COMMUNITY PARTICIPATION AND IRRIGATION DEVELOPMENT

A Case Study from Indonesia

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A Case Study of
THE ASIA REGIONAL COMMITTEE ON COMMUNITY MANAGEMENT

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COMMUNITY MANAGEMENT CASES

AID's Asia Regional Network on Community Management was originally formed in July 1983 as the Asia Regional Committee on Community Management by Eugene Staples, then Deputy Assistant Administrator for AID's Asia Bureau. This action recognized a need to improve AID performance in working with government agencies and private groups to establish locally based, non-governmental systems and institutions for participating in the management of natural resources and human services. The Network facilitates a collaborative effort by participating missions to assess, document, and compare experience with such efforts in the interests of strengthening learning and performance.

While the case materials produced by this effort are prepared primarily for use of the participating USAID missions, some of them are of broader interest for the data and insights they provide. Recognizing the need of teaching and research programs in development management for access to case materials reflecting the realities of field implementation experience, NASPAA has arranged with the Network to distribute selected cases under NASPAA's Technical Cooperation Project. This series is edited by David C. Korten, who also serves as Secretary to the Network under the NASPAA Cooperative Agreement with AID.

These cases are prepared as individual professional contributions by their authors, who are solely responsible for case contents and analysis. They are not official publications of AID, nor do they necessarily represent the views of the Agency.

CASE #1: Beyond Family Planning by Rebecca Conn

The subject of this case is the Village Family Planning/Mother Child Welfare Project funded by USAID/Jakarta and implemented by Indonesia's Family Planning Coordinating Board (BKKBN). BKKBN is internationally known for the effectiveness of its decentralized village based family planning program. This project described in this case was intended to introduce an experimental village based nutriton intervention integrated with existing family planning activities. Contrary to the intentions of BKKBN and USAID, the initial implementation turned out to be highly top-down and blueprinted, with little or no local adaptation, and no attention to how villages would sustain the critical activities beyond the initial three year period of project support.

The case provides insights into the forces that work against decentralization and local adaptation within a new program, even within an agency committed to and experienced in village based program approaches. It describes actions taken by BKKBN and USAID to correct the problem, leading to successful pilot activities in 24 villages. At the end of the case officials are considering the matter of how best to expand the application of the new approach. A number of lessons from the experience are noted by the author.

CASE #2: Community Participation and Irrigation Development
by Michael Morfit and Mark Poffenberger

This case deals with a farmer-oriented pilot project called the High Performance Sederhana Irrigation Systems (HPSIS) Project involving fourteen sites in Indonesia. This project was funded jointly by USAID/Jakarta and the Ford Foundation. Background information is presented on irrigation development in Indonesia, with special attention to the problems faced by government and farmers in conventional governmental programs of assistance to small scale irrigation. The HPSIS Project, which was designed to respond to many of these problems, is described.

The case provides a detailed description of one of the HPSIS project sites, and presents chronologically the project experience--the arrival of the community organizers in the village, the preparation of the water users association to participate in discussions regarding the design, and finally the design and implementation process. The difficulties experienced and the results achieved are assessed. The case highlights the complex inter-relationship between social and technical factors in small scale irrigation development and the barriers to successful implementation of a participatory approach within a conventional government program.

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Acknowledgements

The data reported here were gathered during a series of field trips to Lombok from April, 1981 to March, 1984. During that time we received enormous help from the farmers of the area and local officials including village headmen, officials of the water users association and government extension workers. Their openness to our questions, willingness to spend time with us, and patience in explaining the details of their local organizations were essential to our effort. Special thanks go to the three community organizers, Sdr. A.A. Ngurah Dalem, Sdr. Hatmin and Sdr. R. Sulaya, who not only worked long and hard for the success of the project, but also spent considerable time helping us understand it. We are also grateful to the logistic support and technical expertise of the provincial Ministry of Agriculture office, particularly Ir. Adyana Putra and Ir. Sardjito, as well as the provincial Ministry of Public Works office. Ir. Joes Oemarhamzah prepared the maps and provided technical advice to two social scientists attempting to understand some of the principles of irrigation engineering. Finally, special thanks are due to Dr. Frances Korten for her thoughtful comments on earlier drafts of this study.

While acknowledging the assistance we have received in completing this study, we must emphasize that the views expensed are our own and do not represent the official position or opinion of any agency or government office associated with the High Performance Sederhana Irrigation System pilot project.

Note on Names and Terms

"Kekeri Timur" is the traditional name of the original water users association (subak) located in the area covered by this case study. When the Sederhana Irrigation Project built a diversion weir in 1978, this subak was split into two parts, left (kiri) and right (kanan). Government officials use the name of the dam (Penimbung) to refer to the whole area and designate the specific area of this case study as the left-side of Penimbung dam (Penimbung Kiri). That name will be found in all government documents describing the irrigation project in that area. Because of the importance (in our view) of the traditional subak and its structure, and because the local population contunues to a large extent to use the traditional name, in this article we have followed local practice in retaining the use of Kekeri Timur.

Throughout the article, we have also used Indonesian names for officials, organization and titles, although these first appear alongside their English equivalent. Many of these terms carry specific connotation and references which cannot conveniently be translated into English every time they are used.

Community Participation and Irrigation Development: A Case Study from Indonesia

I. INTRODUCTION

Indonesian farmers over the centuries have developed several million hectares of irrigated rice lands throughout the island archipelago. For decades researchers have recognized the inventiveness of Indonesian farmers in creating some of the most physically and organizationally sophisticated traditional small scale systems in the world.

For over ten years the Indonesian Government has undertaken a massive program to support the further development of irrigation in the country investing $1.72 billion between 1969 and 1979.[1] In the fiscal year 1980/81 alone Indonesia planned to invest $537 million domestic and donor agency funds in irrigation development projects. Small-scale irrigation systems are a major part of this water resource development program. There are approximately 4,600 small systems irrigating less than 1,000 hectares, with an average size of only 300 hectares per system.[2] Small systems under government operation and maintenance programs and small independent village systems constitute 2.6 million hectares or 48% of all irrigated land.[3] To a great extent, irrigation in Indonesia is small-scale irrigation.

While many small-scale systems have benefited substantially from government assistance, there is some evidence to suggest that development programs often have not fully achieved their potential. There are growing indications that because of inappropriate design and construction, many systems perform well below capacity.[4] Furthermore, in many cases government intervention has apparently eroded local organizational ability to manage and operate small-scale systems. One reason given by researchers to explain this situation is that under present procedures farmers, the ultimate users of the irrigation system, are generally excluded from important design, construction and management decisions which determine the utility of the system.

In addition, current national policy requires the government to take responsibility for much of the operation and maintenance of small scale systems after major assistance for design and construction has been provided. In consequence the Department of Public Works has taken on the responsibility for the major works of some one million hectares of village systems over the past ten years.

Government planners are aware of the need to improve the effectiveness of their irrigation development investment. Increasing the role of farmers in system development and management may be one way to do this. Encouraged by promising participatory irrigation development projects in the Philippines and Sri Lanka, in 1982 the Government initiated a farmer - oriented pilot project called the High Performance Sederhana Irrigation Systems (HPSIS) in fourteen locations throughout the country.*

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This report analyzes the experiences of farmers and the community organizers, contractors and government staff in one pilot project system. The objective is to understand better how farmers participated in the development of the irrigation system and what benefits were realized. Particular attention is given to the question of how local participation was encouraged and how this changed the the original design. Estimates are made of the amount of increased irrigated area resulting from farmers' suggestions in revising the design and how this has affected farmers who were far from the water source, occupied hard to irrigate land, or land which had experienced drainage problems in the past. Both the direct and mangement costs of this participatory approach are also reviewed, with particular emphasis on the role of the community organizers (COs) both as a catlyst in helping farmers reach a consensus concerning system needs and as a bridging mechanism in communicating their opinions to government planners and private contractors.

An analysis of the process of interaction between farmers, COs, the government and the private sector reveals both the constraints as well as potential opportunities to increase local participation in small scale irrigation system development. While the findings from a single case study do not represent the experinece of HPSIS in all twenty-one sites, the paper provides some insights concerning the potential implications of a national small scale irrigation development program based on a participatory model.

A large amount of detailed data is necessarily presented in this paper. Interventions in village level irrigation systems are inevitably complex, involving consideration of cropping patterns, water requirements, government extension programs, local traditions and organizations, and political forces. In part the breadth of data presented is intended to illustrate the complexity of the task of the HPSIS pilot project, and the variety of factors to be faced. At the same time, the data is limited to the period of farmer participation in sytem design and construction. Further work is needed to track the performance of the water users association over time to determine if enchanced participation has been followed by effective community management of the completed irrigation system.

The paper begins with a brief review of the history of small scale irrigation system development in Indonesia. This section attempts to outline some of the problems planners and farmers have encountered with past irrigation assistance programs. Next, the High Performance Sederhana Irrigation System pilot project, which was designed to respond to many of these problems, is described.

In the following section the experience of the pilot project site of Kekeri Timur II is discussed. This section begins with a brief summary of the setting and history of that irrigation system. This is followed by a chronological description of the pilot project experience beginning with the arrival of the community organizers in the village, the preparation of the water users association for design discussions, and finallly the design and construction process. The article concludes with a summary of the implications of the case study for national small scale irrigation development policy.

II. INDONESIAN SMALL-SCALE IRRIGATION DEVELOPMENT AND THE HPSIS PILOT PROJECT.

Before reviewing the experience with the participatory approach in the HPSIS pilot project site of Kekeri Timur II, it is useful to review briefly the historical context of small-scale irrigation development in Indonesia and the origins and strategy upon which the High Performance Sederhana Irrigation System project was based.

Small-Scale Irrigation Development in Indonesia

During the period between 1956 and 1968, priority was placed on developing new irrigation schemes in the Outer Islands. Yet because of administrative problems during this period, ambitious goals were rarely achieved. By the time the New Order Government of President Soeharto had been established, it was evident that most of the large scale irrigation systems of Java had fallen into a state of severe disrepair resulting from over 30 years with only marginal maintenance.

In response to this problem the New Order Government reversed the priorities of the Soekarno Government by focusing its attention on the rehabilitation of the large colonial systems mainly in Java. During the 1969-74 period some 958,000 hectares of major works were reported to have been rehabilitated in contrast to only 171,000 hectares of expansion area. During the Second Five Year Plan the rehabilitation of large scale systems continued to be the primary target (835,000 hectares), although expansion into small scale systems took on major importance for the first time in the nation's history.

The emergence of a major program to deal with small scale irrigation systems and on-farm works development during the Second Five Year Plan marked the beginning of the completion of rehabilitation work as a major emphasis of the government. It also reflected a growing awareness among government planners that the achievement of greater technical efficiency in water management required better physical facilities at the farm level. This perceived need was clearly related to the major agricultural transition underway in Indonesia at that time from traditional rice cultivation to the more intensively cropped high yielding rice varieties.

