Crest level _____
Condition _____

Catchment area
Size _____
Condition _____
Vegetation _____

Structures
Main canal (length) _____m
Field channels (number) _____ Total length _____m
Channel offtakes (number) _____
Measuring gauge (yes / no) Type _____
Present command area _____

Comments:

What work was done by the project?

	Month/year construction began	ended	Major items constructed	Name of technical assistant	Name(s) of contractor/s	Amount of contract
Irrigation Department						
Department of Agrarian Services						

B. GENERAL INFORMATION Source: **Farmers**

Who requested ADZAP assistance? (Explain...)

Why was this tank selected for assistance?

Were any meetings held among beneficiaries prior to construction? (yes / no)
Explain how farmers came to know about the project:

C. TANK CONSTRUCTION Source: **Farmers**

	Month/year construction began	ended	Major items constructed	Name of technical assistant	Name/s of contractor/s	Amount of contract
Irrigation Department						
Department of Agrarian Services						

Did project beneficiaries participate in construction work? (yes / no)
Explain:

Task	No. of days worked (approximately)	Payment
Irrigation Department		
Department of Agrarian Services		

Were any committees formed for construction? (explain)

Comments:

PART II. SETTLEMENT PROCESS

A. PRE-PROJECT SITUATION

How was the present command area used before the project?

How was the present upland area used before the project?

What was the land tenure pattern?

How many families used the land? _____
Have these families been allotted project lands? (explain) _____

How many acres were normally cultivated in maha? _____
No. of acres chena_____ upland (settled chena)_____ irrigated_____

Sketch map — Shows land use before project; indicates land ownership, fields, and origin 1 tank area)

What was the typical cropping pattern on this land before the project?
(Note: This land only)

	Crops (%)		
Chena/upland	_____/	_____/	_____
irrigated area	_____/	_____/	_____

No. of acres developed by project:

	No. of acres	No. of plots allocated
Irrigated:	_____	_____
Rain-fed:	_____	_____

Original villages of the allottees:

Village name	Distance from scheme	Number of allottees	No. already settled	Original occupation(s)
_____	_____km	_____	_____	_____
_____	_____km	_____	_____	_____
_____	_____km	_____	_____	_____
_____	_____km	_____	_____	_____
_____	_____km	_____	_____	_____

B. RECRUITMENT

Source: _____
(files? farmers? officers?)

How were the allottees recruited? (explain)

No. of applicants: _____
How were the settlers selected? (e.g., what criteria used, priority adopted?)

Total no. of allottees selected _____
No. of irrigated allotments allocated _____; not allocated _____
How were the allotments allocated among the allottees? (explain)

Irrigated plots

Upland plots

C. STATUS OF SETTLEMENT

No. of allottees currently resident _____
No. who have not moved to scheme _____
Major reasons for not moving: (explain)

Settler type	No.	No. of acres outside cultivated last maha		
		Chena	Upland	Irrigated
Permanent	____	_____	_____	_____
Semi-permanent	____	_____	_____	_____
Not moved	____	_____	_____	_____

Comments:

Estimated no. of acres of abandoned chena due to this project:_____
What is the present land use in old chena area? (explain)

PART III. AGRICULTURAL ECONOMY

How many seasons have you cultivated since the project began? _____

	No. of acres under command	No. of farmers who cultivated	No. of upland acres cultivated	No. of farmers who cultivated
Yala 1988	_____/	_____/	_____/	_____
Maha 1987/88	_____/	_____/	_____/	_____

	Major crop (%)	Second crop (%)	Third crop (%)
Irrigated cropping pattern			
a. This yala (1988)	_____/	_____/	_____
b. Last maha (1987/88)	_____/	_____/	_____
Upland cropping pattern			
a. This yala (1988)	_____/	_____/	_____
b. Last maha (1987/88)	_____/	_____/	_____

Yields: Are crop yields in upland allotments better or worse than in irrigated plots? (check which) Better_____ Worse_____

Explain why:

Marketing: Which crops are marketed? _____/ _____/ _____
Where? (include distance)

Livestock:	Number	No. of owners
Buffalo	_____	_____
Cow/Bullocks	_____	_____

Equipment:

No. of 2-wheel tractors _____
4-wheel tractors _____
pump set _____
dug wells _____ (private) _____ (government)

Infrastructure:

Off-farm jobs: What are other sources of income for farmers?

PART IV. OPERATION AND MANAGEMENT

A. MAINTENANCE

When was the canal last cleaned? _____
How many people helped? _____
Were they paid? (yes / no) (If yes, amount paid) _____
Who called them for cleaning? _____
What sanctions for those who didn't come? _____

B. WATER DISTRIBUTION

How full is the tank today?

0	25%	50%	75%	100%

(If sluice is closed) When was the sluice last opened? _____
Who closed/opened the intake? _____
Does it flow at night? (yes / no)
How is water shared among operators? _____

Are there any written rules for water distribution? (yes / no)
(If yes, explain) _____
What are the most common reasons for water disputes? _____

How are water disputes resolved? _____
Is there any bethma-type practice? (explain) _____

Is there a vel vidane or someone like him? (explain) _____
Did he serve prior to ADZAP? _____
How was he selected? _____
What payment does he receive? _____
What does he do? _____

How many tanks are under his jurisdiction? (If more than this tank, give names) _____
Does he have other ADZAP or VIRP systems? (which ones?)

When was the last kanna meeting? _____
Which systems/villages were included? _____
Who called it? _____
How many farmers came? _____
What was decided? _____

What was the result of those decisions? _____

Any other meetings for irrigation (formal or informal)? _____

GENERAL COMMENTS:

INTERVIEW:

Have farmers who had already been living within the project area gained or lost from the project? (Give reasons)

What are the feelings of the newly settled farmers?

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