Assistance for small scale irrigation systems and for tertiary work development was provided in a variety of ways during the 1970's. Generally, government support can be broadly classified as either locally managed funds under the special Presidential Instruction (Inpres) and Village Subsidy (Subsidi Desa) programs, or centrally controlled irrigation project funds utilized for the Sederhana (Simple) Irrigation Program and the World Bank assisted Prosida tertiary system development program. These two modes of irrigation development contrast sharply in terms of the processes they utilized. The Inpres and Village Subsidy schemes provided relatively small amounts of funding to the district or village government for the rehabilitation and construction of infrastructure. Local officials and communities were usually responsible

for deciding how these funds were to be used and for supplementing the assistance with labor and material to meet local needs. It is estimated that under the Inpres Kabupaten program over 20% of the total program budget was invested in irrigation development for some 570,000 hectares rehabilitated between 1969 and 1976.[5] A survey of the Subsidi Desa program indicates that over half of the communities decided to invest some or all of their grants in building or repairing the irrigation infrastructure.

Under the Subsidy Desa and Inpres Desa programs and to a somewhat lesser degree under the Inpres Kabupaten program, the community was responsible for determining the objectives of the project, hiring skilled laborers, hiring or providing unskilled labor, procuring materials, and generally managing the budget. While evidence suggests that some projects experienced delays and difficulties due to a lack of technical expertise at the village level, it also appears that villagers frequently identified critical problems and through a combination of subsidies, Inpres funds and their own contributions, were able to improve their irrigation systems.[6]

In contrast, the centrally controlled Sederhana program and the Prosida Tertiary development program retained most of the decision making at the national and provincial level. Sederhana utilized design consultants, construction contractors, and certification procedures. The consequences of these new elements in the process of small-scale irrigation development was that the role of national agencies in Jakarta became increasingly important. The determination of sites to be funded during the coming financial year is now made in Jakarta, based on information submitted by provincial authorities. Survey and design work on the selected sites is also reviewed and approved by national agencies before construction is allowed to proceed. Inspection of completed systems and approval for reimbursement for those systems partially funded by AID is also carried out by central inspection teams. As government funding through the Sederhana program increased, the use of Subsidi Desa and Inpres funds for irrigation development declined. It would be difficult to prove that the large Sederhana program caused a decrease in the use of Inpres funds for irrigation. Nonetheless, this change meant that there was a significant shift of the locus of decision-making and authority over small-scale irrigation development from the local level to the national level.

As the Government of Indonesia's development budget increased rapidly during the 1970's (between 1974 and 1978 it was estimated to have grown at an average nominal rate of 40% per annum), an increasing proportion of the funds for small scale irrigation development came through centralized funding channels.[7] Between 1974 and 1983 over $100 million was invested in the program, approximately 50% of which came from USAID.

In addition to the above changes, funds utilized through the centrally supported projects encouraged the Ministry of Public Works to take permanent responsibility for the operation and maintenance of the primary and secondary works in each system assisted. This includes the

placement of a full time gate keeper at the headworks, as well as routine inspection, cleaning and repair of major works by technical staff members from the local Public Works Section office. As the number of systems which had been assisted under the Sederhana project grew, this responsibility became an increasing burden for the Public Works staff. In the early 1980's, when income from oil revenues began dropping sharply, policy makers began seriously to question the Ministry's ability to continue to be responsible in perpetuity for over a thousand small scale systems.[8]

In summary the following trends in small-scale irrigation development during the 1970s can be seen:

- increased used of centralized resources and national programs to support small scale and on-farm works development,
- rapid expansion of small scale and on-farm works projects with a corresponding increase in the workload of local Public Works staff, and
- a decrease in the contributions farmers made in the rehabilitation and maintenance of small scale systems and on-farm works.

During the late 1970's a number of criticisms about the Sederhana program due to problems in site selection, inappropriate design, lack of local participation in construction, and a general tendency to undermine local self-sufficiency and encourage increasing dependence on the Ministry of Public Works for operation and maintenance. According to one consultant "In general, the main weakness of the (sederhana) programme has been the same as that of the tertiary (rehabilitation) program. It has been too centralized in its planning and execution, too technocratic and insufficiently participative".[9]

In response to this, in the late 1970's the Government initiated a program to encourage farmer participation in operations and maintenance through the formation of water users associations (Persatuan Petani Pemakai Air, or P3A). It was felt that if strong water user groups could be established, the effectiveness of the operation and maintenance of new and rehabilitation systems could be increased. Accordingly, between FY 1979/80 and FY 1982/83 government figures reported that 894 P3A were formed in 25 of Indonesia's provinces.[10] While the impact of the P3A formation program is not clear, it appears that although P3A offices were formally established with organizational charts, rules and regulations drawn up, the P3A often had little impact on the operation and management of small-scale systems. One reason for this may be that the nationally standardized P3A program generally was not sensitive to the existing institutions and procedures in many small scale irrigation systems. Secondly, while the responsible government personnel had some understanding of the standard structure for the P3A, they had less understanding of the technical and organizational means of increasing the efficiency of water distribution and improving maintenance. Consequently, in 1982, it was decided that a participatory process model might be able to effectively overcome some of the weaknesses of the Sederhana project mode and the P3A program.

The High Performance Sederhana Irrigation System Pilot Project

The High Performance Sederhana Irrigation System Pilot Project (HPSIS) was initiated by AID and is based upon an analysis of the implementation of the Sederhana Irrigation Project which suggests that there has been an unproductive separation between those who control project funds and carry out project activities, and the farmers who have to live with the consequences of those decisions. Upon completion of a small-scale system, local water users associations are expected to assume responsibility for the maintenance and operation of the on-farm works. That is, the community ultimately responsible at the farm level for managing the systems designed and constructed under the Sederhana program become directly involved in project implementation only at the very end of project activities.

In contrast, the thesis which underlies the HPSIS pilot project is that if from the beginning there is increased direct and active participation of project beneficiaries (farmers) in all stages of project implementation, and increased responsibility for an management of completed projects, then this will result in:

1. better survey and design work, sensitive to local needs and physical conditions;

2. better construction;

3. better water management, including both more efficient use of watr and more equitable distribution within the system;

4. better maintenance of systems.

Taken together, all these will result in better cropping patterns, higher yields and increased rural incomes.

The P3A has been chosen as the appropriate institution to achieve increased farmer participation during project implementation, as well as increased responsibility for an management of the system once construction work is completed. The objective is to establish an institution capable of representing the farmers in dealing with government agencies and resolving problems and issues within the system as they relate to water management and the maintenance of the on-farm works.

The placement of two or three Community Organizers (COs) in a community is a fundamental element of this strategy to achieve strong, active and involved P3As. Their responsibility is to work with the P3A so that it can fulfill its functions. They are to assist with the formation of block groups (kelompok) within the P3A, the development of water management and maintenance plans both for these kelompok and for the entire P3A, the establishment of a system of charges to support the work of the P3A, and the creation of a leadership both within the smaller groups and the entire P3A which has the support of the farmers and which works according to a known and accepted constitution. Therefore, the COs

are intended to be a bridge between the P3A and the government, and not spokesmen for or representatives of any of the government agencies involved in irrigation development. This is supposed to be the case even though the COs have been selected, trained, monitored and paid by government agencies.

The strengthened capacities of the P3A must be matched by responsiveness on the part of those involved in system survey, design and construction to respond to the P3A's needs. This necessarily involves changes in traditional procedures and the practices of both government officials and private contractors. Following construction, those government agencies which continue to have some responsibility for aspects of system management and maintennace should continue to be willing to work with an active P3A and be responsive to its needs in managing and maintaining the irrigation systems.

With this basic strategy in mind, in early 1982 the Ministry of Agriculture, in consultation with the Ministry of Public Works and AID, selected fourteen HPSIS pilot sites in seven provinces. Although the interest of local farmers was one factor considered in selecting sites, national agencies both initiated and controlled the selection process. Provincial, district or village organizations played almost no role in this process. In half these sites, construction work had already been completed and the pilot project was intended to determine the extent to which a strengthened P3A could improve system operation and maintenance. In the remaining seven sites, the main system had been constructed but the on-farm works remained to be built. Here the intention was to determine whether a more active P3A, involved in reviewing the design for on-farm works, would result in improved designs as well as better system operation and maintenance. A third group of sites where no construction had taken place at all was added in 1983. In six of these seven additional sites, involving both major works and on-farm works construction, the Ministry of Public Works rather than the Ministry of Agriculture, is the primary government agency.

Following site selection from January to March, 1982, candidates were identified in each of the seven provinces for the CO positions. The selection process was undertaken by a joint team representing the Ministry of Agriculture, USAID, Ford Foundtion, and LP3ES (a nongovernmental agency chosen to manage the training of the COs.)[11] After their selection, the COs underwent a six week period of training in May and June, 1982. This stressed skills and techniques in community organization and mobilization. A second round of training, emphasizing technical aspects of irrigation design and management, was provided in March and April, 1983. This was after the COs had been in the field for some eight months and had experience working with the community and the P3A.

During the implementation of the pilot project, joint committees, with representatives of the Ministries of Agriculture, Public Works and Home Affairs, were established at the national, provincial and district (kabupaten) level. In most cases, the Ministry of Agriculture had primary responsibility for overseeing project implementation and

financial management. This was largely because present government procedures distinguish between system construction responsibilities (Ministry of Public Works) and system management responsibilities. The objective of achieving better water management suggested the Ministry of Agriculture should be the lead agency. Monitoring project activities was undertaken as much as possible by joint teams including all ministries, AID, Ford Foundation and LP3ES, the training institute.

III. THE CASE OF KEKERI TIMUR II

A. The Setting and History of the Kekeri Timur System

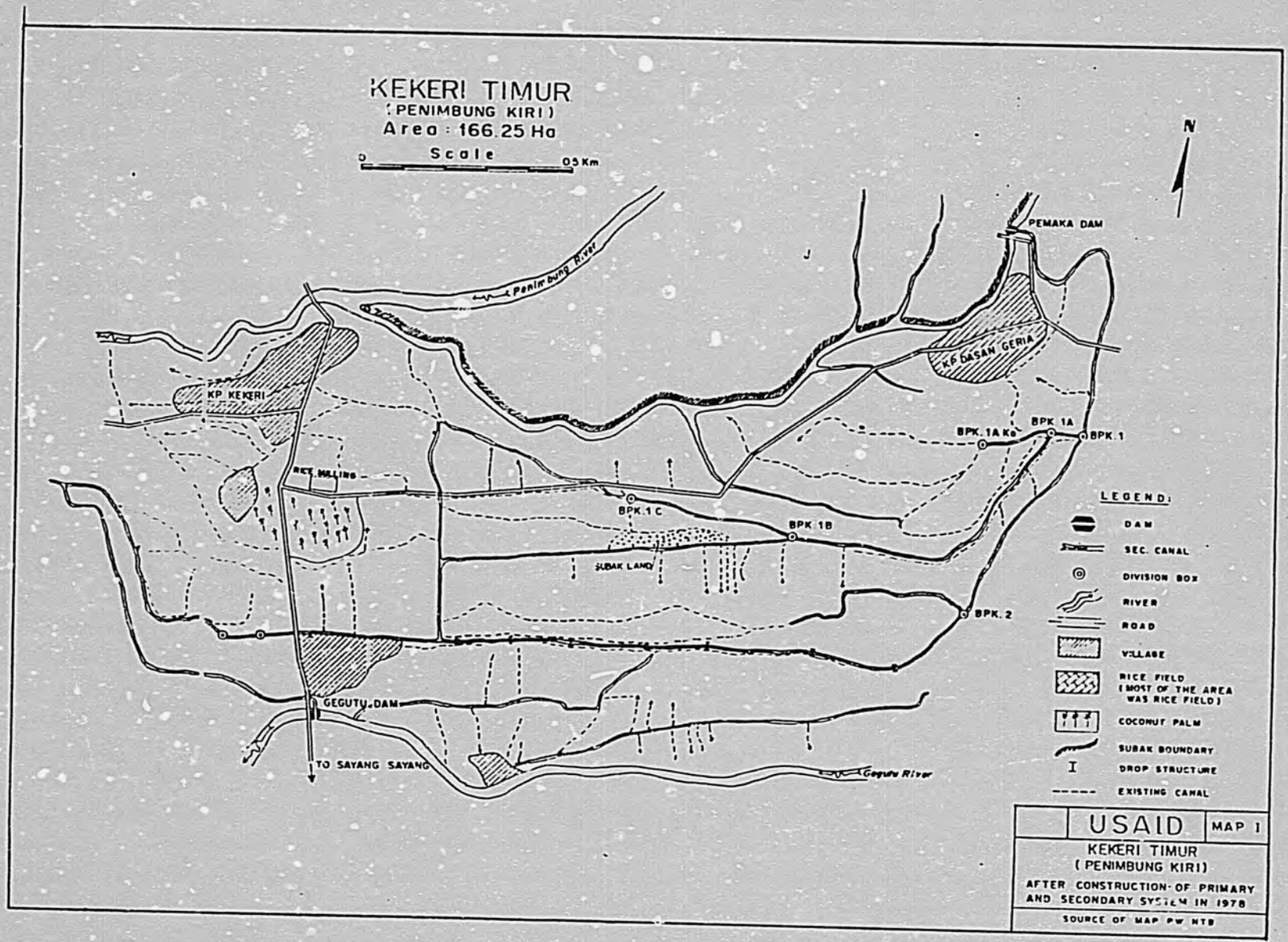
The village irrigation system of Kekeri Timur II is located on Lombok, an island of 2.5 million people in eastern Indonesia. The land is situated in the western side of the island at the base of the foothills of 12,221 ft. Mt. Rinjani, and considered to be the island's best suited agro-climate zone for rice cultivation. The slopes of Rinjani and the foothills are largely covered by primary and secondary forest, though at lower elevation coconut groves take over and form a belt which extends to the edge of the wet rice lands. Kekeri Timur II is located at the edge of the coconut gardens where the first irrigated rice lands begin. Because of its proximity to Lombok's western coast, there are few irrigation systems located downstream of Kekeri Timur.

The irrigation system draws its water from Meninting river where the river flow fluctuates between an estimated 1 to 5 m3/sec. Most of the system's water arrives between the months of December and February, but due to small springs which also feed the river even during the extended dry periods (August through October) there is usually a substantial volume of water in the river throughout the year.

The approximately 166 hectares of irrigated lands which comprise the Kekeri Timur II system are cultivated by 345 farmers from four villages, Dasan Geria and Duman at the top, and Kekeri and Gegutu at the bottom of the system. The rice lands run east to west on a gradually sloping plateau, bordered to the north and south by streams into which run-off water drains (see Map 1).

Because of the fertility of the soil and the relative abundance of water in West Lombok, farmers are able to get two or three harvests a year. The proximity of the provincial capital of Mataram, 15 Kms to the southwest, also allows many farm families to supplement their incomes through trade and manual labor in the markets.

As is true in many areas of Java and Bali, the size of land holdings in the Kekeri Timur systems have diminished over the past generation. The current estimates of average holding is .52 ha/family, while 31% of the families own less than .25 ha and 7% own between 1 and 3 hectare. Only 10% of the rice lands are reported to be worked by tenant farmers.


KEKERI TIMUR
(PENIMBUNG KIRI)
Area : 166.25 Ha
Scale
0 0.5 Km
N
PEMAKA DAM
Penimbung River
KP DASAN GERIA
KP KEKERI
BPK.1A Ka
BPK 1A
BPK.1
RICE MILLING
BPK.1C
BPK.1B
SUBAK LANGI
BPK.2
GEGUTU DAM
TO SAYANG SAYANG
Gegutu River
LEGEND:
DAM
SEC. CANAL
DIVISION BOX
RIVER
ROAD
VILLAGE
RICE FIELD (MOST OF THE AREA WAS RICE FIELD)
COCONUT PALM
SUBAK BOUNDARY
DROP STRUCTURE
EXISTING CANAL
USAID
MAP 1
KEKERI TIMUR
(PENIMBUNG KIRI)
AFTER CONSTRUCTION OF PRIMARY AND SECONDARY SYSTEM IN 1978
SOURCE OF MAP PU NTB

Before the installation of the permanent dam (the Penimbung dam) under a Sederhana project in 1978, local farmers used a stone and log diversion to direct water from the Meninting river into a 2 km long canal which brought the water to the top of their fields. The original system, which irrigated over 300 hectares of land, was managed by the local water users association or subak named Kekeri Timur.[9] This was later divided into two subak after the construction of the Penimbung dam (see Map 1).

The subak activities were coordinated by the Pekasih (distinct from the village headman) who was elected by and accountable to the system's farmers. The Pekasih had no fixed term of office and a successor was selected when the old Pekasih retired or when subak members lost confidence in him. At such times the membership would nominate several candidates based on their leadership capacity and perceived ability to carryout subak functions. When an election was held each candidate was represented by one container into which subak members would place their vote in the form of a kernel of corn. This electoral process gave each farmer, regardless of the size of his land holding, as equal voice in selecting the managers of the system.

The Pekasih's primary tasks included:

- mobilizing subak work groups to repair the diversion structure and canals at the beginning of each planting season, as well as after flood damage;

- facilitating agreement (among subak members) concerning water rotation schedules;

- monitoring water distribution in the dry season;

- settling disputes over water conflicts and levying fines in the case of water theft, animal related crop damage, etc.,

- representing the subak in negotiations with other subak on the river course concerning water distribution issue;

- and helping to collect the local land tax (now known as the Ipeda).

In these tasks the Pekasih worked with two assistants (Wakil Pekasih) whom he appointed. As payment for his services the Pekasih was allocated .4 hectares of village rice land for the duration of his term. The harvest from this land was used to support his family and shared with his assistants. The Pekasih also received 2% of the land tax of which he collected. He then turned the remaining revenues over to his immediate superior, the Pembekal Pekasih, who received 4% of the tax revenues as well as .75 hectares of village rice land. Even with the advent of new legislation regulating and standardizing the structure of village government throughout Indonesia, the subak has survived, still retaining much of its original form at the level of the irrigation system. The Pekasih and Pembekal Pekasih still enjoy the use of village land and receive their percentages of the Ipeda land tax.

While tax collection was undoubtedly an important activity of subak leaders, the major task prior to the construction of the permanent dam in 1978, was the seasonal and emergency repairs made on the diversion weir. The Pekasih would call the 250 subak members to repair the diversion weir and canals in preparation for planting. This process usually took only a few days, though work groups were frequently needed another three or four times during the rest of the season to repair wash-outs resulting from heavy rains and floods.

A retired Pekasih who had been in office during the 1950s and 60s reported that attendance in workgroups was good and that simple reminders were sufficient to assure regular participation. He noted the awareness among subak members that the dam was the source of their livelihood and their survival.

Water Distribution:

Prior to the adoption of high yielding rice varieties in the mid-70's, the farmers of the area planted the tall red local rice in November or December. During the first few months of growth there was usually sufficient rain and irrigation water to meet all the farmers' needs without careful water management. Halfway through the 150 day maturation period, however, water supplies were frequently insufficient to meet the needs of all farmers simultaneously. Consequently, a rotation system was established, usually after several meetings of the subak membership. Water rotation was also used for the second crop of legumes.

The subak divided the water in two 12-hour periods, with top enders receiving water in the morning and tailenders receiving water at night. Water was further rotated within the top and bottom half based on quartinery canal blocks known as banjar (which varied in size from 2-15 hectares). Each banjar received water on alternate days or nights. Depending on water availability, individual farmers within a banjar usually received water every 7-14 days during the dry season.

Downstream farmers have always experienced the greatest water shortage during the dry season. In part this is due to their second place position on water rotation schedules. The humor of the farmers is reflected in one tailend block which is named the "red eye" banjar (mata merah) due to the all night task of ensuring water reaches their field in the dry season. Another problem faced by tailenders is the high sand content of their soil. The soil is so porous that a bunded field will be empty of water six hours after being filled, versus several days in the top end. Due to the difficulties tailenders have faced in receiving and retaining water they sometimes will not attempt to plant a second crop. One group of farmers named their banjar "Pension" (pensiun) because they often left it unplanted in the dry season because of lack of water. Even within the banjar, water rotation starts at the top. While outright theft was said to be rare in Subak Kekeri Timur, top enders have always had a natural advantage in gaining access to water and have rarely experienced shortages.

When downstream farmers experienced water shortages, they had the right to report the problem to the Pekasih and request an emergency supplemnent or an adjustment in the rotation schedule. If the problem was not addressed, and a substantial number of farmers were affected, those farmers had the right to request the Pekasih be replaced. In Kekeri Timur such a request was made in the early 1970's and a tailender replaced a man from the top end as the new Pekasih. However, he resigned his position two years later to become village headmen in a downstream village.

At that time a new election was held and downstream farmers nominated a reputedly well-qualified tail-ender for Pekasih while the top enders nominated a similarly experienced upstream farmer. The Pembekal Pekasih also proposed the candidacy of his younger brother. A new government regulation required that all Pekasih candidates take a written test concerning knowledge of the national ideology (Pancasila). After the tail-ender and top ender candidates failed the test, the Pembekal's brother passed and was appointed to the position by the sub-District Head (Camat), not elected by the farmers as had previously been the custom. As we have seen, this coincides with a general trend in the 1970s to bring previously independent village systems under government control through national programs for small-scale irrigation development.

During the past decade many subak members are reported to have found this Pekasih's performance disappointing. They claim he lacks the experience and energy required for that position and noted that a man of his age and limited leadership skills would not have been elected in the past. As recently as October 1983 a group of tail-enders petitioned the Pembekal Pekasih, to have the Pekasih dismissed. No action was taken, providing further evidence that the recent past has seen a decline in farmer control over the irrigation system, and indeed over their own subak organization.

Despite the feeling among many subak members that the quality of leadership has declined in recent years, water theft remains rare and schedules of water rotation are still adhered to. Further, when there are disputes among individuals over water use they are still referred the subak rather than being dealt with by individuals.

It appears the biggest single problem in achieving an effective water rotation system has been the transition to high yielding varieties. Because high yield varieties and more dependable water supplies since the construction of the Sederhana dam in 1978 have made possible some flexibility in planting, the cropping calendar has become extremely varied throughout the system, making water rotation difficult. Some farmers are anxious to return to a synchronized cropping calendar. They feel it will help control damage from pests and disease (particularly the brown planthopper and tungro). They also feel that with better management the entire system could get two rice crops a year and one dry crop. Tenant farmers, however, feel they need as many rice crops per year as possible in order to earn enough to pay their rent and feed their families.

Physical System Development:

In Kekeri Timur the earliest reported outside assistance for physical development came through a regional irrigation project (Proyek Daerah) in 1967. These funds were used to provide materials and technical assistance to construct a permanent dam on the neighboring Memaka river to supplement the water needs of the Kekeri system. This assistance also included funds for several drop structures along the canal originating at the Meninting dam.

In 1971 the provincial government provided Rp. 100,000 for irrigation development under the village subsidy program (Subsidi Desa).The Subak members raised an additional Rp. 300,000 through a special harvest tax (bon) to supplement these funds. The village headman (Kepala Desa) then arranged with local skilled laborers to build a permanent check dam and turn-out structure in the primary canal serving one part of the entire system. Farmers claim that prior to this the temporary structures would regularly wash out during flood periods causing water shortages and crop damage. Since the permanent check dam was build they have had no further problems with wash-outs.

In 1977 the Subak learned that the government had included the Kekeri Timur system as one of its Simple Irrigation Projects (Irigasi dan Reklamasi Sederhana). The initial budget of Rp. 134 million ($315,000 at the old exchange rate) was to build a gabion weir with concrete control and flush gates, and two primary canals with turn-out structures and secondary canals capable of irrigating 656 ha. of rice lands. This was completed in 1978. On the whole farmers say they are very satisfied with the new main system, particularly the permanent headworks and main canal which saves the Subak hundreds of person-days of labor each year for system repair. The absence of dam wash-outs during the rainy season has also increased the dependability of the water supply. While farmers generally feel that the availability of water has not increased, they do feel it is more dependable, easier to distribute and requires less work to maintain, at least in the main system.

Some Subak members, however, have experienced serious difficulties with some secondary turn-out structures. They find some gates too small to release canal water during periods of heavy rain with the result that water backs up the canal and spills over the canal walls flooding fields and eroding the walls, and in one case flooding a village. In October, 1983, a 15 meter section of the canal wall washed out in the tail end resulting in the creation of a new river course from that point. Fortunately, because it was near the bottom of the system, little sawah was damaged.

B. Initiating the Pilot Project in Kekeri Timur II

After their initial period of training, the three COs arrived at the project site in August, 1982, when a series of meetings were held at the provincial, district (kabupaten) and sub-district (kecamatan) level to introduce them to the various government departments concerned and to explain the objectives of the pilot project. Formal meetings were supplemented by individual discussions with specific officials who had responsibility for different phases of the project. Of particular importance were discussions with Ministry of Public Works officials. Although the COs had been selected primarily by the Ministry of Agriculture, and were under their responsibility, the role of the Ministry of Public Works was paramount in the survey, design and eventual construction of the on-farm works.

From the start of the project, the COs lived in the immediate project area. Initially they lived together in the house of the Pekasih of a neighboring irrigation system (Penimbung Kanan) drawing its water from the same diversion weir. It was the Pekasih who took the COs under his wing and was responsible for introducing them to members of the community and explaining their role. Eventually, however, all of the COs moved to different houses, only two of which were within the area of the irrigation system where they would be working. This was a gradual process, with the last CO moving only in May, 1983.

Following the formal meetings and informal discussions with government officials, most of the first month was spent meeting farmers in different areas of the system. The village of Dasan Geria, near the head of the system, seems to have been a focal point for many of the these activities (see Map 1). The COs diaries record meetings with the Kepala Desa and his staff, and it seems that from the first a close relationship with Dasan Geria was established which has endured throughout the project. It is at the Kantor Desa of Dasan Geria where most of the P3A meetings are held, and a separate room for the P3A is being built as a part of a project to expand and improve the facilities there.

Almost immediately upon arriving at the project site, the COs found that the Ministry of Public Works already had a design prepared in the on-farm works. Public Works officials were anxious to begin construction as soon as possible. (See below," Designing the System"). This was a strong incentive for the COs to create small groups (kelompok) of farmers. These could then be the forum for reviewing the Public Works design and suggesting changes. Although there had been block groups or (banjar) in the traditional subak, their role apparently declined in recent years. The reasons for this are not clear but may be related to the construction of the new permanent weir by the government in 1978 and the general pattern of increased government interventions in and control over traditional village systems. Consequently the kelompok formed by the COs were seen as new organizational entities and as the basic working unit of the association. (However, it appears that the new quartenary kelompok boundaries are coterminous with those of the earlier banjar.) These simplify the task of the pekasih because he is able to deal with

six kelompok heads, and they in turn have responsibility for ensuring that canals within their area are well maintained and that the farmers understand arrangements for water rotation. In comparing the previous situation with the present, farmers often told us that the water users' association is now more manageable.

With the emergence of the six kelompok, and their central role both as a channel for discussion of the Public Works design and later as the basic organizational unit of the P3A, it was necessary to select a head for each kelompok. We were told that the heads were selected by the farmers themselves between September, 1982 and June, 1983. Most seem to be younger farmers with average sized landholdings. Some farmers reported that the kelompok heads were selected on the basis of their known seriousness, willingness to work, and trustworthiness. They are compensated by the P3A for the time they must devote to their duties. A service tax (iuran) of 25 kg/ha/harvest is levied by the P3A on all farmers, and of that 50% is scheduled to go to kelompok heads. (This is distinct from the subak land which is made available to the Pekasih and Pembekal Pekasih.) As of the last field visit, the iuran (agreed to only in November, 1983) had not been collected. That will occur only at the end of the harvest. In principle, however, the P3A has established a system of compensation which probably will work to the extent that the Kelompok Heads do their job and the P3A is able to deliver water.

Members of the kelompok are those who own land within that specified area. Only 10% of the farmers in Kekeri Timur II either rent or sharecrop the land. Both rental and sharecropping arrangements are generally of short duration, usually lasting no more than one or two years. This represents a shifting population that moves in and out of the kelompok, and for that reason neither renters nor sharecroppers are considered full members of either the kelompok or the P3A. They have no role in the decision-making process, either in terms of a vote or in terms of the right to speak at meetings to try to influence the group's emerging consensus. However, they are under an obligation to adhere to water rotation schedules, assist with canal maintenance and to pay the iuran charges assessed on all land irrigated by the system. In this sense, they constitute a small group of second-class farmers, with obligations but no right of participation in the decision-making process. The farmers we spoke with (none of them sharecroppers or renters) seemed to feel that the rapid turn over of sharecropping and rental make this sort of distinction inevitable and proper.

The gradual establishment of the six kelompok as functioning units occured over the entire period of CO work, from September, 1982, to the formal establishment of the P3A in November, 1983. During this time the COs enjoyed uneven success in creating active and viable kelompok capable of assuming the burden for canal maintenance and water management. Kelompok V, toward the head of the system, was the first focus of their efforts and is said to be the strongest. Kelompok VI, in contrast, is at the tail end of the system and is said to be the weakest. This was probably due to the fact that the COs resided at the head end of the system and initially concentrated their attention there. As is discussed below, the relative weakness of Kelompok VI had an impact on the extent to which farmers were able to participate effectively in the design process.

The formal establishment of a P3A was the final step in the development of water management organizations in this area. Only after the kelompok had been identified and established, and considerably after the Public Works design was discussed and the on-farm works built, was the P3A constitution formally adopted. That constitution specifies the leadership of the P3A (a Chairman, assisted by a Secretary and Treasurer as well as the head of the six kelompok), the iuran charges and sanctions for failure to adhere to rules and procedures established by the P3A. The same series of meetings established guidelines for the distribution of the iuran charges as follows:

compensation for kelompok heads	--	50%
compensation for P3A leadership	--	15%
maintenance costs	--	15%
contribution to village funds	--	10%
reserve fund	--	10%

There was an effort to have the newly established P3A use some of the traditional organizational arrangements of the subak. Although the actual boundaries of the subak were disrupted in 1978, the traditional organizational structures and offices were retained. The present chairman was formerly the traditional pekasih for nearly 10 years and is referred to by that title.

This deliberate attempt to harness the traditional organizations to the needs of the new system makes some sense. It can be argued that there is a prima facia case for building upon established institutions and traditions, using their strengths and authorities rather than attempting to build new institutions from scratch. At the same time, this approach is not without drawbacks. It is almost inevitable that the new institution will inherit the weaknesses or inequities of traditional institutions as well as their strengths.

The case of Kekeri Timur offers a clear example of the problems associated with trying to adopt such traditional institutions. Traditionally the pekasih was selected by farmers but his function was not restricted simply to water management. He was also responsible for the collection of land taxes. For both the Pekasih and the Pembekal Pekasih administrative arrangements provide a strong incentive to concentrate on tax collection rather than water management. This is particularly the case when in the early 1970's the Pekasih as appointed by the sub-district head (Camat) rather than elected by the farmers as in the past. It is not surprising, therefore, to find that farmers complain that the Pekasih has not been active enough in ensuring that the irrigation system is well maintained and is delivering adequate supplies of water to their land. There is, in fact, strong grounds to see the Pekasih as a representative of the local government apparatus rather than as a representative of the farmers.

This tendency is reinforced by the description that the Pembekal Pekasih gave of his duties, emphasizing his responsibility for collecting the land tax as his primary concern. Second, he said he was

responsible for ordering or commanding the seven pekasih under his jurisdiction ("perintah pekasih"). However, he admitted that this generally did not require a great deal of time. He only deals with matters which the pekasih are unable to settle themselves, and said that he was not actively involved in discussion with the Ministry Public Works about the irrigation system design or with the contractors about the construction of the on-farm works in Penimbung Kiri. Third, the Pembekal Pekasih is required to certify legal documents concerning the sale or rental of land. This function is clearly closely related with the collection of the Ipeda tax. Fourth, the Pembekal Pekasih said that he participated in the determination of cropping patterns for the kabupaten ("ikut mengatur pola tanaman"). This latter function requires some elaboration, especially because it further emphasizes the extent to which the Pembekal Pekasih serves increasingly as a representative of the government apparatus rather than as a representative of farmers in the locality.

"Pola tanaman" refers not simply to "cropping patterns" in the abstract, but also the cropping pattern which has been determined for the entire district (kabupaten). A kabupaten committee, with the Bupati as Chairman and comprised of representatives of various government agencies (Agriculture, Public Works, BIMAS amongst others) establishes a detailed plan for the food crops to be cultivated within the kabupaten. This includes the schedule for planting crops, as well as the kind of crops to be planted and the kinds of seeds fertilizer, pesticide and herbicide to be used. A formal decree on the cropping pattern is issued by the Bupati each year. The driving force behind this plan is the target for food crop production which has been set in Jakarta, after some consultation with provincial officials.

Enforcement of the established pola tanaman is obviously uneven, and there were frequent comments from farmers in Penimbung Kiri indicating that the cropping patterns were still far from orderly ("tertib") and in conformity with the governments plans. (This was confirmed by personal observation of the area.) Nonetheless, it was also clear that there is some effort to enforce the cropping schedule and that harsh steps are sometimes taken to ensure that farmers conform as far as possible. The Pembekal Pekasih stated that his responsibility for enforcing the cropping pattern includes cutting off water or uprooting crops of farmers who do not conform to the relevant governmental decree. He added that this had been more of a problem in the past then at present, but also made it clear that he regarded this as an important duty that he had.

This description of the responsibilities of the Pembekal Pekasih suggests that he occupies a kind of grey area at the lower level of the government bureaucracy. Although he is not officially a civil servant, he has the responsibilities of one and is responsive to commands and incentives which are determined by the kabupaten government. This fundamentally colors his perception of the P3A and the Pekasih. He clearly sees the Pekasih as under his control, and welcomed the establishment of the six kelompok because this would make it easier for the Pekasih both to collect the Ipeda and to ensure that government programs and directives are understood and adhered to. That is, the

creation of stronger P3A is seen by the Pembekal Pekasih as strengthening his capacity to organize and control farmers in accordance with government priorities. He does not see the P3A as an instrument which is under the control of the farmers and which is intended to manage their own internal water management concerns or to express their views to government agencies such as Public Works.

The traditional relationship between the Pembekal Pekasih and the Pekasih, as well as their traditional role as tax collectors, strengthens the tendency to view the P3A/subak as an instrument to regulate, control and tax farmers. The combination of tradition, established institutional incentives and arrangements for compensation provide a powerful force for defining the P3A functions in terms of strengthening government programs rather than strengthening community management capacities.

The decision of the Ministry of Agriculture extension agent (PPL) to establish the boundaries of his farmers groups (the kelompok tani) to coincide with the P3A kelompok, and to select the head of the P3A kelompok as the contact farmer (kontak tani) for that group, also suggests difficulties in distinguishing between the P3A as an instrument of the government's bureaucratic apparatus and the P3A as a farmers' organization designed to articulate and serve their interests. The government's extension services, aimed primarily at increasing rice production to meet nationally determined targets, has yielded impressive results in the past. However, it has done so through active efforts to use the kontak tani and the kelompok tani as an instrument for converting farmers to the use of new agricultural technologies and adherence to government rice intensification programs using standardized government packages of agricultural inputs and credits. By combining in a single group two divergent objectives and goals -- one of enlisting farmers in government rice production programs, and the other of encouraging farmer participation in and control over irrigation development -- the purposes of the P3A become confused. It is not clear if it is intended to be a government organization, spreading technical information downward, or a farmers' organization, expressing their views upward.

The capacity of the P3A to serve effectively as an agency promoting the interests of the farmers is further constrained by the division of responsibility for the different parts of the system. The Ministry of Public Works retains responsibility for and control over the operation and maintenance of the primary and secondary system. For the operation of this system, the Ministry places a person to regulate water (juru pengairan) in each system, paid by and under the direction of the local Public Works office. The juru pengairan (responsible for approximately 1,000 ha) directs the juru pintu air (responsible for about 250 ha). The juru pintu air lives at the diversion dam and is responsible for opening and closing the gates that divert water to the systems served by that structure.

The decisions of these two staff from Public Works have a profound affect on the capacity of the P3A to provide sufficient water on a regular and timely basis. Yet both are beyond the direct control of the P3A, and are answerable to a government agency, not the farmers. If

decisions of the juru pengairan are taken without consultation with the P3A (as is said to be frequently the case in Kekeri Timur II), those decisions can seem arbitrary and unproductive. If farmers directly approach the juru pintu air to regulate water (as is also said to be the case, especially with regard to farmers from the tail end of the system), the management of water is likely to become chaotic. Either way, in the past critical decisions have been taken without well established institutional mechanisms for ensuring that the farmers views are known and are taken into account.

Perhaps the establishment of strong kelompok which are seen as representative of farmers interests rather than government programs will help overcome this problem. The kelompok heads may be able to articulate clear demands from the farmers to the pekasih, thereby enabling him to represent farmers needs more clearly. At the same time, the kelompok heads should also be able to communicate decisions about water rotation schedules to the farmers so that they can plan their activities accordingly.

The government programs for the maintenance of primary and secondary structures and canals, however, present a different kind of problem. Here the issue is not merely one of establishing known, effective and systematic communication amongst farmers within the immediate area to deal with problems acknowledge to be their responsibility. Instead it involves coordination with kabupaten and provincial government offices. These offices, with their various maintenance budgets, operate under bureaucratic procedures and imperatives. Simply communicating the needs of farmers within the system and coordinating the requirements of different kelompok is not sufficient to ensure that maintenance problems within the area of the government's responsibility are overcome. The ability of provincial and kabupaten Public Works offices to respond quickly and effectively to maintenance needs depends on a whole series of variables which are beyond the control of the P3A, and may frequently be beyond the control of the Public Works office itself.

These factors indicate that encouraging farmer participation in the design of an irrigation system is not the same as ensuring effective community management of the system once it is constructed. The work of the COs (described below) to establish channels of communication between farmers and Public Works during the design and construction phase does not ensure an on-going capacity or institutional mechanism to operate and maintain the system. Even with an active and representative water users association, there are other constraints which need to be addressed if farmers are to manage their own systems and deal with operations and maintenance problems.

C. Designing the System

Because the system design for Kekeri Timur had already been completed by a private consultant prior to the arrival of the COs at the site the burden of explaining and defending the design lay with the provincial Public Works office. This was unusual since Public Works officials generally are not so directly or intimately involved in the

formulation of a system design. More commonly they review designs completed by the private contractor to ensure that they meet technical standards and specifications. Therefore, some changes were required in the role and procedures of the Public Works officials in order to meet the objectives of the project.

One example is the attitude concerning the timetable for approval of the system design and initiation of construction activities. Because a contract for construction had already been signed by the time that the COs arrived at the project site, provincial Public Works officials were anxious to move ahead with construction as quickly as possible. Although no deadline was ever specified, the COs were informed from the first that they were expected to start immediately to work with the farmers with the objective of securing approval for the design as soon as possible. Substantial increases in fuel prices in January, 1983, and consequent increases in construction costs, led to fears that the cost of building the system would exceed the contract. If this were the case, a revision in the government's budget for the project site would be required and might be difficult to obtain. In addition, there were concerns that if construction work were not started before the end of the financial year (31 March, 1983), the allocated budget funds would no longer be available. This was considerably in advance of the schedule which had been anticipated and it meant the COs were immediately involved in discussions about design details before they had an opportunity to establish a strong P3A or undergo the second round of training providing technical knowledge and background to deal with design issues. This highlights the problems of coordination between two ministries, Agriculture and Public Works. Selection, training and placement of COs was primarily the responsibility of Agriculture. Public Works was responsible for system design and construction. Each ministry responded to its own internal schedules and bureaucratic imperatives, with a resulting lack of synchronization and coordination of project activities.

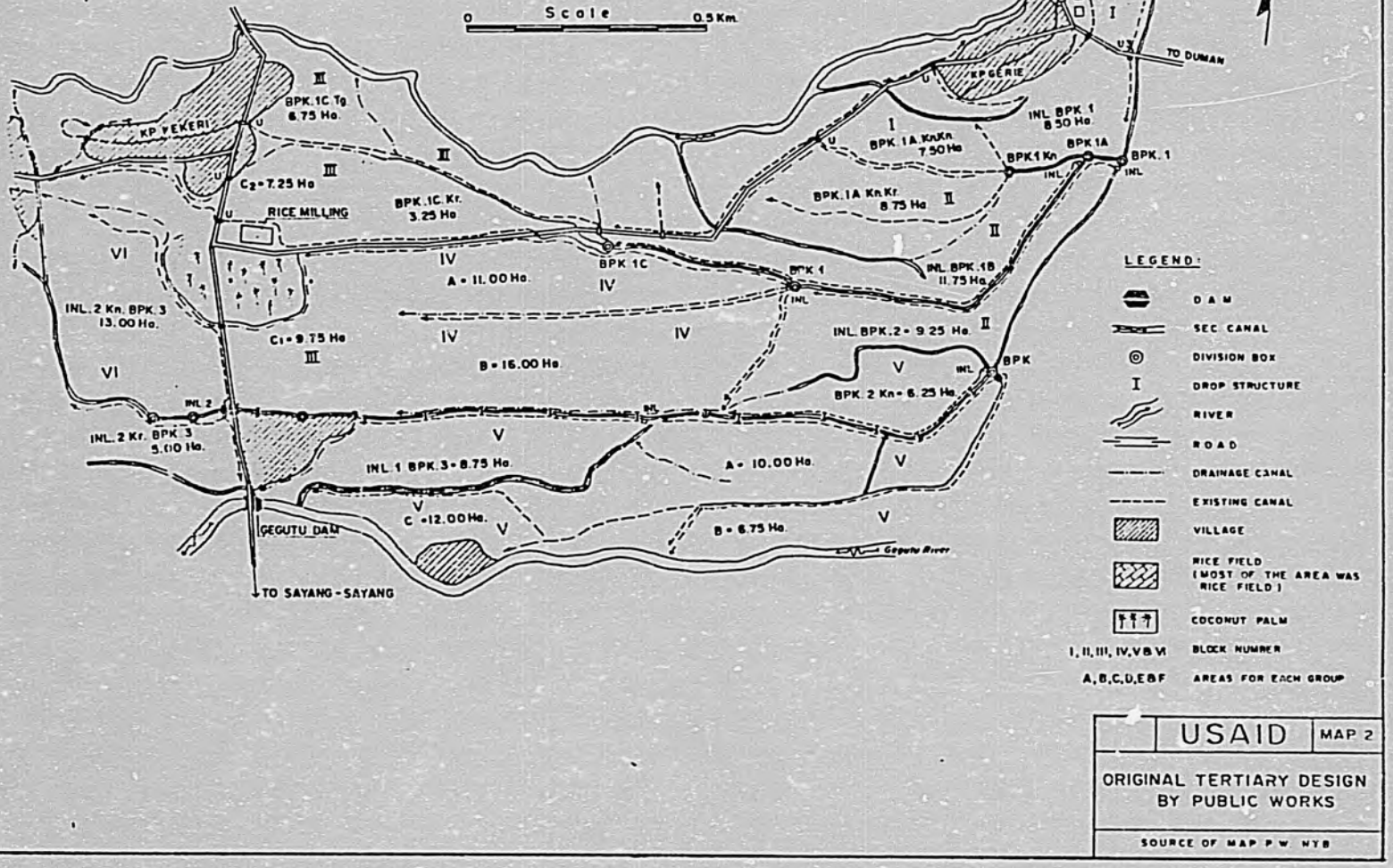
Initially it seemed as if the provincial Public Works office was inclined to push for immediate approval of the design, even if this were in violation of the general objectives of the projet. Indeed, they may have had little choice but to do so since revisions in budget allocations or rescheduling use of funds were not within the authority of the provincial agencies and would have required the concurrence and approval of national level agencies. Support from Jakarta, however, ensured that the pressure to move ahead at all costs was substantially reduced, and the provincial officials were able to see more clearly that procedural and attitudinal innovations were a part of the project purpose.

The realization of these innovations, however, was complicated by the fact that different Public Works officials participated in the various meetings and discussions with the farmers over the August, 1982, to May, 1983, period. The COs counted five different officials who took part at different stages of the process, and claim that consequently the response of Public Works to the suggestions for alterations in the system design were not always consistent.

KEKERI TIMUR

(PENIMBUNG KIRI)

Area : 166.25 Ha.



LEGEND:

- DAM
- SEC. CANAL
- DIVISION BOX
- I DROP STRUCTURE
- RIVER
- ROAD
- DRAINAGE CANAL
- EXISTING CANAL
- VILLAGE
- RICE FIELD (MOST OF THE AREA WAS RICE FIELD)
- COCONUT PALM
- I, II, III, IV, V & VI BLOCK NUMBER
- A, B, C, D, E & F AREAS FOR EACH GROUP

USAID	MAP 2
ORIGINAL TERTIARY DESIGN BY PUBLIC WORKS	
SOURCE OF MAP P.W. NTB	

In discussing possible design alterations with the farmers, the COs made a conscious effort to identify unofficial leaders in the community who could serve as a conduit for information about the proposed design. In many cases, the COs worked more directly with these informal leaders than with the farmers, and appear to have relied heavily on the informal leaders both to convey information about the system design and to obtain views and suggestions from the farmers about possible changes. This may in part have been due to the time constraints faced by the COs and the need to agree to a final design as quickly as possible.

Because of the lack of structured farmers groups and the use of informal leaders, it is difficult to get a sense of how effectively or actively individual farmers participated in the process of reviewing the design and suggesting changes. "Farmer participation" was apparently mediated through a group of respected community leaders whom the farmers trusted to explain the significance of the designs and to represent the interests of the farmers in response to the design. The results, however, may have been uneven or unrepresentative of the whole community. Farmers at the tail end of the system, an area where the COs spent the least amount of time, indicated that they had little understanding of the system design before it was built and had little opportunity to participate in discussions about it. Toward the head end of the system, one of the stronger kelompok's head said that he had relied upon the advice and guidance of the informal leaders in assessing the design and making changes. Another kelompok head said that he could not understand maps and diagrams, and got confused when discussions were based only on them. On the other hand, the Pekasih insists that there was substantial discussion of the design with everyone who wanted to participated. The village headman from Dasan Geria, claims that in the end about 70% of the farmers in his village had attended one or more meeting which considered the design and possible changes to be recommended to Public Works. Nonetheless, there is still some question of the extent to which the list of suggested changes in the Public Works design can be said to represent the views of the whole community rather than one part of it.

As a result of discussions with the farmers a number of changes were suggested and incorporated into the final design. In retrospect it seems important that there was a completed design to which farmers could react. While this may have effectively precluded radical changes, it also provided a concrete focus for discussions. It is likely the process would have been much more prolonged had there been no design at all for farmers to respond to. A total of four changes were accepted by Public Works during discussions of the design, with an additional six changes made by mutual agreement between farmers and the contractor during the course of construction. The changes agreed upon during the design phase, the reasons for them and the consequences of their acceptance (to the extent these are known to date) are summarized in Table 1 below. Map 3 shows the location of these changes within the system.

Table 1:

Summary of changes incorporated into final design during the design stage

Change No.	Location	Canal	Reason Claimed	Consequence Claimed
1.	Kelompok I	Canal location	area too high to be irrigated by original canal design	additional 3 ha. able to be irrigated
2.	Kelompok II	Canal location	-"-	additional 4 ha. able to be irrigated
3.	Kelompok II	Additional turn-out box	tertiary canal too long to deliver water effectively	additional 4 ha. able to be irrigated effectively
4.	Kelompok V	Canal location	area too high to be irrigated by original canal design	less land able to be irrigated (2 ha) than originally hoped but the tertiary canal functional

(Note: the change number corresponds to numbers on the accompanying maps showing where changes occurred.)

While insufficient information was collected to undertake a precise cost-benefit analysis, enough data is available to suggest the scale of benefit realized. First, as can be seen in Table 1, farmers estimate that an additional total of approximately 11 hectares can be irrigated during the dry season as a result of farmer intervention in the design process. This land, they claim, would not have been irrigated had the original Public Works design been built.[12] The average rice production for the area amounts to approximately 5 metric tons of wet, unhusked rice per hectare crop. This would mean an increase of approximately 55 metric tons per year for the entire system. Calculated at the May 1984 farm-gate rice (Rp 150/kg) this would amount to a total annual value of Rp 8,250,000 (approximately $7,860). Actual benefits would amount to less than this, however, because even without irrigation it is unlikely that the land would remain totally fallow. Farmers would almost certainly try to grow an rain-fed non-rice crop (palawija) crop which would realize a much lower market value.

In contrast, the cost of field three COs during the twenty-four months of design and construction was substantially less than this. Salary and support costs amounted to only Rp5,000,000 (less than $5,200). If the costs of recruiting and training COs is added on a pro rated basis, the total direct cost of both training and fielding COs would amount to only Rp 1,630,000 ($ 2,500 at the then prevailing exchange rate.). There are, however, important hidden costs which are difficult to calculate. These include additional administrative expenses incurred by provincial Public Works and Agriculture staff in monitoring the work of the COs and taking time to meet with farmers to review the original design and suggested changes. The farmers themselves incurred opportunity costs in taking time to understand the proposed system design, attending meetings and helping to form the P3A and its constituent kelompok.

Despite these uncertainties, however, the evidence available suggests that even within one year the cost of fielding COs and encouraging greater farmer paticipation was repaid in terms of increased production within the system. To the extent that design changes and farmer participation results in a sustained and functioning system over time, the net benefits will be greatly increased.

It can be seen that many of these changes involved corrections of errors of fact in the original design. Because of errors concerning the topography of the area to be irrigated, the original design could not have functioned without requiring water to run uphill. That is, specific improvements resulted from having farmers review proposed designs before construction.

It is important to try to understand better why such inaccuracies occur in system survey and design work, and then to identify how best to overcome these problems. In Kekeri Timur active participation of farmers identified several inaccuracies, but this may not be the only way or even necessarily the most efficient way. If the problem is one of poor initial survey work and incomplete data on which later designs are based, administrative steps to raise the standards of survey work may be just as effective. The question is whether they would be too costly. For example, at present topographical maps which are the basis for system design work are generally calibrated in one meter intervals, thereby increasing the likelihood of inappropriate designs. The costs of obtaining more accurate and detailed maps, and more complete hydrological data, should be compared with the costs of fielding COs to encourage the use of local knowledge in system design. The COs, however, also provide valuable information on local customs and traditional organizations. Understanding these is important in establishing a well managed and maintained system, and steps to inform technical information will not meet this need.

This does not mean that professional judgement and technical standards should always give way to local knowledge and wishes. What it does suggest is that under some conditions local knowledge may be more significant than technical knowledge and requirements, particularly when

design decisions are based on limited physical data. Rigid administrative requirements and insistence on formal technical requirements, coupled with inadequate data, may actually result in poorer design work.

While the Public Works officials were generally said to be open to suggestions and willing to discuss changes with the farmers, not all changes were ultimately accepted and incorporated into the final system design. Clearly some judgements were being made, and some criteria being applied. The nature of these criteria was not clear to the respondents we spoke with.

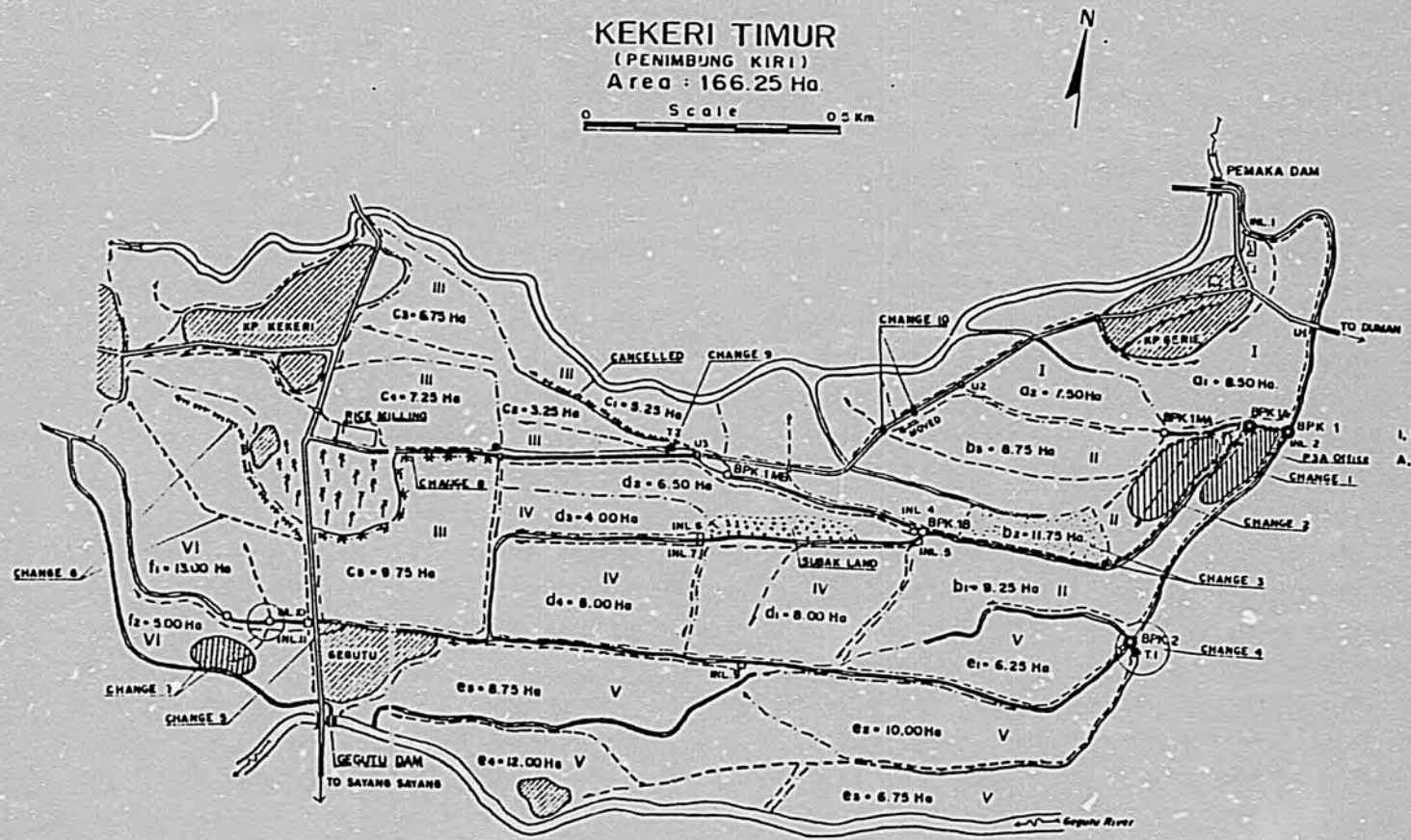
There were varying accounts of exactly how many suggestions were not accepted and what the reasons for this were. Some informants said that after Public Works engineers had an opportunity to explain to farmers why certain changes were technically not feasible or undesirable, the farmers accepted the explanation and were willing to withdraw their suggestion. Others said that not all reasons given by Public Works were technical in nature. In one case, it was said, farmers had asked that the design be altered to include more turn-out boxes from the tertiary canal. However, Public Works officials are said to have stated that there was no good technical reason for building so many inlet boxes for only 16 ha., and that in any case there were insufficient funds in the budget for the additional three boxes requested.

Despite the length of time that eventually transpired between the arrival of the COs in August, 1982, and the final agreement on the system design in May, 1983, the COs still felt that more time was needed to ensure that the design was fully in accord with the farmer's wishes. They particularly felt it was unfortunate that they were away during the six week period of March-April 1983, and returned only at the final stages of discussions between the Ministry of Public Works and farmers. Although the second round of training increased their technical understanding and helped them deal more effectively with design issues, they were absent during a critical period of negotiation. There were some issues which they feel were not satisfactorily handled during this time. This again points to the problems of coordinating schedules and activities between two ministries.

What may be even more significant, however, is a careful analysis of the kinds of issues which were discussed when changes in the design were suggested by farmers. All the changes cited in Table 1 relate to the location of physical structures, and our conversations with farmers, P3A leaders, and government officials confirmed that this was the primary focus of discussion. The use or management of the structures, as opposed to their location, appears to have received little attention. That is, farmer participation in design rather than discussion of on-going community management of the system, received the primary emphasis. Also, during the design phase there seems to have been no discussion of the type of structure to be built, although farmers did make suggestions to the contractor about the size of turn-out gates during the construction phase. Some of these were accepted by the contractor.

KEKERI TIMUR
(PENIMBUNG KIRI)
Area : 166.25 Ha.

Scale 0 0.5 Km



LEGEND

- DAM
- DIVISION BOX
- INL (INLAAT) — TURNOUT BOX
- TERTIARY BOX
- QUARTERNARY BOX
- SEC. CANAL
- TERTIARY CANAL
- QUARTERNARY CANAL
- DRAINAGE CANAL
- RIVER
- ROAD
- VILLAGE
- RICE FIELD (MOST OF THE AREA WAS RICE FIELD)
- COCONUT PALM
- I, II, III, IV, V & VI — BLOCK NUMBER
- A, B, C, D, E & F — AREA FOR EACH GROUP
- CHANGE 1 AT KELOMPOK II
- CHANGE 2 AT KELOMPOK II
- CHANGE 3 AT KELOMPOK II
- CHANGE 3 AT KELOMPOK II
- CHANGE 4 AT KELOMPOK V
- CHANGE 5 AT KELOMPOK V
- CHANGE 6 AT KELOMPOK VI
- CHANGE 6 AT KELOMPOK VI
- CHANGE 7 AT KELOMPOK VI
- CHANGE 7 AT KELOMPOK VI
- CHANGE 8 AT KELOMPOK III
- CHANGE 9 AT KELOMPOK III
- CHANGE 10 AT KELOMPOK II

USAID	MAP 3

FINAL DESIGN WITH CHANGES INCORPORATED AT SUGGESTION OF FARMERS (JUNE, 1983)

SOURCE OF MAP P.W. NTB

This separation between use and location parallels the institutional division of responsibility between the Ministry of Agriculture and the Ministry of Public Works. The Ministry of Public Works is responsible for survey, design and construction work, along with some continuing responsibility for the maintenance and operations of major works (primary and secondary canals). Their primary concern is with determining the location of physical structures and with ensuring that the structures are built where they are supposed to be. The Ministry of Agriculture, on the other hand, is concerned with water management, and therefore with the use of the structures. This institutional division is echoed in a common perception concerning the normal sequence of events in the establishment of a functioning irrigation system. First, Public Works is concerned with survey, design and construction, and later Agriculture is concerned (amongst other things) with water management.

This kind of institutional, sequential and perceptual cleavage between locating structures on the one hand, and managing them on the other, is necessarily a false dichotomy. Location implies function, and decisions about system lay out, location of division boxes and number of turn-outs all entail water management arangements. The location of physical structures will determine the parameters within which management decisions must be made.

Public Works engineers admit that they have only minimal amounts of data relating to water availability, water requirements, and the water management possibilities implied by a given system design. They are not in a position to talk about water management with farmers because they do not have the information or training to do so. Farmers participation, then, which involves only discussions with the Department of Public Works about the physicl location of structures, may overlook questions about the use of the system once it is completed -- questions which are likely to be more important to the farmers within the irrigation system.

D. Constructing the System:

After returning from the CO training meeting in Solo in May 1983 the COs discovered that several changes requested by farmers had not been included, but it was clear that both the Public Works staff and those farmers involved in the discussion were anxious to see construction begin. Public Works had already made arrangements with the contractor (E.P. Ana) to begin work in June, 1983, and neither the COs nor local farmers were a part of these discussions.

Apparently without prior notice to the farmers, the field supervisor and a crew of laborers from South Lombok began work in June on a turn-out structure in kelompok I at the top of the system. Some farmers in the area were upset because they had been led to understand that they were to be contracted to provide the labor. Other farmers objected to the construction team disturbing planted sawah. The COs reported the situation to the Pekasih, and then informed the provincial Public Works office in Mataram of the misunderstanding. (This suggests the COs at this stage were still playing a mayor and active role in directly communicating with Public Works rather than assisting the farmers in doing so.)

The contractor on the other hand was surprised to find that the area was the location of a special participatory pilot project and to learn of the presence of the COs. At the instruction of the provincial Public Works office, the contractor stopped work for a week while a meeting was organized and held between the contractor, the Subak leadership and several Ministry of Agriculture and Public Works officials.

At this meeting it was agreed that planted rice less than two weeks of age could be removed for canal construction while work in areas with older rice would have to await harvest. It was also decided that 2 of the six kelompok block groups would be contracted to provide manual labor for the construction of field canals. The contractor initially suggested a payment of Rp. 100 per meter for the 8,000 meters of field canal to be dug. The farmers countered with a request of Rp. 350 per meter be paid and that the payment would be made in full at the completion of the contract. In the end, a rate of Rp250/meter was agreed upon.

In an interview a few months after the on farm works were completed the contractor stated that he found it more difficult to work with the local farmers than their usual hired laborers because they could not be depended upon to show up for work. He suggested that this was because the farmers were economically relatively well-off at least in contrast to the landless laborers normally hired. One CO, however, noted that while normal laborers were paid on a weekly basis, because the kelompok had a contract they could only receive payments after the completion of the system, a number of months later and this dissuaded some farmers from participating. In any case, only 10 men out of the 44 farmers in kelompok wanted to participated in the contract, and probably less than 30 farmers were actually involved of the 345 in the Subak. Consequently, the contractor did rely considerably on outside labor (consisting of approximately 4 supervisors, 20 skilled laborers, and 80 manual laborers).

The contractor claims that while under ideal conditions he could have completed the project in two months, the involvement of local farmers delayed the completion an additional two months. However, although labor management was more difficult, he encountered few problems regarding right-of-ways for canals, normally a major problem and source of frequent delays. For example, in a neighboring system where no COs were present during the design and construction period, the contractor encountered a number of delays arising from disputes about right-of-way. One such dispute was never resolved with the result that a nearly completed tertiary canal was never integrated into the final system. The contractor claimed that in general there is considerable resistance from farmers in positions near the canal who have no water problems when they are asked to give up valuable land for canal construction. The absence of such dispute, he felt, was a result of the preparatory work done by the COs in discussing design plans with the kelompok and Subak leaders.

While right-of-way issues were not a major difficult in Penimbung Kiri, a number of problems related to the design emerged during on-farms construction. These problems generally appeared at the tail of the system in Kelompok IV-VI. This may be due to the fact that the COs lived and focussed their organizing activities in the top of the system during

their first 9 months. One CO finally moved into Gegutu village at the bottom of the system to begin concentrate on farmers in this area in May, 1983, only one month before the contractors arrived. Consequently, most of the tail end farmers, including the Kelompok VI leader, were not aware of the construction plans until the contractor began work. Because the design plans had not been agreed to by most of the Kelompok VI farmers a number of changes were requested during construction. These are summarized in Table 2 next page.

In Table 2 we see that two of the changes in the design for Kelompok VI simply required the locations of existing field canals be maintained, rather than being elimiated and replaced by new canals serving the same area but following a slightly different route. Instead Kelompok VI farmers recommended a new field canal be built to service a small 2 hectares block at the bottom of the system.

In Kelompok III farmers rejected a proposed drainage canal be built along the edge of the road claiming that they did not experience drainage problems in that part of the system and the they were not prepared to sacrafice the 2 meter wide and 100 meter long strip of land required for the canals construction. Instead they suggested that the new supply canal turnout gate openings be increased from 40 cm to 60 cm to allow excess water to flow out of the system when heavy rains occur. In the spirit of the pilot project, the Public Works engineers compromised their technical requirements in favor of local knowledge and wishes. During the past rainy season (1983/84), there was no apparent flooding in this area and the farmers seemed to be satisfied with the way the system was functioning.

Finally, in Kelompok II a final change occured during construction after a drainage culvert was built in the wrong location. After seeing the location of the new culvert a group of local farmers complained to the COs that the new structure would be of no use in draining a flood-prone one hectare plot of sawah. The COs then reported the problem to the contractor who built a new culvert in the required location.

Unlike the changes made in the design prior to construction, the alterations made during the construction period are likely to lead to little increased irrigated hectarage or cropping intensity. At most an additional 2 to 3 hectares will be served by the changes. Of greater importance is probably the sense of involvement of the farmers themselves. While the farmers at the bottom of the system responded that they felt the changes would have no major effect on their ability to get weater to their fields they also indicated that they felt satisfied with the outcome of the project. They also noted that there real problem is more their porous, sandy soils which require large quantities of water, rather than changes in the delivery system. Consequently, it is likely that a large section of tail end lands will have to settle for a single rainy season rice crop.

Table 2

Summary of Changes Made in Design during Construction

Change Number	Location	Change	Reason Claimed	Consequence Claime
5	Kelompok VI	rejected proposal to erase existing field canal	existing canal flowed through houseyard serving multiple functions	old canal continue. to be used to transport bain manure to fields, water livestock
6	Kelompok VI	rejected proposal to change location of existing field canal	farmers felt existing canal location adequate feared loss of land to canal	existing canal continues to function
7	Kelompok VI	new canal added difficult at tail end	access to water	2 additional hectare to be irrigated
8	Kelompok III	farmers reject proposal to build drainage canal	fear loss of land to canal, no experience with flooding	no flooding took place during 1983/84 rainy season .06ha of land continues to be used for rice
9	Kelompok III	turn-out opening increased in width from 40cm to 60cm	wider opening required to release water during heavy rains	reduced canal wall erosion to do canal overflow
10	Kelompok II	drainage culvert built in wrong location, farmer petition results in new Culbert in proper location	poor drainage	improved drainage ~ lha of sawah

(Note: The change number correspondents to numbers on the accompanying maps, showing where changes occurred.)

In general, the COs appear to have functioned effectively as go-betweens throughout the construction process. Comments from the farmers, Subak leaders, contractors, and Public Works staff indicate the COs role as problem-solvers was widely appreciated and helped smooth the implementation process.

At the same time a number of lessons emerged from the experience including the need for better coordination between the daily activities of the contractors and farmer groups. Many design issues can not be clarified during the design process because farmers have difficulty understanding the maps and terms used. Further more, the design maps are often not detailed enough to clarify the precise locations of structures. In the case of the misplaced culvert, the contractors spent three days completing the structure before it was agreed that it was improperly located. A brief meeting between farmers, CO, and the contractor before construction began could have avoided this mistake. This experience argues for a more systematic series of discussions with the kelompok in each area where a structure is planned immediately preceeding its construction. Guidelines need to be developed to clarify the types of changes that can be made during the design process and just prior to construction. Contractors need to be properly oriented to the participatory process prior to entering the field so they have a clear understanding of procedures and expectations.

Regarding local participation, the COs noted that while the contractor experienced some delays by involving local farmers, the participation of subak members in construction and decision making generally enhanced their sense of involvement in system development and responsibility for system maintenance. Those farmers who coordinated local farmer labor input have now emerged as group leaders who have a commitment to seeing the new canals effectively maintained and utilized. There is also the knowledge gained by local Subak members regarding techniques for the building of canals and structures.

Clearly, improvements need to be made in the process for establishing the terms for farmer involvement. The fact that the farmers were not paid in full for their work until three months after the terms of the contract had been fulfilled resulted in some hard feelings. This situation arose because Public Works could not pay the contractor until the certification process had been completed. Since farmers who want to participate are generally the poorest in the community and can not afford to wait 6 months to be paid, some method of streamlining or of making regular payments needs to be developed if farmers are to be encourage to participate.

IV. CONCLUSION

The data presented in this article shows the extent to which the Community Organizers, working with and through local institutions, were able to establish a more effective channel of communication between government agencies controlling both funds and technical expertise for irrigation development and farmers responsible for managing and

maintaining completed systems. This improved communication resulted in the identification of several problems in the original design. Because of the willingness of the Ministry of Public Works engineers and the private contractor to listen to the views of farmers and incorporate many of their recommendations, approximately 11 hectares was irrigated which would otherwise not have received water. This effectively constitutes a 7% increase in the area actually irrigated by the project. Although sufficient data is not available to do a thorough cost-benefit analysis, this research indicates that the benefit of the changes in terms of increased rice production surpassed the cost of the pilot project in one year.

It is important, of course, not only to determine who benefits from a project but also who (if anyone) loses benefits. We know that "informal leaders" were important in discussion of the original Public Works design, and that we cannot be sure all farmers had an adequate opportunity to participate or that all views were fully represented. "Community participation" in this case may have favored one element of the community over another. Nonetheless, in the short run we were not able to identify any group which suffered a clear loss as a result of the project. Within the project area, the primary result seems to have been an improved irrigation system which benefits some specific farmers but does not disadvantage any. Outside the system, the contractor incurred unexpected costs arising from delays in construction because of the need to consult with farmers. However, the contractor himself has pointed out that disputes of rights of way frequently occur where there is no consultation with farmers and these, too, can delay construction.

Over the long run, it is possible that the growth and development of strong kelompok, and the P3A with its internally generated source of funds, may weaken the position of the Pekasih and Pembekal Pekasih as water management officials. The more effective the kelompok and P3A are, the more independent they will be of the Pekasih and Pembekal Pekasih who are likely to be seen more and more as simply a tax collecting agents. This, in turn, may diminish their authority in the management of community affairs.

This experience, however, does not provide sufficient evidence to conclude that the Community Organizer approach in Kekeri Timur constitutes a model which can be replicated throughout Indonesia. While it is clear that there have been clear and demonstrable benefits from the pilot project as it was implemented, the success achieved may be in part due to a Hawthorne effect. The High Performance Sederhana Irrigation System pilot project was a high visibility pilot effort, attracting considerable attention at the national level and enjoying a kind of privileged status as a result. Provincial officials could not help but be influenced by the fact that senior officials from national headquarters in Jakarta were taking an interest in the project and were directly involved in its implementation through their participation in project Working Groups and Steering Committee. Visits to Kekeri Timur by those officials as well as AID and Ford Foundation staff, also increased the attention the project received at the kabupaten, kecamatan and village level. This attention undoubtably helped to improve project performance. If the project were attempted to a national scale in all provinces, this kind of support from officials at all levels of government would not be possible.

To move toward a national model, both the Government of Indonesia and AID will have to give more attention to improving the efficiency of the Community Organizer approach if it is to become a standard part of the government's strategy for small-scale irrigation. For example, in the case of Kekeri Timur, critical in-puts from farmers occured during discussions of the system design and then again during the period of system construction, suggesting that it may not be necessary to field COs for a continuous twenty-four month period. Shorter periods of time in the field at critical times in the system development process may yield the same results.

Another example of possible efficiencies is the development of appropriate social science techniques to enable the COs to understand more quickly the characteristics of the community and the nature of the traditional water users association. It took the COs a considerable period of time to understand how this traditional system worked, who the critical individuals in the community were, and what kinds of issues either united or divided the farmers within the system. To a large extent, the COs embarked upon this task with few tools beyond a list of questions for a village profile. In our view, more attention should be given to developing analytic techniques which focus on key aspects of village life which the COs have to understand in order to fulfill their functions.

Coordination among different government agencies is another area where greater efficiencies can be achieved in the future. For fourteen of the twenty-one HPSIS sites, the Ministry of Agriculture was designated the lead implementing agency. The most important decisions regarding system design and the operation of the main irrigation works, however, rest with the Ministry of Public Works. Efforts to establish inter-sectoral coordinating groups at the national, provincial and kabupaten levels may divert scarce time and attention to a series of meetings among government agencies, rather than discussions between farmers and the one government agency which is responsible for most of the critical decisions. For this reason, perhaps future AID work should be concentrated on the Ministry of Public works only.

Apart from the clear benefits of the project, and the need to look for improved efficiencies, Kekeri Timur points to other lessons for the future. One concerns the complex and evolving social and cultural traditions which form the context for small-scale irrigation development. The existence of the traditional subak, with its office-holders, defined roles and established procedures, had a profound impact on the way in which the community responded to the design and construction of the Sederhana system. In the past, some government programs and interventions appear to have weakened the traditional water users' association. This diminished the indigenous institutional capacity to articulate the views of the community and to resolve differences of opinion. In turn, this affected the work of the COs and contributed to their reliance, for example, on informal leaders and unofficial channels of communication. Simply improving the government's capacity to gather technical data and improving the formal design specifications would not adequately deal with this important dimension.

Effective communication of farmers views during the design of an irrigation system, of course, is distinct from establishing an institutional capacity to manage the system after it has been constructed. At the time that this field work was done, the P3A in Kekeri Timur was only entering the first rainy season after the system had been completed. The real test of its capacity to manage the system would come during the following dry season, and this study does not include that period. However, experience elsewhere suggests that once a system is constructed and farmers have water in greater abundance than before, there is a strong incentive for them to organize themselves to arrange for its distribution and use. The way it is distributed may not always be equitable or technically the most efficient, but a system will emerge. (In contrast, in other HPSIS sites where there were severe problems in obtaining water even at the head end of the system, COs were significantly less successful in organizing a P3A.) This suggests that future support for water users' associations is perhaps best utilized at the time of system design and construction. This is a logical point of entry both for government agencies and donor agencies such as AID. Interventions at later stages are more difficult to gauge and manage.

A final issue concerns the interface between community management groups and government agencies. We have seen the extent to which the line between government bureaucracies and local organizations is blurred. There is a clear tendency on the part of some officials to regard the P3A as a means of mobilizing farmers to meet national goals and as an instrument to extend government programs into the village. To a large extent, even after the work of the COs in a government-sponsored project, the P3A remains dependent upon the government. The Department of Public Works continues to own and control the operation of the primary and secondary irrigation system, from which the P3A draws its water. Funds for the survey, design and construction of the system continue to be controlled by the government, although there was increased openness to farmer participation in the planning and implementation process. Some traditional leaders with continuing responsibilities within the P3A emphasize their tax collection duties over water management concerns. If national objectives and local objectives are not congruent and complementary, then it is the view of many officials that national objectives must take priority. In their eyes, the P3A is one instrument, and community participation is one approach among many to ensure that national priorities are adhered to.

Footnotes

1. Booth, Ann "Irrigation in Indonesia; Part I," Bulletin of Indonesian Economic Studies, v. XIII: N. 3 (March 1977) pp. 54.

2. Based on discussions with officials at the Ministry of Public Works, September 1984.

3. Bottrall, Anthony "Financing Irrigation"; Overseas Development Institute: London, August 1981, pp. 7.

4. - Bottrall, Anthony, pp 29-43
   - Coward, Walter E. "Improving Policies and Programs for the Development of Small-Scale Irrigation Systems" unpublished manuscript, January 1984, pp. 14
   - Barker, Randolph et.al. "Irrigation Development in Asia: Past Trends and Future Directions," Studies in Irrigation CSI Number 1, March 1984, Cornell University: ITHACA, pp 45-47.

5. Bottrall, Anthony (1981) pp. 21

6. Bottrall, Anthony (1981) pp. 36-37

7. Bottrall, Anthony (1981) pp. 21

8. Bottrall, Anthony (1981) pp. 36

9. Bottrall, Anthony (1981) pp. 37-38

10. "Rekapitulasi Tata Laksana Air 1979/86 - 1982/83" (mimeograph) Direktorat Irigasi, Ministry of Public Works

11. The three COs for Kekeri Timur II were not unlike of the other thirty-one COs selected during the April-May, 1982, period. They were young single men (only two COs were women) with no previous experience with community organization or irrigation projects. All three had obtained high school (SMA) diplomas prior to working for a few years in various occupations. One was an assistant in a store and the other two were junior teachers in private schools. All were originally from the island of Lombok, although none were from the immediate project area.

12. The following calculations of project costs and benefits are based on reports received from farmers and COs concerning the impact of design changes were reasonably accurate. We did not attempt to verify directly the precision of these estimates. The estimates, however, were later plotted on a map and in some cases were apparently too high. Preferring to underestimate rather than overestimate benefits, we reduced the increased area claimed from an original total of 23 ha. to a more plausible 11 ha.